

**PALYNOSTRATIGRAPHIC STATUS AND DEPOSITIONAL ENVIRONMENT
OF GIRUJAN CLAY AND DUPITILA FORMATION EXPOSED ALONG
SHARI RIVER (DIGRAIL) AND DUPIGAON, SYLHET, BANGLADESH**

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Abstract: The Girujan Clay Formation is demarcated as *Bangladeshopollenites barishalensis* Zone, which is equivalent to middle-upper Siwalik sediments of Punjab Basin. The mangrove and coastal palynotaxa present in this formation indicate that these sediments have been deposited under the delta condition in a supratidal environment. The Girujan Clay Formation is considered to be of Mio-Pliocene in age. The DupiTila Formation is recognized here as *Corrugatisporites* sp. Zone. This formation is equivalent to Namsang bed of Assam-Meghalaya region. The palynological assemblage of this formation is suggestive of a high degree of precipitation and the presence of rainfed river system prevailing in the basin of deposition. It is of Plio-Pleistocene in age.

Key words: Girujan clay; DupiTila; Palynostratigraphy; Pliocene; Pleistocene; Sylhet; Bangladesh

Introduction

The Girujan Clay Formation develops conformably and gradationally from the underlying Tipam Sandstone. The arenaceous deposits of the DupiTila Formation unconformably overlie the Girujan Clay. Red, brown, purple and pale blue mottled clay is the characteristic lithology of the unit. Sandstone lenses of small lateral extent are present (Evans, 1932). The best exposures were observed at the banks of the *Shari* river near *Digrail* village. The DupiTila Formation is generally divided as the lower part (composed of variegated coarse grained, cross bedded sandstone) and the upper part (consists of fine to medium grained sandstone with mudstone). Some wood fragments and leaf impressions are present in the upper part. The exposed section of Dupitila was found in the *Dupigaon*, which is also the type locality of the formation (Fig. 1).

Johnson and Alam (1991), Khan (1991) and Reimann (1993) investigated the process of sedimentation and tectonics of Sylhet Trough. In terms of palynology the published data are scanty in Bangladesh; however Bakshi (1971) and Deb (1970) did the reference work in Bengal Basin. Dzitiev and Amin (1967) and Chowdhury (1982) investigated some Tertiary sediments of Bangladesh palynologically. But none of them investigated the

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Girujan Clay and Dupi Tila Formations. To the best of the knowledge of the authors no investigation on palynostratigraphy on the Girujan Clay and Dupi Tila Formations of Bangladesh has been yet published.

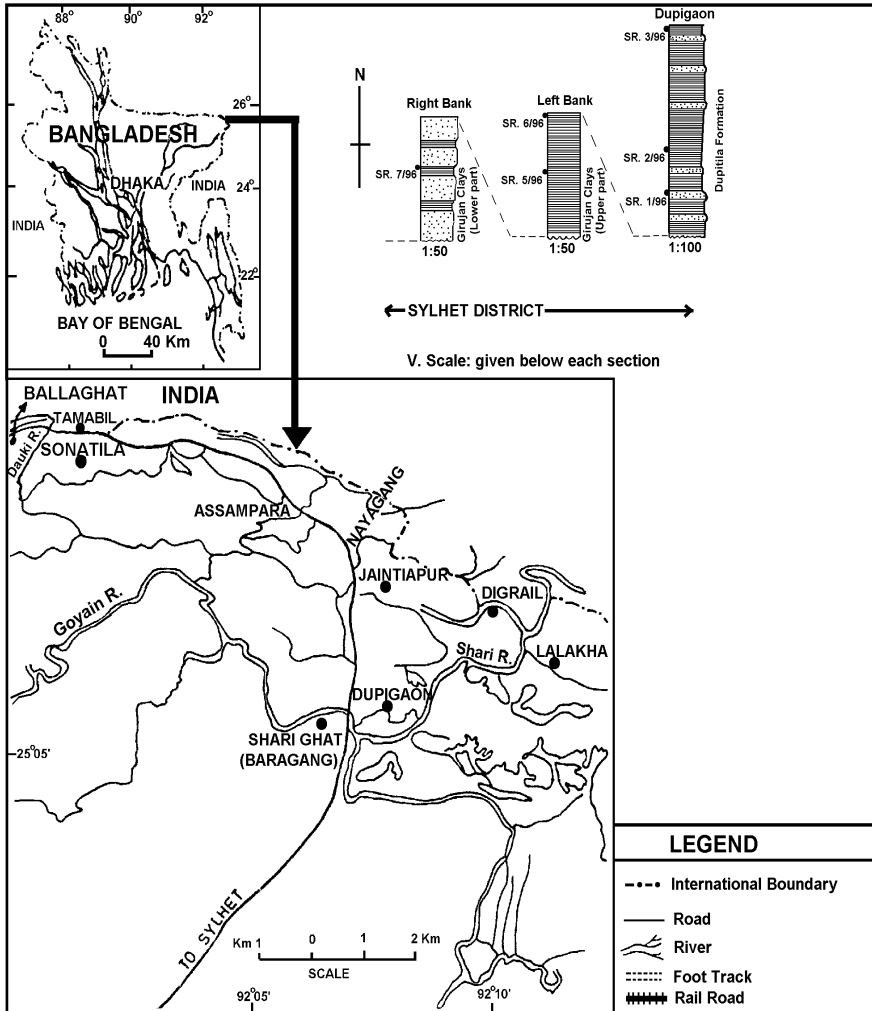


Fig. 1. Map of the study area.

The present investigation emphasis on establishing the Palynostratigraphic status of the Girujan Clay and Dupi Tila Formations and correlate them with the standard palynozones established in the North-Eastern India and with that of Internationally recognized Pantropical Zones of the Globe. The study also endeavor to interpret the depositional environment of the said formations.

Materials and Methods

The samples from the stratigraphic formations were collected during 1996-97. They were digested with HCl, HF and HNO₃ for palynomorphs recovery for 7 to 10 days. The samples were then washed with distilled water and treated with 5% KOH solution for 5-10 minutes. The recovered pollen were smeared with polyvinyl alcohol and fixed with DPX mountant. The slides were photographed under microscope (Olympus BH-2). The slides and unused materials are deposited in the repository of Environmental Science Discipline, Khulna University, Khulna, Bangladesh.

Results and Discussion

Palynomorphs assemblage of the Girujan clay formation: The Girujan Clay Formation has yielded a rich assemblage of palynomorphs containing 25 species belonging to 21 genera. The pteridophytes are represented by *Dictyophyllidites trilobiformis*, *Cyathidites australis*, *Concavisporites triquetrus*, *C. shariensis* sp. nov., *Concavisporites* sp., *Corrugatisporites turpitus*, *Corrugatisporites* sp., *Pteridacidites triangulatus*, *Cingulatisporites* sp., *Nityanandaspora indica* gen. et sp. nov., *Polypodiisporites formosus*, *Verrualetes baculatus*. While those of angiosperms origin are *Monosulcites rectangularis*, *Matanomadhiasulcites (Liliacidites)* sp., *Palmidites assamicus*, *Bangladeshopollenites barishalensis* gen. et sp. nov., *Palaeoalternanthera muladilis* sp. nov. The gymnosperms include *Araucariacites* sp. Those of algal origin are *Cryptosphaera pachyderma*, *C. valbata*, *Octaplata palanaensis*, *Psilosphaera plicata*, *Polysphaeridium subtile* and the fungal body is *Callimothallus* sp.

Palynomorphs assemblage of the DupiTila formation: The DupiTila Formation of the type area in Bangladesh is represented by 14 species belonging to 14 genera. The pteridophytes are *Concavisporites shariensis* sp. nov., *Leiotriletes punctatus*, *Eximispora indica*, *Leptolepidites verrucatus*, *Biretisporites cingularis*, *Striatriletes* sp. and *Polypodiaceasporites major*. The angiosperms are represented by *Retipilonapites* cf. *Remusatia vivipara*, *Verrualetes baculatus*, *Palmaepollenites eocenicus*, *Bangladeshopollenites barishalensis* gen. et sp. nov., *Palaeoalternanthera muladilis* gen. et sp. nov. and the gymnosperms is *Araucariacites* sp. The reworked Permian palynomorph recorded from this formation is *Circulisporites striatus*.

Regional floral comparison: The microfloral assemblage recovered from Girujan Clay Formation with its equivalent horizons in Assam-Meghalaya region, India (Kar, 1992) does not show any apparent relationship which may be because of different physiographic controls and differing environmental condition in the two basins. Whereas in case of DupiTila Formation the same locality shows the following characteristic features. In the Namsang Sandstone/Clay Formation in Lakwa bore hole 27 (Kar, 1992) the gymnosperms are poorly represented. It is represented by pteridophytes are: *Osmundacidites wellmanii*, *Striatriletes susannae*, *S. paucicostatus* and *Polypodiaceasporites tertiarus*. Kharsang 2, Namsang exhibits the abundance of *Crassoretiriletes vanraadshoovenii* and *Striatriletes susannae* etc. The DupiTila

Formation of Bangladesh and Lakwa borehole 27 have the common taxa like *Striatriletes* and *Polypodiaceasporites* etc. perhaps due to their synchronicity.

However the floral assemblage in Girujan Clay Formation with that of Punjab Basin has the following similarity. Nandy (1975) demarcated the Siwalik Palynological Zone-iv, which covers the uppermost portion of the Middle Siwalik and entire upper Siwalik. The palynotaxa of this zone is *Cyathidites*, *Leptolepidites*, *Polypodiaceasporites*, *Podocarpidites*, *Pinuspollenites*, *Alnipollenites*, *Betulaepollenites*, *Myrtaceidites* etc. The pteridophytic taxa reported by Nandy (1975) and Ghosh (1977) closely fit with the Girujan Clay Formation of Bangladesh. Thus Girujan Clay Formation of Bangladesh certainly enjoys a higher range in Neogene time demonstrating its equivalency with that of the Middle-Upper Siwalik sediments of the Punjab Basin.

Palynozonation: The Girujan Clay Formation of Bangladesh is characterized by frequent occurrence of monocolpate palm pollen, total absence of dicot pollen grains and presence of cingulate and corrugate spores. This formation is distinguished as *Bangladeshopollenites barishalensis* gen.et.sp. nov. Zone. The constituent palynotaxa of this zone are *Bangladeshopollenites barishalensis* gen.et.sp.nov., *Verrualetes baculatus*, *Palmaepollenites eocenicus*, *Retipilonapites* cf. *Remusatis vivipara* etc. The above mentioned palynozone recognized in Girujan Clay Formation of sediment is equivalent to *Crassoretitriletes vanraadshooveni* Pantropical Zone recognized by Germarrad, *et al* (1968) in the Miocene sediments of South East Asia.

The characteristic mioflora of Dupi Tila Formation is characterized by the occurrence of smooth exine bearing *Leiotriletes* grains and by the common occurrence of *Palmaepollenites* grains. Dupi Tila Formation is designated as *Corrugatisporites* sp. Zone. The major taxa in this horizon are *Cingulatisporites* sp., *Corrugatisporites* sp., *Nityanandaspora indica* gen.et.sp.nov., *Palmidites assamicus*, *Concavisporites shariensis* sp.nov. etc. This zone can be compared with *Echitricolporites spinosus* Pantropical Zones proposed by Germeraad *et al* (1968) of Pliocene age in South America, Africa and Borneo. The stratigraphic marker palynotaxa of Girujan Clay and Dupi Tila Formation are depicted in Fig. 2.

Climate and vegetation: The quantitative and qualitative analysis of the spore-pollen genera and their mode of deposition in the Girujan Clay Formation and Dupi Tila Formation reveal that the vegetation as well as climate conditions were not uniform. The probable affinity of the spores and pollen grains with the modern plant genera and families and the present day geographical distribution indicate that the floral assemblage includes spore and pollen of two climatic zones viz. tropical and temperate. The third and major upheaval of the Himalaya during Mio-Pliocene initiated the incoming of the colder climate. This area was an access to the open sea to the south and southeastern side. The floral distribution of the Girujan Clay Formation such as *Dictyophyllidites trilobiformis*, *Concavisporites triquetrus*, *Araucariacites* sp. indicate temperate climate whereas *Cyathidites australis*, *Corrugatisporites turpitis*, *Corrugatisporites* sp., *Pteridacidites triangulatus*, *Verrualetes baculatus*, *Monosulcites rectangularis*, *Matanomadhiasulcites*

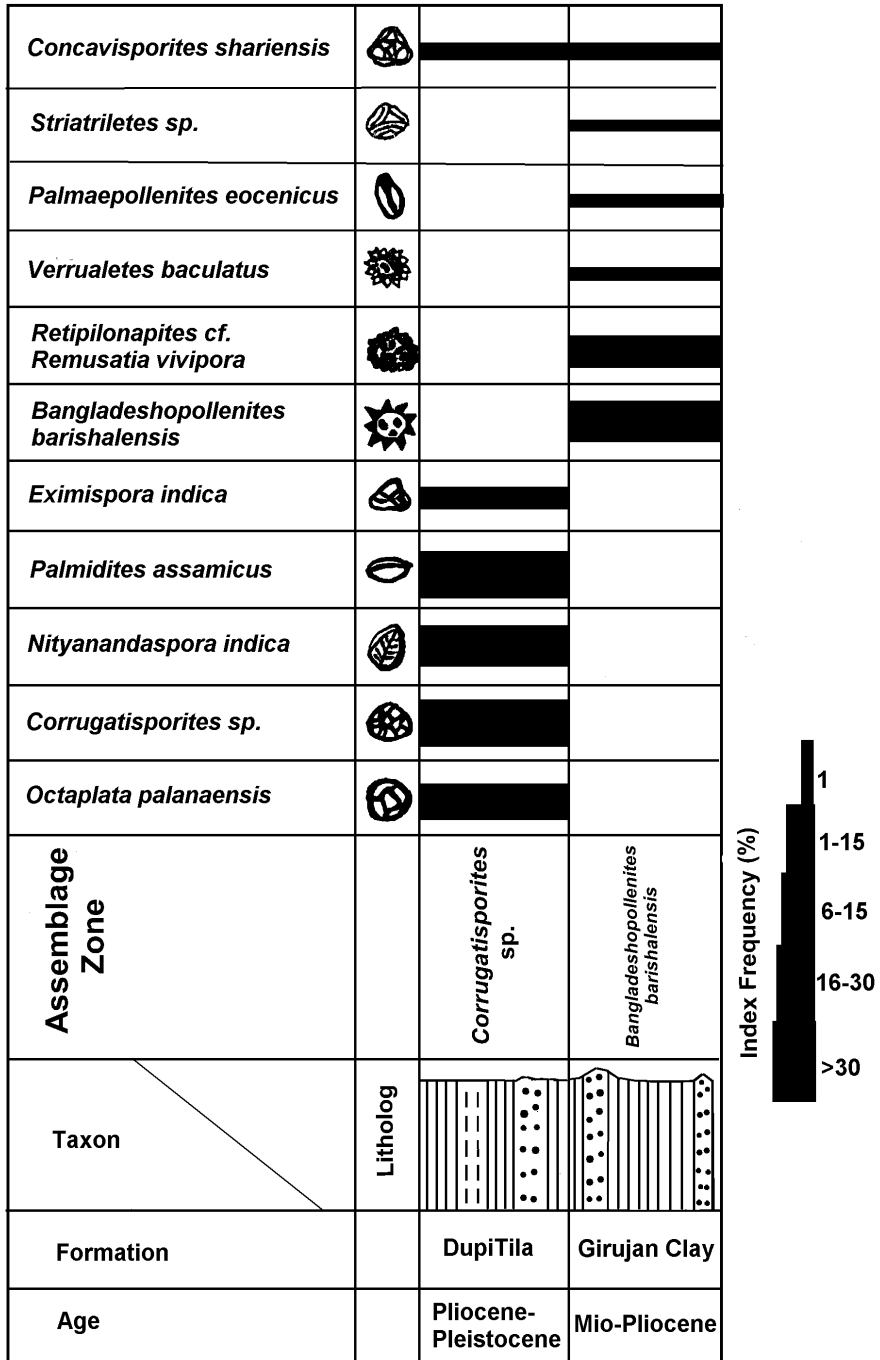


Fig.2.

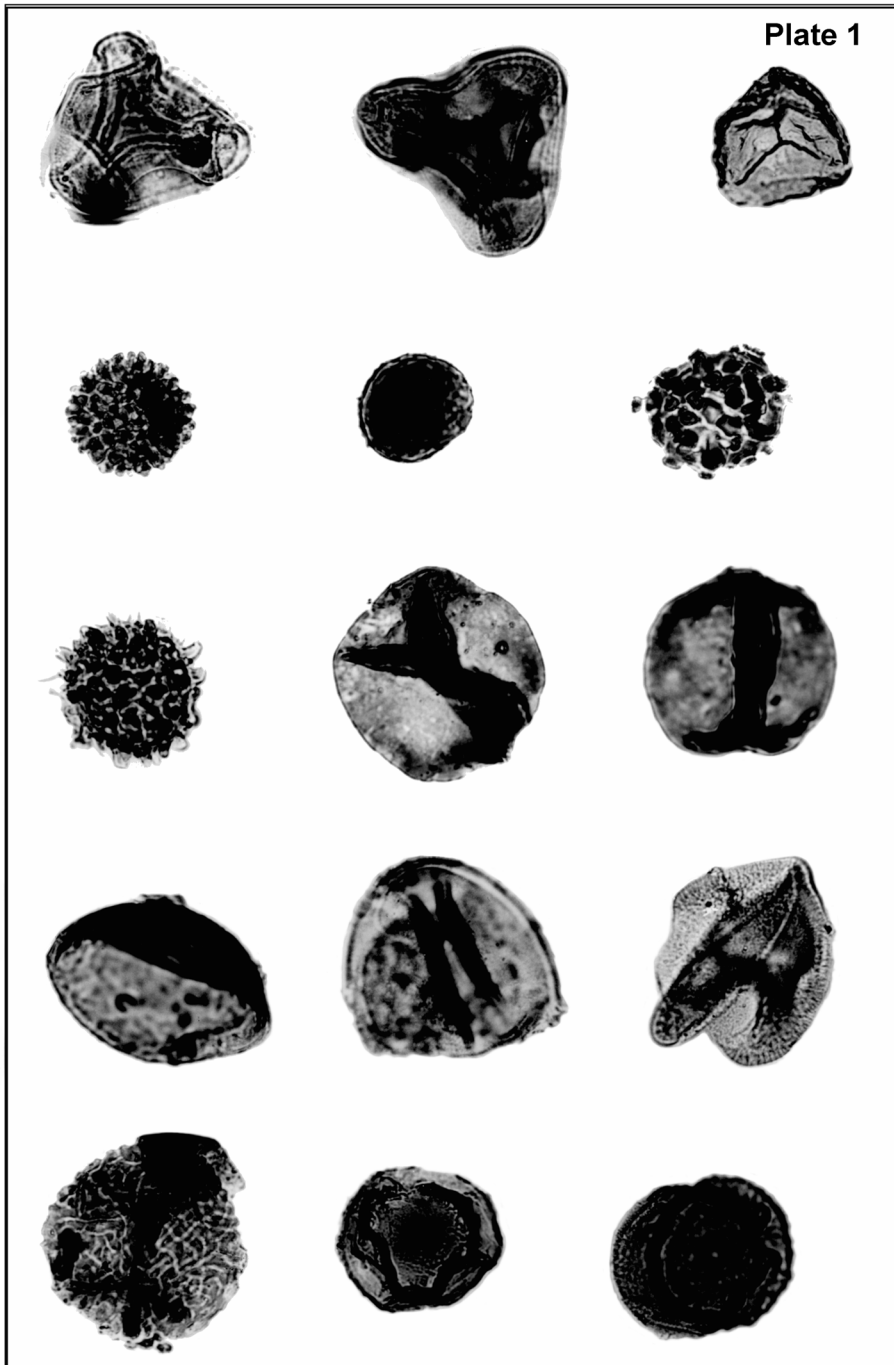


Plate 1. Palynotaxa recovered from Girujan clay and Dupitila formation.

Table 1. Explanations of plate 1.

Sp. No	Name	Code
1	<i>Concavisorites shariensis</i> sp.nov.	SR. 6/96 ,5/2)
2	--	SR. 6/96, 5/1
3	<i>Striatriletes</i> sp.	SR.2/96, 6/3
4	<i>Verrualetes baculatus</i> Kumar	SR. 3/96, 1/2
5	<i>Retipilonapites</i> cf. <i>Remusatia vivipara</i> Ramanujam	SR. 2/96, 10/7
6	<i>Bangladeshopollenites barishalensis</i> gen. et sp. nov	SR. 1/96, 6/1
7	--	SR.1/96,1/5
8	<i>Eximispora indica</i> sp. nov.	SR. 1/96, 4/5
9	--	SR.1/96,5/2
10	<i>Palmidites assamicus</i> Singh	SR. 1/96, 5/2
11	<i>Nityanandaspora indica</i> gen et sp nov	SR. 6/96, 7/10
12	--	SR. 6/96, 7/11
13	<i>Corrugatisporites</i> sp.	SR. 5/96, 3/2
14	<i>Octaplata palaeoensis</i> Sah and Kar	SR. 5/96, 1/1
15	--	SR.5/9

N.B. SR. 1/96, SR. 2/96, SR. 3/96 represent DupiTila formation and SR. 5/96, SR. 6/96, SR. 7/96 represent Girujan clay formation.

(*Liliacidites*) sp., *Palmidites assamicus*, *Bangladeshopollenites barishalensis* gen. et sp. nov., *Palaeoalthernanthera muladilis* sp. nov. *Cryptosphaera pachyderma*, *C. valbata*, *Octaplata palanaensis*, *Psilosphaera plicata*, *Polysphaeridium subtile*, *Callimothallus* sp. represent tropical to subtropical climate (Baksi,1971; Deb,1970; Kar,1992). Retention of the two type of vegetation in the Girujan Clay Formation suggests that the sediments might have derived from two different sources i.e. the spores and pollen inhabiting temperate climate might have been derived from the north and that of tropical to subtropical climate from the south. And finally it can be concluded that the Girujan Clay Formation in Bangladesh deposited under the marginal marine condition. It is considered to be of Mio-Pliocene in age.

Paucity of miofloral elements in the DupiTila Formation might be due to the tectonic disturbances. The palynological assemblages present in the DupiTila Formation such as *Palmidites assamicus*, *Nitysnandaspora indica*, *Striatriletes* sp., *Corrugatisporites* sp. (Baksi, 1971; Deb, 1970; Kar, 1992) represent its association with tropical to subtropical climate. It suggests a high degree of precipitation in the area and the presence of rainfed river system prevailing in the basin during the time of deposition. The DupiTila Formation of Bangladesh is considered to be of Pliocene-Pleistocene in age.

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References

- Baksi, S. K.,1971. On the palynological biostratigraphy of Bengal Basin. *Proc. Sem. Paleopal. Ind. Strat.*, Calcutta :188-206.
- Chowdhury, S.Q., 1982. Palynostratigraphy of the Neogene sediments of the Sitapahar Anticline (western flank), Chittagong Hill tracts. *Bang. Jour. Geol.*, Vol. 1: 35-49.

Saha, S.K. and Singh, R.Y., 2000. Palynostratigraphic status and depositional environment of Girujan clay and Dupitila formation exposed along Shari river (Digraii) and Dupigaon, Sylhet, Bangladesh.

Deb, U., 1970. Palynological investigation of Tertiary sediments of Bengal Basin, South of Calcutta. *Bull. O.N.G.C.*, Vol. XIII, No. 3: 127-139.

Dzitieva, A. H. and Amin, S. M., 1967. Palynological basis for the subdivision of Miocene deposits in bore holes of the Jaldi area, East Pakistan. *Geol. Bull. Panj. Univ.*, No. 6: 25-36.

Evans, P., 1932. Tertiary succession in Assam. *Trans. Min. Geol. Inst. Ind.*, 27:155-260.

Germeraad, J. H., Hopping, C. A. and Muller, J., 1968. Palynology of Tertiary sediments from tropical areas. *Rev. Palaeob. Palynol.* 6 (3 and 4): 189-348.

Ghosh, A.K., 1977. Palynology of the Siwaliks. *Adv. Pollen-Spore Res.* II: 1-6.

Johnson, S. Y. and Alam, A. M. N., 1991. Sedimentation and tectonics of the Sylhet trough, Bangladesh. *Bull. Geol. Soc. Ame.*, Vol. 103 :1513-1527.

Kar, R.K., 1992. Stratigraphic implications of Tertiary palynological succession in north-eastern and western India. *Palaeobotanist* 40: 336-344.

Khan, F.H., 1991. Geology of Bangladesh. U.P.L Dhaka, 207 pp.

Nandy, B., 1975. Palynostratigraphy of the Siwalik Group of Punjab. *Him. Geol.*, Vol. 5: 411-424.

Reimann, K.U., 1993. Geology of Bangladesh. Gebruder Borntraeger. Berlin. Stuttgart, 142 pp.