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INTERPLAY BETWEEN POLLEN AND VEGETATION IN AND AROUND DHIR BEEL, DHUBRI DISTRICT, ASSAM: A FUTURE POTENTIAL RAMSAR SITE

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Wetland has a significant role to maintain biodiversity offering suitable habitat for support and growth of varied aquatic life forms both macrophytes and microphytes, playing vital role in primary productivity of the ecosystem. This paper deals with the study of macro and micro phytodiversity in relation to pollen preservation and human impact in and around Dhir Beel of Dhubri District, Assam. The present palynological studies though does not fully match the extant vegetation, the interplay between pollen quantum and vegetation in the study area will be of great significance to understand the pattern of pollen / vegetation relationship in a coveted wetland in the District. The presence of Cerealia (*Triticum* and *Oryza*) associated with other cultural pollen especially, *Xanthium*, *Ambrosia*, Caryophyllaceae including *Paspalum distichum* (a typical grass at crop land) directly support pastoral activity in and around the study area. The large number of fungal remains especially Microthyriaceous fruiting body, *Xylaria*, *Nigrospora*, *Cookenia* and *Glomus* strongly suggest humid climatic condition during deposition of microbiota. The evidence of degraded palynomorphs and few fern allies in sediment suggests the induction of biological degradation in wetland. However, the evidence of degraded pollen like *Betula* and *Corylus* also support the long distance transport of microbiota from higher altitude (Arunachal Himalaya). The further study on this exotic element is needed to understand the fact whether the biological degradation happened after incorporation in sediment or carried in degraded form and then become part of sediment.

Key words: Assam, Biodiversity, Dhir beel, Palynology

Wetland or Beel (call by Assamese people) are among the most productive ecosystem in the world, they are repositories of diverse species of microbes, plants, insects, amphibians, reptiles, birds, fishes and mammals. The ideal climate, landscape, geology, movement and abundance of water help the flora and fauna inhabiting the wetland ecosystems. Wetlands are "biological supermarkets", which provide immense food and other nutrients that attracts many animals and plant species for completion of their life cycle. The decaying plant and animal parts in the wetlands are converted into organic matter by bacteria that are fed by many small aquatic insects, and fishes which are fed for larger predatory fishes, reptiles, amphibians, birds and mammals respectively. Wetland can be used for conservation of biodiversity (Kundu *et al*. 1997) too. A preliminary data on flora and fauna of Hashila beel, Goalpara District have also been generated by Ahmed and Basumatary during 2004. The satellite data (ARSAC, Guwahati), reveals that total coverage of wetland area is 1,01,229.4 ha, accounting for 1.9% of total geographical area of the state (Deka and Goswami 1992).

The Dhir beel is a major water body which is situated at Lat. $26^0$17'N and Long. $90^0$23'E in the Dhubri District of Assam (Fig.I) It is characterized as a major floodplain wetland, covering an area of 689 ha and has connection with the mighty Brahmaputra river through a 11-km long channel. In the East of the Dhir beel there is Chapor tea Estate in the West surrounded by Pakhipara, Gobindapur and Bangaldoba villages. However, in the North Chakrasila Wildlife sanctuary lies and the NH

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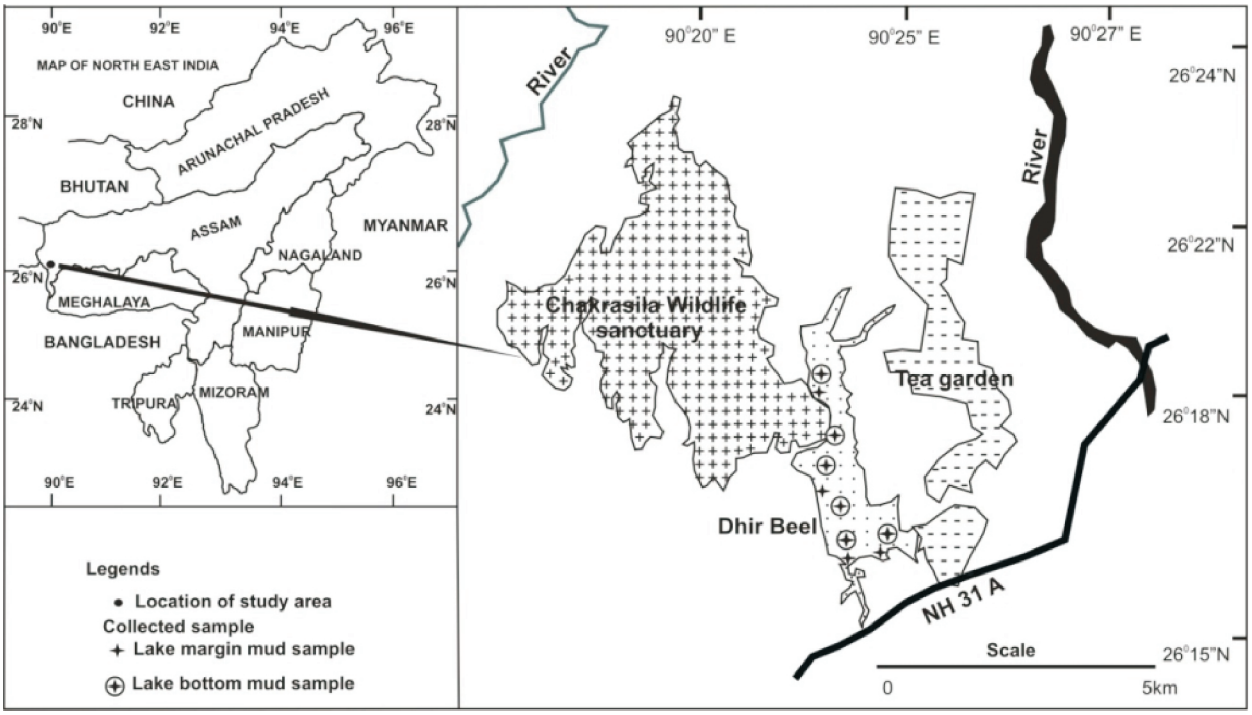

Figure 1: Location map of Dhir Beel

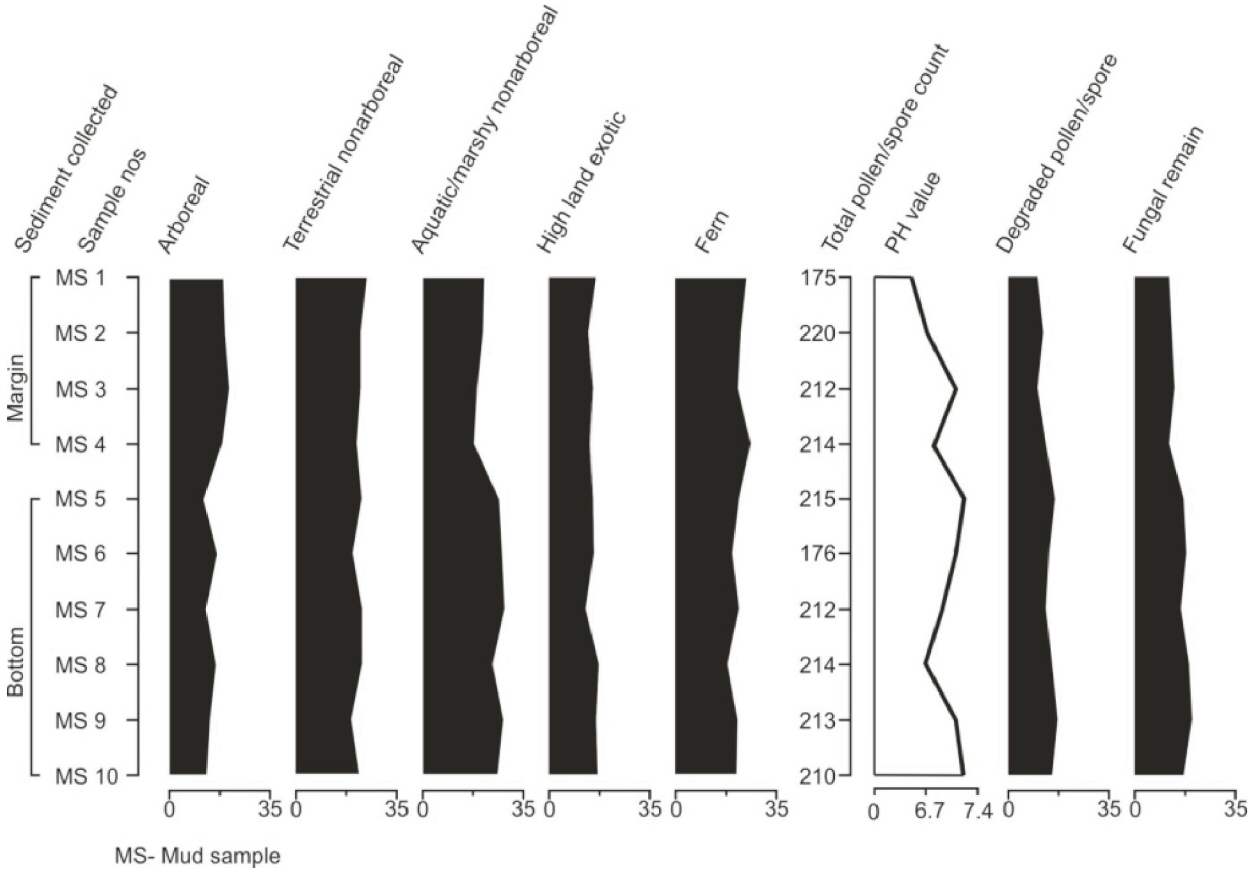

Figure 2: Pollen spectra of Dhir Beel

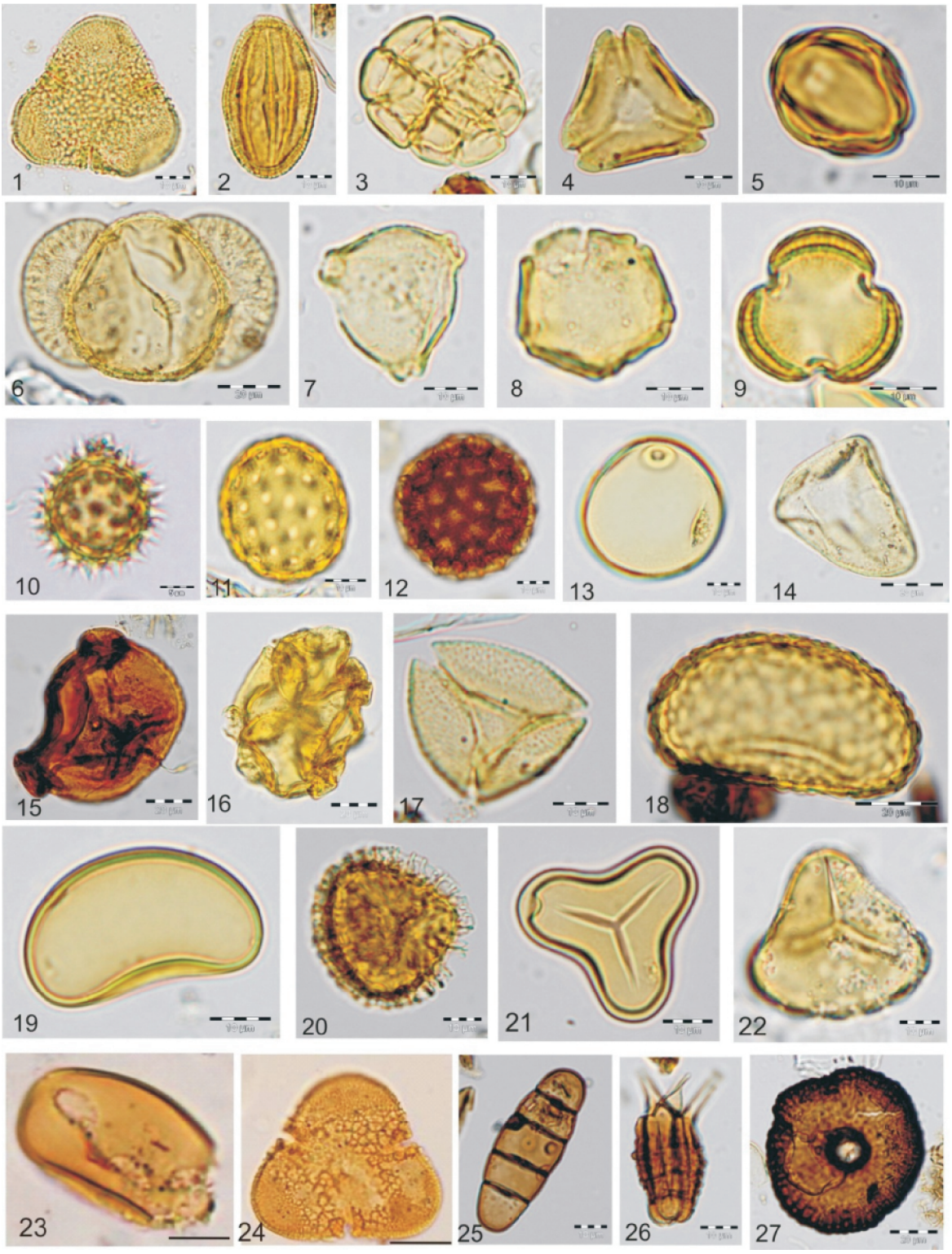

Figure 3: Palynoassemblage recovered from the Dhir Beel Photoplate

1. Salmalia malabaricum, 2. *Semecarpus anacardium*, 3. *Acacia catechu*, 4. *Syzygium cumuni*, 5. *Terminalia bellerica*, 6. *Pinus* sp., 7. *Betula* sp., 8. *Alnus* sp., 9. *Artemisia* sp., 10. Tubuliflorae, 11. Chenopodiaceae, 12. *Polygonum serrulatum*, 13. Poaceae, 14. Cyperaceae, 15. *Ludwigia* sp., 16. *Typha sp.*, 17. *Nymphoides* sp., 18. *Davallia* sp., 19. *Dryopteris* sp., 20. *Lycopodium* sp., 21. *Pteris* sp., 22. Degraded trilete, 23. Degraded monolete, 24. Degraded *Salmalia* pollen, 25. *Meliola* sp., 26. *Tetraploa*, 27. Microthyriacae

31A is situated in the south. The general climate around the study area is warm and humid during summer. The tropical monsoon climate is characterized with a prolonged monsoon season from May to September. Whereas, the winter is relatively cool and dry and a pre-monsoon period continue from March to May with occasional storms. Temperature ranges from 10.6^{0}C to 32^{0}C at places during winter and summer respectively. The Dhir beel not only provides water for cultivation in the nearby agricultural land, but also maintains the eco-system and a potential site for ecotourism (Singha *et al*, 2006) through preservation of many species of aquatic flora (floating and submerged) and rich fauna. Despite the rich phytodiversity the present coveted beel has all eligibility features which make suitable for being declared Ramsar site like many other in the country. The present communication is an attempt to provide some clues (pollen proxy) toward conservation and preservation status of the Dhir beel ecosystem in relation to palynological interpretation and is also expected to bring out the anthropogenic impact on natural wetland vegetation as well as migration and extinction of many important plant elements as a consequence of increasing over exploitation, climatic shifts and natural catastrophe.

MATERIAL AND METHODS

The total 10 mud samples (Fig. 2) were pollen analyzed. Out of which MS 1- 4 from margin and MS 5-10 from bottom were procured from the beel for pollen analytical investigation. The samples were chemically treated by conventional acetolysis method (Erdtman 1943). Pollen counts were made ranging from 160-220 per sample. The pollen frequency percentages have been calculated in terms of total plants pollen counts, whereas microphytes such as diatoms, algae, degraded pollen and spore and fungal remains have not been included in the pollen sum. The plant taxa are grouped as arboreals, terrestrial nonarboreals and aquatic/marshy, high land exotic and fern accordingly in the pollen spectra.

POLLEN/VEGETATION RELATIONSHIP

Vegetation composition

The Dhir beel is one of the most potential area for palynological studies owing to its unique phytodiversity. Soil pollen analysis is an important component of palynological research while pollen preservation and the relationship between pollen and vegetation can influence the correct interpretation of fossil pollen spectra. Keeping this view in mind, the sediments have been analyzed in order to portray relationship between pollen and vegetation and its preservation within this pristine ecosystem.

The principal aquatic/marshy angiosperm vegetation were found in Dhir beel can be distinctly categorized, viz., free floating: *Eichornia crassipes*, *Ceratopsis thallictroides*, *Trapa bispinosa*, *Salvinia oblongifolia*; Free and submerged: *Potamogeton pectinatus*, *Ceratophyllum demersum*, anchored submerged: *Hydrilla verticilata*, *Vallisnaria spirales*; anchored and floating: *Nymphaea nouchali*, *Marsilea minuta*, *Nelumbo nucifera*, *Myriophyllum indicum*; emergent amphibious: *Rumex nepalensis*, *Polygonum orientale*, *Hypericum joponicum*, *Ranunculus reptans*, *Hydrocotyle javanica*, *Scirpus articulatus*, *Fimbristylis scirpoides*, *Sagittaria segitifolia*; marshy and amphibious: *Ammania baccifera*, *Commelina benghalensis*, *Ipomoea aquatica*, *Jussiaea repens*, etc. Most economically important medicinal plants include *Rauvolfia serpentine*, *Vitex negundo*, *Dioscorea pentaphylla*, *Costus speciosus*, *Holarrhena antidysenterica*, *Datura metal* and *Dryopteris*

sylvestris, etc. The scattered arboreal taxa in the vicinity are *Salmalia malabaricum*, *Dillenia indica*, *Butea monosperma*, *Emblica officinalis*, *Cassia fistula*, *Terminalia bellerica*, *Lagerstroemia speciosa*, *Albizia lebbeck*, *Melastoma malabathricum*, etc.

Hitherto, no much palynological information is available for interpretation of modern pollen/vegetation relationship from wetland area of lower Assam region. Although some preliminary works have been carried out at Cinnamara (Gupta 1971), Mikir Hill (Bera 2000), Deepor beel (Bera *et al*. 2008) and in East Garo Hills (Basumatary and Bera 2007).

POLLEN SPECTRA

Sample nos MS 1-4: The study of MS (1-4) mud samples procured from the margin of beel reflects the dominance of nonarboreals belongs to both terrestrial and marshy/aquatics. The major terrestrial nonarboreal pollen taxa belong to Tubuliflorae, Poaceae, Apiaceae, Rubiaceae, Euphorbiaceae, Lamiaceae, Ranunculaceae, Cyperaceae, etc., under 11-23%. However, The marshy aquatic taxa consisting of Polygonaceae, Onagraceae, *Nymphaea*, *Potamogeton*, *Typha*, etc., within the value of 17-30.0%. The major arboreal taxa namely *Salmalia malabaricum*, *Terminalia bellerica*, *Syzygium cumunii, Dillenia indica and Emblica officinalis are recorded under the value of 19%.* The high land exotic taxa like *Pinus*, *Betula*, *Alnus*, etc., were encountered at the average value of 15%. The ferns allies namely *Dryopteris*, *Gleichenia*, *Polypodium*, *Pteris*, *Lygodium*, *Lycopodium*, etc., are encountered at the average value of 24%.

Sample nos MS 5-10: The study of (5-10) mud samples procured from the bottom sediment of beel also reflects the predominance of terrestrial nonarboreal and marshy/aquatics taxa over arboreal. The major terrestrial nonarboreals are represented as Asteraceae, Poaceae, Apiaceae, Rubiaceae, Convulvulaceae, at the average value of 22%. Likewise, among marsh aquatics Cyperaceae, *Nymphoides*, *Nymphaea*, *Potamogeton*, *Typha* and *Trapa* are recorded at the average value of 27%. The major arboreals are recorded viz., *Butea monosperma*, *Salmalia malabaricum*, *Zyzyphus jujuba*, *Dillenia indica, Albizia lebbeck and Melastoma malabathricum*, etc., within 14%. The high land exotic taxa like *Pinus*, *Betula*, *Corylus*, etc., also are encountered in good values (14%). Fern spore taxa such as *Dryopteris*, *Polypodium*, *Davallia*, *Pteris*, *Lygodium*, *Lycopodium*, etc., are encountered at the average value of 21%. It has also been observed that the frequency of degraded palynomorphs was relatively more in sediments of high pH (Fig. 2).

The presence of fairly good frequency of degraded pollen and spores along with adequate fungal remain indicate the inception of microbial degradation during sedimentation. The presence of extra regional taxa has supported long distance transportation in and around the study area. The presence of Microthyriaceae in poor value indicate humid climatic condition and the presence of Cerealia pollen along with other cultural pollen viz., *Xanthium*, Acanthaceae, Caryophyllaceae, Brassicaceae directly support pastoral activity by the local people. The further studies on more sediment are needed for palynological study in relation to pollen production, dispersal, deposition and vegetational history from the coveted beels.

Though the pollen spectra does not fully cohere with the modern wetland vegetation set up both qualitatively and quantitatively, the interpretation of pollen deposit assume that frequencies of pollen types found reflect changes in proportions of species or genera in different season. These changes are

often interpreted as the result of climatic change along with anthropogenic activity as one of the major factors affecting species composition of the ecosystem. Therefore, with the acquired knowledge of the extant vegetation, one may reconstruct the vegetation succession and related environmental changes in recent past in terms of ecological status of the dispersal pollen grains.

REMARKS

The palynological investigation from the present account, it is evident that the Dhir beel is suffering from the several problem of ecodegradation and rapid eutrophication caused by massive debris from the floating vegetation and the silt carried by surface run off as well as stream during rainy season. Despite luxuriant growth of many medicinal plants no medicinal plants (*Costus speciosa*, *Rauvolfia sarpentina*, *Vitex negundu* etc.) pollen has been deposited, needs further investigation. Exotic thermophilous taxa like *Pinus*, *Betula* and *Corylus* suggest high wind activity around the beel. It has also been observed that the frequency of degraded palynomorphs was relatively more in sediments of high pH (Fig.3). The presence of low profile of *Trapa*, *Nymphaea*, *Eichhornia* and *Nelumbo* pollen predicts poor water condition causing uncondusive depositional environment in the Beel. It is surprising to note that, Dhir beel has all eligibility criteria like vulnerable, endangered or threatened species attract more than 20,000 birds including bare headed goose, lesser whistling teal, white breasted water hen, spotted dove and purple horn for declared a Ramsar site of international importance. But at present, Deepor beel is the only water body in the state, designated as a Ramsar site in November 2002.

Therefore, to save the diversified life forms in this fragile ecosystem, more multidisciplinary scientific approaches including limnology, sedimentology and palynology along with proper wetland management by Government as well as NGOS are required urgently. If not, the whole biodiversity will soon disappear and loose its entity.

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