from KNP during the period April 2011 to March 2013.

The survey undertaken at KNP revealed the occurrence of 96 species of thrips in 55 genera under two major families, viz. Thripidae and Phlaeothripidae of the two respective suborders, namely Terebrantia and Tubulifera. Of the 53 species of phlaeothripids of the latter suborder, the subfamily Phlaeothripinae had a representation of 44 species in 21 genera and the fungal spore feeding Idolothripinae with 9 species in 4 genera. On the other hand, among the 43 species of terebrantians, 33 were represented by members of the subfamily Thripinae in 21 genera and the rest 10 species under 9 genera by Panchaetothripines. It is significant to note that of the 96 thrips collected in the present study, 32 are endemic. Further, the collection record has also indicated the occurrence of 22 species of free-living foliage feeders, 19 anthophilous forms, 17 gall makers, 14 mycophagous thrips, 8 pests, 7 each of weed and grass inhabitors, besides 2 predatory thrips (Table 1). Thus the field survey has not only reflected the diverse feeding habits and habitats of thysanopterans, but also signifies the faunal similarity to some extent with that of the Western Ghats of South India (60%), the Great Himalayan ranges of North India (35%) and also with Southeast Asia (20%) at varying levels, besides having fauna of its own along with a few cosmopolitan species. Because KNP is located in the Indo-Malaya ecozone, there is a possibility of sharing the fauna with SE Asia owing to proximity. Therefore, thrips of KNP can be considered as a mixed composition of diverse species from different geographic regions. Table 1 provides the systematic inventory of 96 species of thrips collected from KNP during the survey period 2011–2012.

Although the maiden attempt at KNP indicated the presence of 96 species of thrips with diverse feeding habits and habitats, a concentrated survey in future would certainly reveal existence of many more species. Occurrence of 80 species of phytophagous thrips inhabiting the flowers, foliage, gall, grass and the weed in comparison to 14 mycophagous and two predatory forms reflects appreciably the rich floristic composition of KNP. The faunal similarity of KNP with that of Western Ghats, Himalayan ranges and SE Asia highlights that it can be considered as a safe zone for thrips conservation as the study site comes under the protective area of the local administration.

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Microforaminiferal linings from the upper part of the Upper Disang Formation at Gelmoul quarry, Churachandpur, Imphal valley and their bearing on palaeoenvironment

Diverse microforaminiferal linings with a few pollen, spores and dinoflagellate cysts in the upper part of the Upper Disang Formation, Disang Group are reported in the present study. Five main types of microforaminiferal linings are encountered in the preparations by standard palaeo-palynological analysis. These are biserial type II, planispiral type III, planispiral type IV, trochospiral type I and trochospiral type II. A warm, shallow marine environment of deposition for the

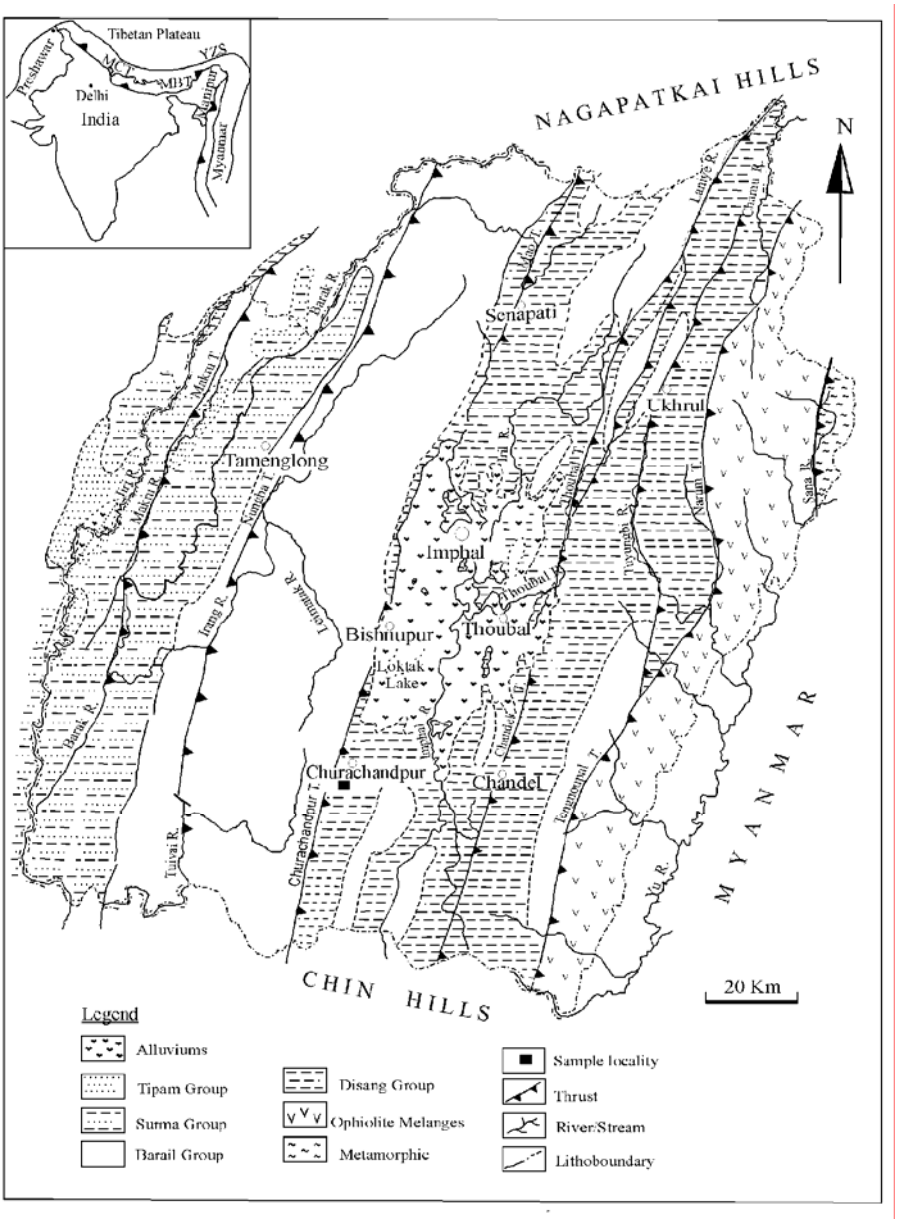

Figure 1. Geological map of Hills of Manipur (after Soibam[1]) showing sample locality of Gelmoul quarry, Churachandpur.

upper part of Upper Disang Formation is implied on the basis of these linings and associated palynomorphs. The occurrence of flaser bedding and lenticular bedding in the Upper Disang Formation suggests that it deposited under a tide-dominated environment, most likely on a tidal-flat.

The Hills of Manipur which lie between the Nagapatkai Hills on the north and northeast, and the Chin Hills on the south which form an integral part of the Indo-Myanmar Range (IMR) in northeastern India, have evolved as an accretionary prism due to the subduction of the Indian plate below the Myanmar plate (Figure 1, after Soibam[1]). The Cretaceous through Palaeogene sequences are crucial to reading the geological history of IMR, which represents a palaeoenvironmental change from a deep ocean represented by ophiolite mélange to continent represented by the Barail Group. The Cretaceous–Eocene Disang Group occurring between the above-mentioned two units is important for interpreting this evolutionary history. Earlier, geologists have interpreted depositional environment of the upper part of the Disang Group of the Imphal valley based on trace fossils[2]. Up till now, few palynological studies have been conducted on this Group for interpreting palaeoenvironment, except one[3]. In this study we lay emphasis on the microforaminiferal linings and dinocysts for interpreting palaeoenvironment.

The material under study was obtained from Churachandpur (Imphal valley) in the southwestern part of Manipur (Figure 1). The Disang Group is exposed very well there. It is subdivided into two formations, namely Lower Disang and Upper Disang formations[4,5]. The Lower Disang Formation is made up of mainly shale and thin sandstone bands, whereas the Upper Disang Formation consists of shale, siltstone, sandstone with fossils and slices of ophiolitic rocks[4,5].

Sixteen samples were collected for this study from the upper part of the

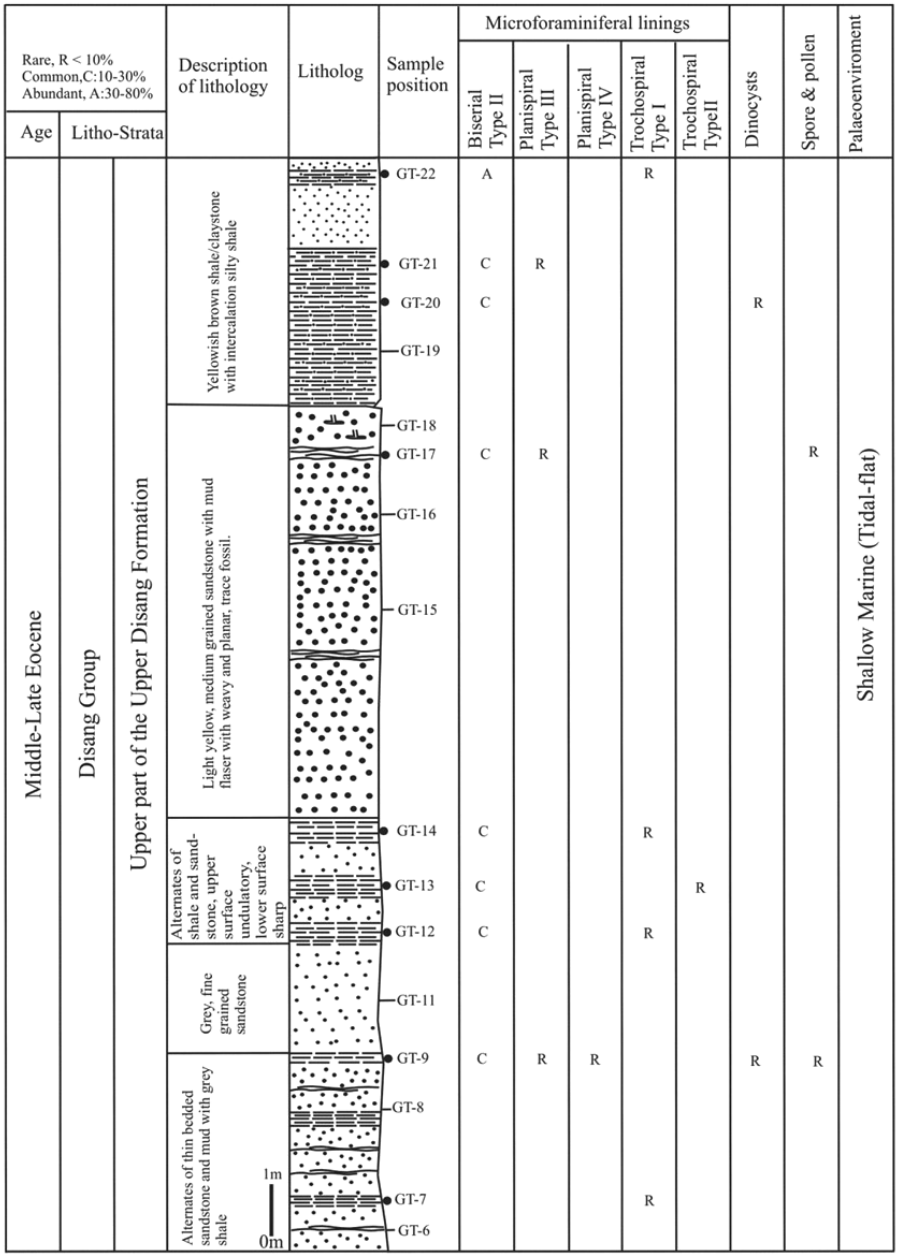

Figure 2. Lithostratigraphical log of upper part of the Upper Disang Formation at Gelmoul quarry, showing distribution of selected microbiota.

Disang Formation exposed at Gelmoul quarry (Figure 2; GPS 24°20′40.4″N: 93°39′39.6″E). The samples were chemically processed using HCl, HF and HNO_3 acids for different durations. Of these, nine samples were found productive. They were examined under a microscope. A considerable number of microforaminiferal linings together with a few dinoflagellate cysts and pollen and spores were counted in the assemblage (Figure 3). Besides, forminiferal linings were also recorded in sandstone thin sections as observed during petrographic studies. The Middle–Late Eocene age for the Upper Disang Formation assigned by earlier workers is supported by the occurrence of dinoflagellate cyst, *Hystrichokolpoma* cf. *rigaudiae* (Figure 3 *j*) recognized in the present study.

Microforaminiferal linings are acid-resistant organic remains of foraminifera preserved in sediments. Their frequent occurrence in palynological preparations led many researchers to classify and use them in stratigraphic and palaeoenvironmental interpretations[6–24] (M. R. Bradford, unpublished). Until now there is no impeccable system to assign or refer microforaminiferal linings to a generic or specific level. Here we have adopted Stancliffe's informal classification[24], which classifies the microforaminiferal linings to various morphological forms or types. Microforaminiferal linings here are marked by five main types, viz. planispiral type III, planispiral type IV, biserial type II, trochospiral type I and trochospiral type II (Figure 3 *a*–*h*). Their vertical distribution is presented in Figure 2.

Some aspects of the preservation mechanism of the microforaminiferal

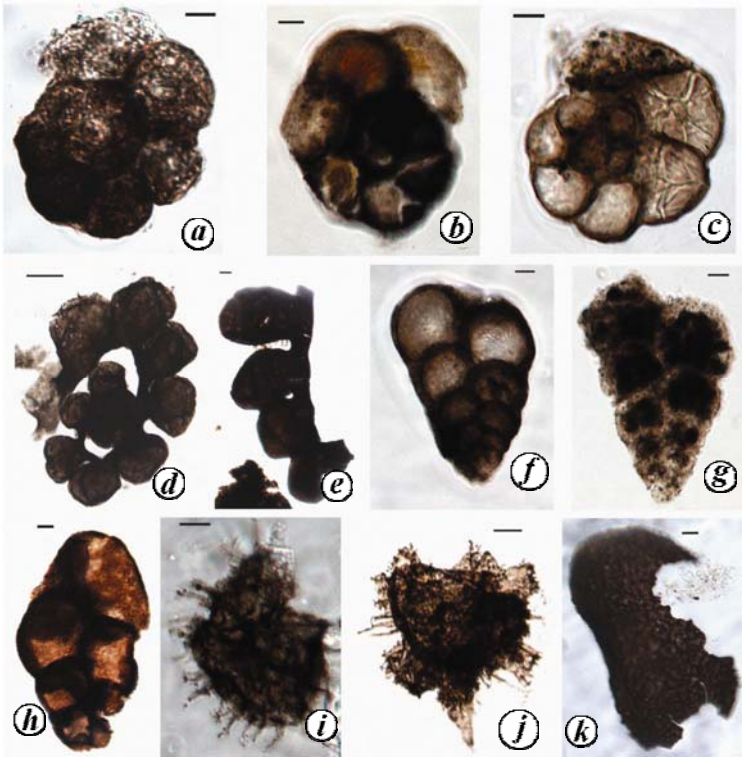

Figure 3. ***a***, Trochospiral type II; ***b***, ***c***, Trochospiral type I; ***d***, Planispiral type III; ***e***, Planispiral type III (broken); ***f***–***h***, Biserial type II; ***i***, *Cordosphaeridium* sp.; ***j***, *Hystrichokolpoma* cf. *rigaudiae*; ***k***, Spore (fragment) (bars represent 10 μm).

linings (organic remains) are still unclear. They are believed to be abundantly preserved under such conditions as upwelling of nutrient-rich water, higher salt concentration and local shallow water[13]. Besides, high summer temperature has also been regarded as an important condition for the concentration of microforaminiferal linings in coarse sediments of the Gulf of Arabia (M. R. Bradford, unpublished). The abundant occurrence of these linings, such as in samples GT-7, GT-9, GT-12, GT-13, GT-14, GT-17, GT-20, GT-21 and GT-22, and their distribution in an individual morphotype (Figure 2) imply that a warm, shallow marine depositional environment comparable to the one cited in the above-mentioned studies may have dominated in the study area during the Eocene as preserved in the upper part of the Upper Disang Formation. This inference is consistent with the presence of dinocysts in the association and the palaeoenvironment interpretations based on *Skolithos* and/or *Cruziana*-containing ichnofacies of the Upper Disang Formation, which suggest the shallow marine environment during the Eocene in the Imphal valley, Manipur[2]. The occurrence of flaser bedding and lenticular bedding in the shale, siltstone and sandstone-containing successions of the Upper Disang Formation suggests a tide-dominated coastal environment. The most probable depositional environment for the Upper Disang Formation looks similar to modern tidal-flats.

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