

## A THELYPTERIDACEOUS FOSSIL FERN FROM THE LOWER SIWALIK OF THE EAST KAMENG DISTRICT, ARUNACHAL PRADESH, INDIA

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**An impression of a fern frond, collected from the Lower Siwalik Formation from the left bank of the Pakke River in the East Kameng District, is being described and constitutes the first reported occurrence of a fern megafossil from Northeast India.**

The Lower Siwalik rocks are considered to be Middle-Upper Miocene in age (Awasthi, 1982). The generalized lithotectonic sequence of the Kameng District has already been described by Joshi et al. (2002) and is presented in the Table 1. The Main Boundary Fault (MBF) is the northern limit of the Siwalik Group whose constituent formations exhibit reverse stratigraphic order due to a number of reverse faults. However, in the area (Fig. 1C), Lower Siwalik rocks have been thrust over the rocks of Upper Siwalik and there is a complete elimination of Middle Siwalik rocks in this part of the East Kameng District.

The type specimen has been housed in the repository of the Geological Survey of India, Kolkata.

Table 1. Generalized lithotectonic sequence in the Kameng District, Arunachal Pradesh (after Joshi and Chakraborty, 2001)

North	
Gondwana	Carbonaceous shale, sandstone and coal with plant fossils
..... MBF .....	
Lower Siwalik	Well indurated sandstone, shale and siltstone Abundant plant fossils
..... Fault .....	
Middle Siwalik	Weakly indurated sandstone with concretions, shale, siltstone and conglomerate Abundant plant fossil
..... Fault .....	
Upper Siwalik	Sandrock, claystone/shale and boulder beds/ gravel beds Abundant plant fossils especially petrified and carbonised wood
..... Main Frontal Fault .....	
Assam alluvia/Quaternary deposits	
South	

### SYSTEMATICS

Division Pteridophyta  
Family Thelypteridaceae  
Genus *Thelypteridaceophyllum* gen. nov.

*Thelypteridaceophyllum tertiarum* gen. et sp. nov.

Fig. 2a,c

*Description:* Frond sterile, preserved length 2.5 cm, width about 1 cm, appearing sessile, oblong in shape; apex broken; base obtuse; margin appearing entire; texture coriaceous; about 13 pairs of pinnules visible, each about 6 mm in length and 1.5 -2 mm in width, sub-opposite, mid-rib stout; venules maximum 10 pairs observed in each pinna, arising at acute angle, opposite to sub-opposite.

*Remarks:* The above characters of the fossil indicate its affinities with the family Thelypteridaceae (Beddome, 1970, p. 57, pi. CLXXn; Hebarium sheet nos. CNH 52291,20243; Fig. 2b). Holttum et al. (1970) studied in detail the morphologically allied genera *Cyclosorus* Avk, *Goniopteris* Pr., *Ampelopteris* Kunze and *Thelypteris* Schmidel and mentioned certain differences among them. These differences are based on characters, viz. unicellular glandular/non-glandular hairs, spores, anatomy of rhizome, chromosome number etc. which could not be observed in the present fossil frond. Therefore, its affinities upto the generic level can not be traced.

About a decade ago Prasad (1991) described a fern frond resembling *Goniopteris prolifera* Presl from the Lower Siwalik sediments of Kathgodam-Nainital road, Uttaranchal. A few years back Guleria and Srivastava (2000) pointed out that one of the species of *Goniopteris*, *G. prolifera* had already been merged with the genus *Ampelopteris* as *A. prolifera* (Retz.) Copel. (Sledge, 1982) and therefore, they assigned the fern described by Prasad to *Ampelopteris*. The present fossil was compared in detail with the same and it was found similar to the Prasad's specimen. Prasad (1991) while describing his fossil fern neither mentioned any type/figured specimens nor named the fossil. Guleria and

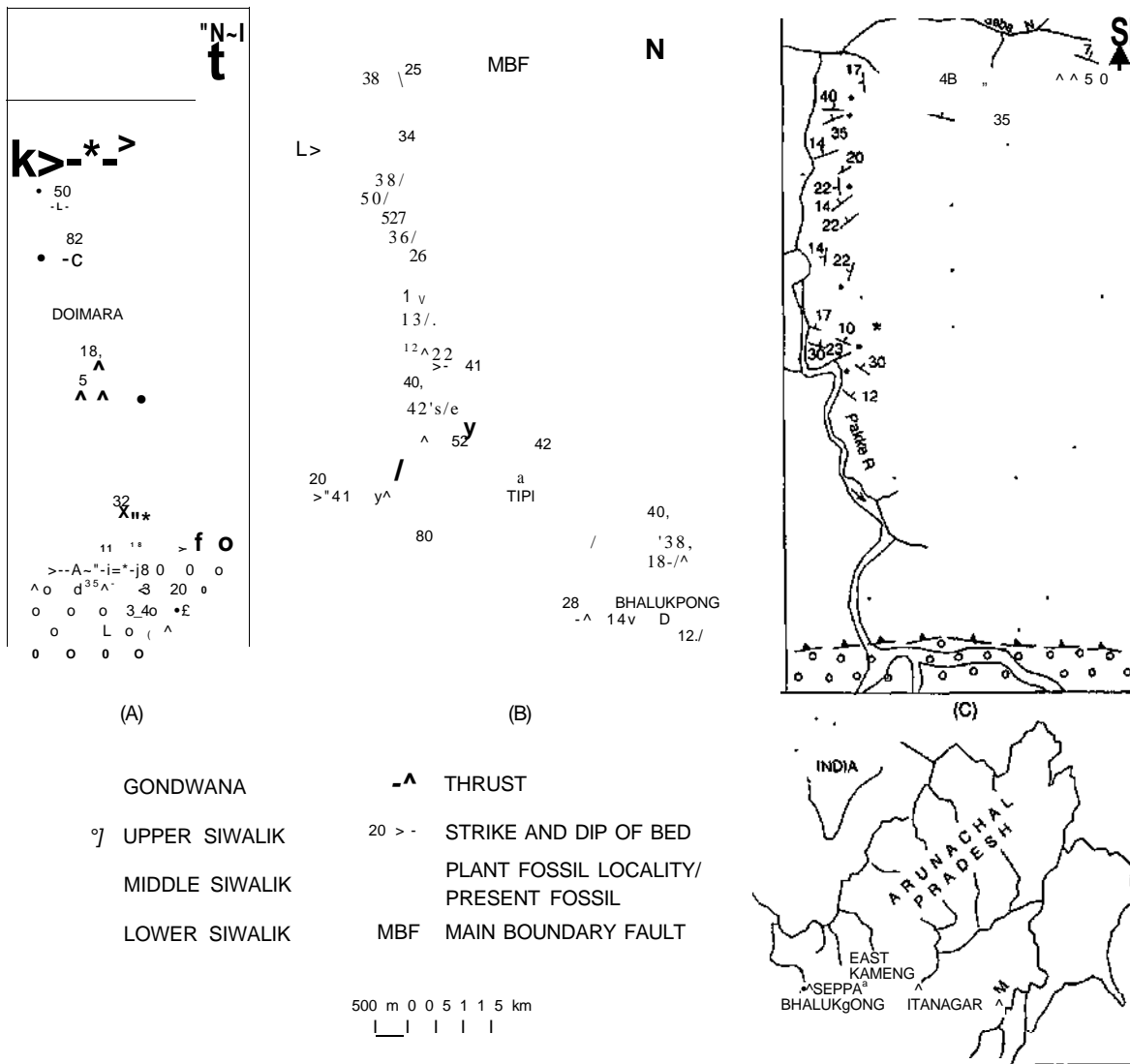


Fig.1. Parts of geological map of the region depicting the location of plant fossils in East and West Kameng districts of Arunachal Pradesh, India (after Joshi and Chakraborty, 2001)

Srivastava (2000) though mentioned type numbers of Prasad's specimens (without mentioning the name of the repository), assigned his fern to *Ampelopteris* without following the binomial system of nomenclature. In our opinion its placement to *Ampelopteris* is not correct on the basis of the available characters, as it can only be identified up to the family level. According to Lakhanpal and Prakash (1980) when it is not possible to identify a fossil plant part beyond the family level, a new organ genus may be created by adding the suitable suffix after the family name. Therefore, a new organ genus *Thelypteridaceophyllum* gen. nov. is instituted to include the fern fronds showing resemblance with the family Thelypteridaceae.

In the present communication we are describing our fossil as *Thelypteridaceophyllum tertiarum* gen. et sp. nov., the specific epithet indicating its occurrence in Tertiary. As Prasad's specimens are similar to that of ours, we have also assigned them under the same.

Further, Guleria and Srivastava (2000, Fig.1B) showed the finer venation of Prasad's specimen in the form of a text figure. Unfortunately, in this figure venules are shown inversely oriented (bent towards the rachis) which is not natural. We are of the opinion that the authors misunderstood margin as the mid-vein and vice-versa. In the leaves and leaf-lets veins/venules are bent towards the tip as shown by Holttum et al (1970, fig. 13).

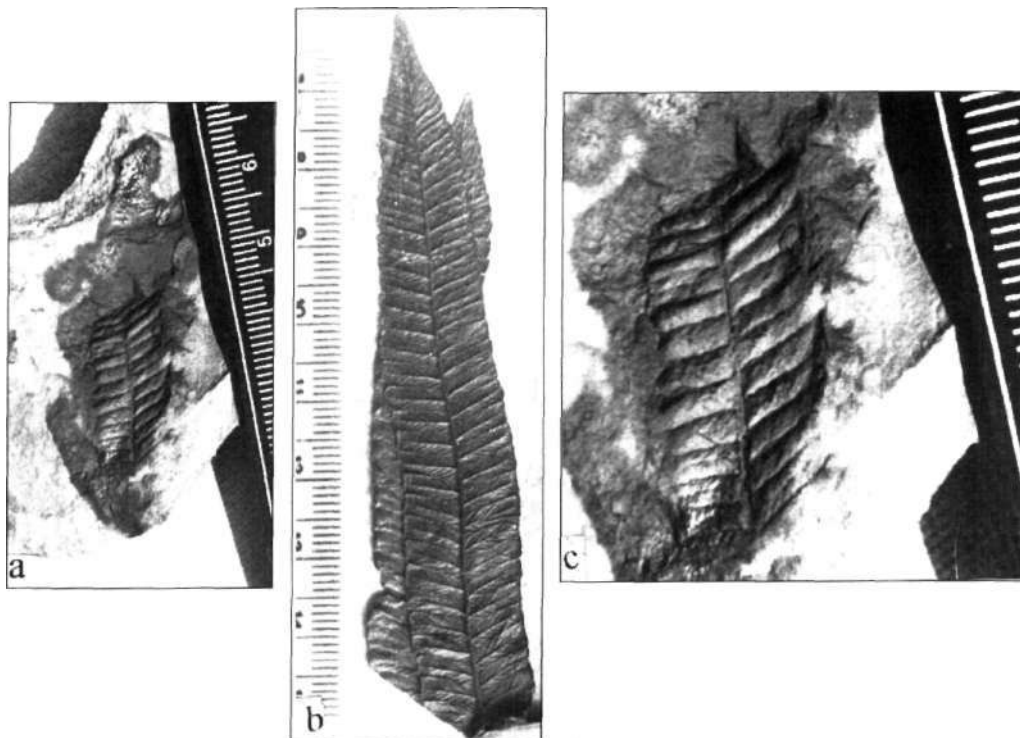


Fig. 2. *Thelypteridaceophyllum tertiarum* gen. et sp. nov. (a) Fossil frond in natural size to show its shape and size, (b) An extant species (*Ampelopteris prolifera*) of Thelypteridaceae in natural size showing similar frond, (c) Fossil frond magnified to show about 13 pinnules, x 2.

#### Generic Diagnosis

##### *Thelypteridaceophyllum* gen. nov.

A fossil fern frond assignable to the family Thelypteridaceae.

Genotype: *Thelypteridaceophyllum tertiarum* gen. et sp. nov.

#### Specific Diagnosis

##### *Thelypteridaceophyllum tertiarum* gen. et sp. nov.

Frond sterile, preserved length variable, width upto 2 cm, oblong to lanceolate in shape; apex acuminate; base obtuse; margin smooth to subentire; texture coriaceous; consisting of a number of pinnules, sub-opposite, mid-rib stout; venules up to 10 pairs in each pinna, arising at acute angle.

*Holotype*: Central Repository of Geol. Surv. of India, Kolkata; Type No.: 21133.

*Horizon*: Lower Siwalik Formation

*Locality*: Left bank of Pakke River, East Kameng District, Arunachal Pradesh (Fig. 1C).

*Age*: Middle-Upper Miocene.

In the Mesozoic, ferns were dominant in India but their number declined during the Tertiary. Only a few water ferns belonging to the modern taxa *Azolla*, *Marsilea*, *Regnellidium* and *Salvinia* are known to occur in the Deccan Intertrappean flora considered as Maastrichtian - Danian in age (Bande et al. 1988). Recently, two more forms, viz., *Acrostichum* Linn. (Awasthi et al. 1996) and *Arthomeris* J. Smith (Arya et al. 2001) have been described from the Lower Miocene sediments of Kasauli Formation of Himachal Pradesh.

The presence of the family Thelypteridaceae indicates the occurrence of swamps/rivers in the region during the deposition of the beds (Holtum et al. 1970). The occurrence of same fossil species *Thelypteridaceophyllum tertiarum* in Utranchal and Northeast India permits one to infer that more or less similar climatic conditions prevailed during the Miocene in India.

Joshi and Chakraborty (2001) have described the Lower Siwalik rocks represented by well indurated sandstone and shale. These exhibit unimodal current distribution indicating westerly palaeocurrent direction. The environment of deposition was flood plain and accretionary point bars of multi-storey sandstone are formed by meandering and shifting channels over its flood plains. The other fossils collected along with the fern from the Lower

Siwalik rocks belong to the families Dipterocarpaceae, Clusiaceae, Annonaceae and Gramineae etc , which indicate the existence of a tropical evergreen forest in the area during the period

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