

## Leaf impressions from the Siwalik beds of South-Eastern Buthan and their climatic significance

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### SUMMARY

Two leaf impressions collected from Darranga river section of the Siwalik beds (Formation II, Middle Miocene-Pliocene) of Bhutan have been described with their climatic significance. A comparative study of the leaf impressions has been done with the modern taxa *Lagerstroemia parviflora* Roxb. and *Lagerstroemia microcorpa* Linn of the family Lythraceae. Occurrence of these two leaf impressions indicate that tropical evergreen forest may have flourished under warm humid climatic conditions in the Himalayan foot hills of Bhutan during Mio-Pliocene times.

Key words : Megafossils, Mio-Pliocene, Himalayan, Foot Hills, Bhutan.

A variety of plant megafossils including petrified woods and impressions of leaves, fruits, flowers and seeds have been recorded from Siwalik Sediments of India and Nepal (Prakash and Tripathi, 1992; Antal and Awasthi, 1993; Konomatsn and Awasthi, 1999; Prasad and Awasthi, 1996 and Tripathi *et al.*, 2002). Very little detailed work was carried out so far considering the wide extent of Siwalik Sediments in the Bhutan sub Himalaya. Banerjee and Dasgupta (1984) described a few leaf impressions from the Siwalik sediments of Lakshmi and Darranga River sections under some artificial genera such as, *Siwalikiphyllum*, *Dilcheria*, *Ghosia*, *Pseudopaxillatophyllum* and *Darrangiophyllum*. Unfortunately, these artificial genera could not be compared with any extant taxa, They have discussed the palaeoenvironmental and palaeoecology of the area only on the basis of morphological features of fossil leaves, The identification and documentation of more and more taxa from different localities of the known sequence are important for precise reconstruction of the floristics and climate. Later on two fossil woods and five leaf impression such as *Dipterocarpoxyton parabaudii* Prakash 1978, *Hopenium kalagarhensis*; *Mitrephora siwalica* Antal and Awasthi, 1993, *Dipterocarpus siwalicus* Lakhanpal and Guleria 1987; *Toona siwalica* Awasthi and Lakhanpal, 1990; *Milletia koilabasensis* Prasad, 1990, *Combretum miocenicum* sp. nov. were described by Prasad and Tripathi (2000) from the Middle Siwalik Sediments (Formation - II) from Lakshmi river section Based on the floral assemblage, recorded so far from the south eastern Bhutan, Palaeoclimate during Mio-Pliocene has been interpreted.

### Geological setting :

The uplift and erosion of the Himalayan high land during the Neogene has resulted in an extension apron of terrestrial sediments deposited all along the Himalayan Foot Hills in India, Nepal, Pakistan and Bhutan, These sediments are called the Siwalik sediments and made up of sandstones, grits, conglomerates, pseudoconglomerates, clay and silts. The exposed Siwalik sections along the foot hills in Bhutan are mostly normal, without tectonic complications except for some local faulting and secondary thrusting near the Main Boundary Thrust. These sediments delineated by the E-W trending Main Boundary Fault separating it from Pre-Tertiary metasediments and spindle shaped fault slices of Gondwana rocks in the north and overlain by Brahmaputra alluvium in the south.

The various Siwalik outcrops along the Himalayan foot hills of eastern Bhutan have more or less steep northerly dip and include well exposed Derrathang Section which seems mainly to belong to the Middle and Upper Siwaliks. The youngest outcrops occur near the Main Boundary Thrust and the oldest along the southern margin. Mallet (1875) also described the Middle and Upper Siwaliks from western and eastern Bhutan. Nautiyal *et al.* (1964) and Ganser (1983) observed the classical three fold division in this region but mentioned that the distinction between the Lower and Middle sub division is not easily recognizable.

Jangpangi (1974) followed them and suggested three fold division for south-eastern Bhutan in addition to the locally Diklai boulder beds.

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