Kashmiropteris meyenii Kapoor : A possible cycadalean leaf from the Early Permian Mamal Formation in the Kashmir Himalaya

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The nomenclatural status of *Kashmiropteris meyenii* gen. et sp. nov. proposed by Kapoor is formalised. On the basis of gross morphological features it is suggested that the taxon may have cycadalean affinities.

Key-words—Perigondwana, Early Permian, Mamal Formation, Megaflora, Cycadophyta (India).

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सारांश

कश्मीर हिमालय में प्रारम्भिक परमी मामल शैल-समूह से एक सम्भाव्य साइकेडेली पत्ती : कश्मीरॉप्टेरिस मीयेंनाई कपूर

हरिमोहन कपूर, ऊषा बाजपेयी एवं हरिकृष्ण माहेश्वरी

कपूर द्वारा प्रस्तावित **कश्मीरॉप्टेरिस मीयेंनाई** नव प्रजाति व जाति की नामार्थ स्थिति को व्यवहारिक रूप दिया गया है। समग्र आकारिकीय लक्षणों के आधार पर यह प्रस्तावित किया गया है कि इस वर्गक में साइकेडेली सजातीयतायें विद्यमान हैं।

KAPOOR (1979, p. 461, pl. 169, figs 1, 2) recorded a specimen collected by him from the plant-bearing beds at Mamal as *Kashmiropteris meyenii* gen. et sp. nov. He, however, did not formally institute the name as required under clauses of International Code of Botanical Nomenclature. We have re-examined the figured specimen, and two more specimens referable to this taxon, to validate the nomenclature, and to ascertain the affinities of the taxon.

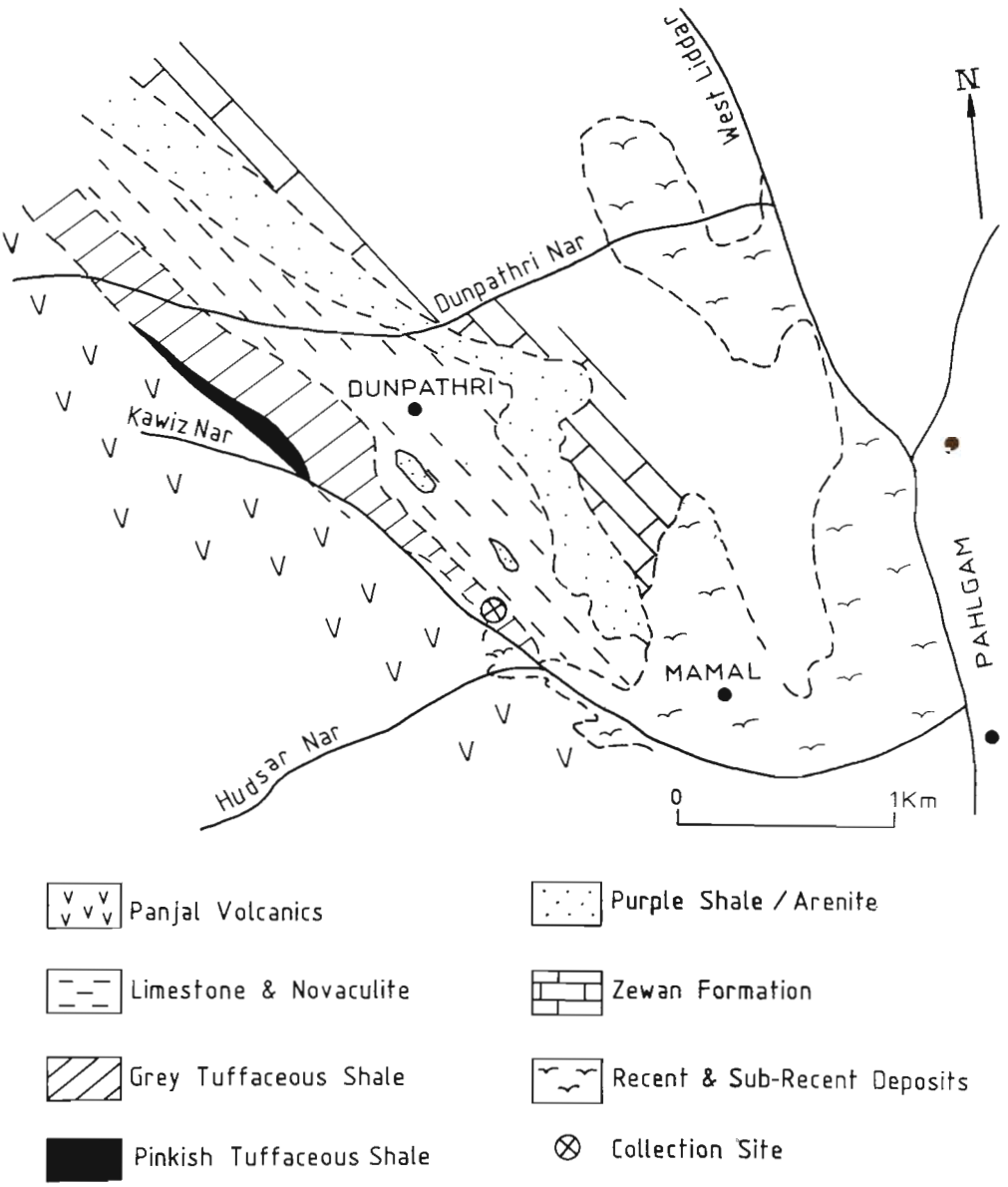
The specimens were collected from within lower 3 metres of the grey shale exposed near the junction of Hodsar Nar and Kawiz Nar, 1/2 km east of the Mamal Village (34° 01′ : 75° 18′), which in turn is about 1 km east of famous tourist resort Pahlgam (Text-figs 1, 2a-b).

DESCRIPTION

There are three specimens in the collection that separately represent the apical, median and basal parts of a pinnate-type of leaf. The three specimens, however, do not necessarily form part of the same leaf.

The specimen representing apical part of the leaf (Pl. 2, figs 1, 2) is about 6.5 cm long. Rachis in this region is 0.5 cm wide, apex apparently is paripinnate. Pinnae are fairly long in the lower part of the specimen and measure 9.2 cm in length and 1.0 cm in width. Towards the apex, the pinnae tend to become shorter and measure only 3.5 cm in length and 0.9 cm in width. Pinnae are linear, strap-shaped, thin and with entire margins. Apex is not preserved in any of the pinnae. Pinnae attached on to the rachis through their wide bases at an angle of 70°-80°, are oppositely arranged with an interval of about 0.6 mm or more between adjacent pinnae. Pinnae bases are not expanded or auriculate and there is no evidence of any laminar wing between the pinnae. Pronounced median furrows on each pinnae indicate the presence of a strong midrib; however, no secondary vein is seen.

The specimen that presumably represents the median portion of the leaf (Pl. 2, fig. 3) is 14.6 cm



Text-figure 1—Sketch geological map of a part of the Kashmir Basin.

long. Rachis in this specimen is 1.1 cm wide towards lower end and thins out to 0.3 cm towards the top. All the pinnae are incomplete; their preserved length is up to 5.8 cm. Pinnae are 1.5 cm broad at their widest. As pinnae of only one side are preserved, their arrangement on the rachis is not decipherable. Each pinna seems to be linear, strap-shaped and thin, with an entire margin and apparently a decurrent base. All the pinnae show a strong midrib running all through the preserved length. No secondary vein is seen, though the rachis does show vertical running striations, which probably represent the vascular strand of the rachis.

The specimen representing the basal part of the leaf (Pl. 1, fig. 1) is 13.5 cm in length. Rachis is up to 1.4 cm in width. Pinnae are alternately arranged on

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PLATE 1

1. *Kashmiropteris meyenii* Kapoor 1979: holotype, here designated. Geological Survey of India specimen no. 18176, × 1.
2. A portion of the holotype enlarged to show the adaxial insertion of the pinnae on the basal part, and the faint dichotomous venation on the pinnae, × 2.
3. Another view of the portion of rachis as in figure 2, × 2.

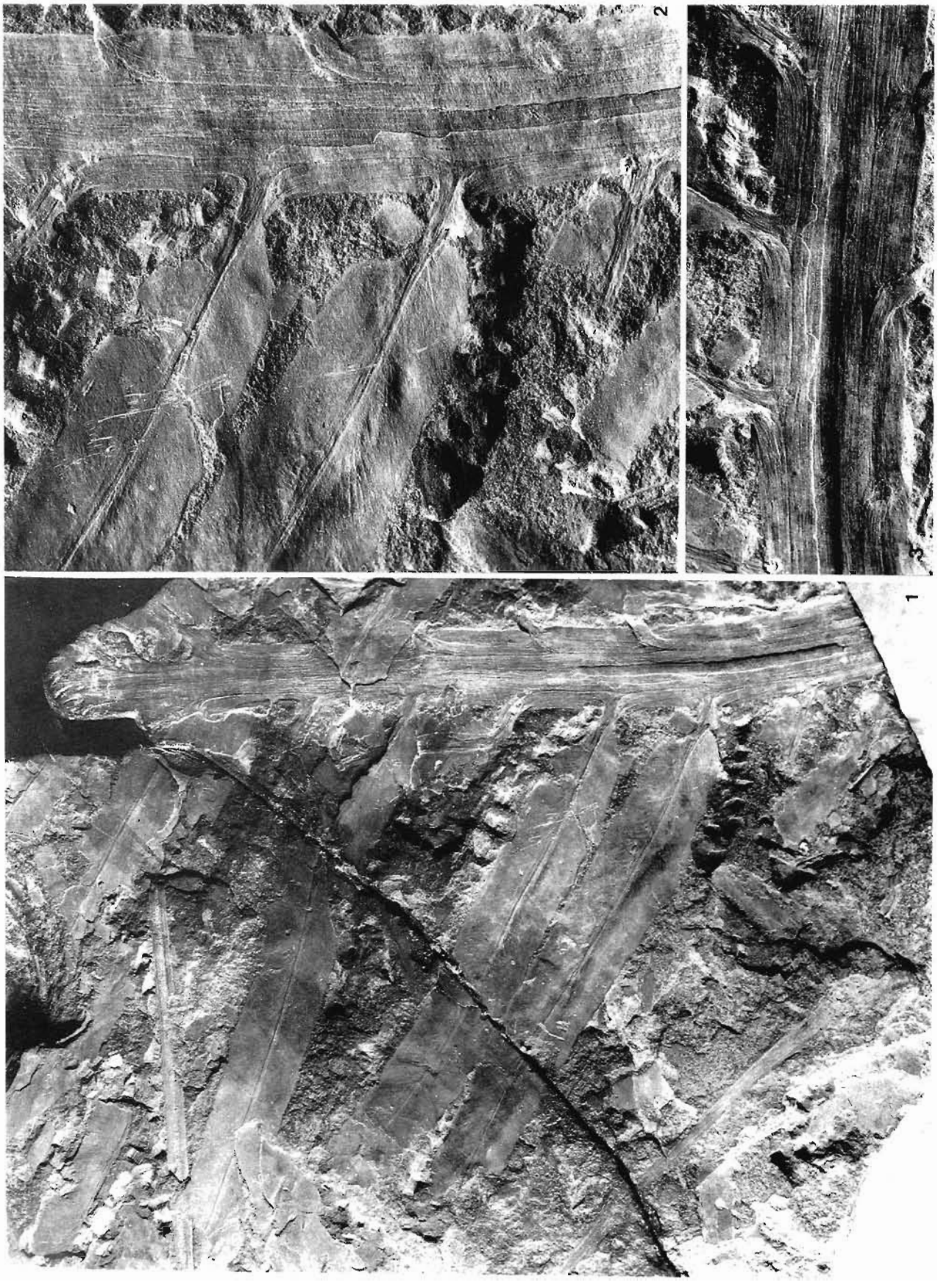
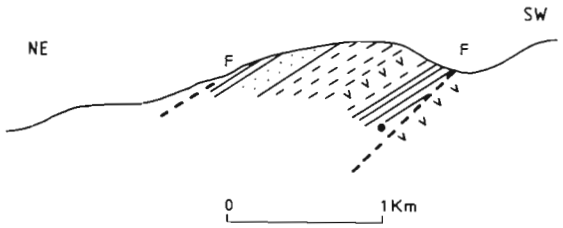
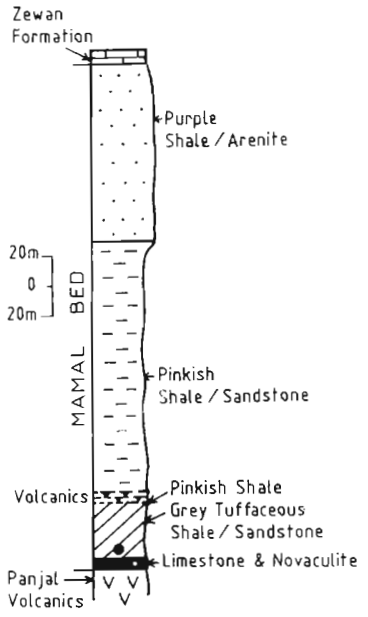


PLATE 1



2a



2b

Text-figure 2—a. Hypothetical cross-section, East of Dunpathri; **b.** Columnar section of the Mamal bed at Dunpathri.

the rachis; are up to 10.5 cm long and 1.3 cm wide. The base is evidently constricted and looks like a petiole (Pl. 1, fig. 2). Infact, the vascular strand entering the midrib of the pinnae is so strong that it gives the appearance of a petiole (Pl. 1, fig. 3). From the origin of vascular strands of the pinnae, it is clear that pinnae are attached towards the adaxial side of rachis, and are not lateral to it. Midrib of the pinnae gives off secondary veins which dichotomize two to three times, but do not anastomose.

In all the three specimens, pinnae are basically attached on the adaxial side—a very characteristic feature.

COMPARISON

In its general morphology, the leaf (all the 3 specimens are taken as representing the same type of leaf) shows a certain resemblance to *Daeniopsis* Heer (in Schenk, 1864), *Protoblechnum* Lesquereux 1880, *Glenopteris* Sellards 1900, *Supaia* White 1929, and *Comsopteris* Zalessky 1934.

The genus *Daeniopsis* refers to a fern which is known both in sterile and fertile stages. Halle (1927) strongly advocated that the name should be applied only to the kind of fertile frond which has large, free sporangia as in the extant genus *Archangiopteris*. Furthermore in *Daeniopsis marantacea* Heer, the type species, the secondary veins anastomose, in a characteristic manner, close to the margin. *Daeniopsis hughesii* reported from the Late Triassic Parsora Formation of the South Rewa Gondwana Basin (Feistmantel, 1882), was therefore transferred to the genus *Dicroidium* by Gothan (1912). *D. hughesii* is characterized by a bifurcate rachis, and arching dichotomizing, occasionally simple, veins which run up to the margins. This species was transferred to the genus *Protoblechnum* by Halle (1927), and to the genus *Comsopteris* by Zalessky (1934). Frenguelli (1943) established a new genus *Diplasiophyllum* for this species and other similar forms. These changes in the nomenclatural status of this species have almost virtually been ignored by later workers (Lele, 1962; Rao & Lele, 1963; Pal, 1984). Lele (1962) described the epidermal features of the species as seen on the surface of the specimen under incident light. Pal (1984) also described cuticular features of certain carbonified specimens which he thought belonged to this species. His specimens, however, do not show the characteristic bifurcate rachis or even the secondary veins of the pinnae. The features of the cuticle are also not characteristically that of the genus *Dicroidium*. We believe that Frenguelli (1943) was right in establishing a new genus for forms of *'hughesii'* type. Following is the list of synonyms of this species:

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PLATE 2

1, 2. Part and counter part of the specimen representing the apical region of the leaf. Geological Survey of India specimen nos. 18177, 18178, × 1.

3. Specimen representing the median portion of the leaf. Geological Survey of India specimen no. NRP1/36B, × 1.

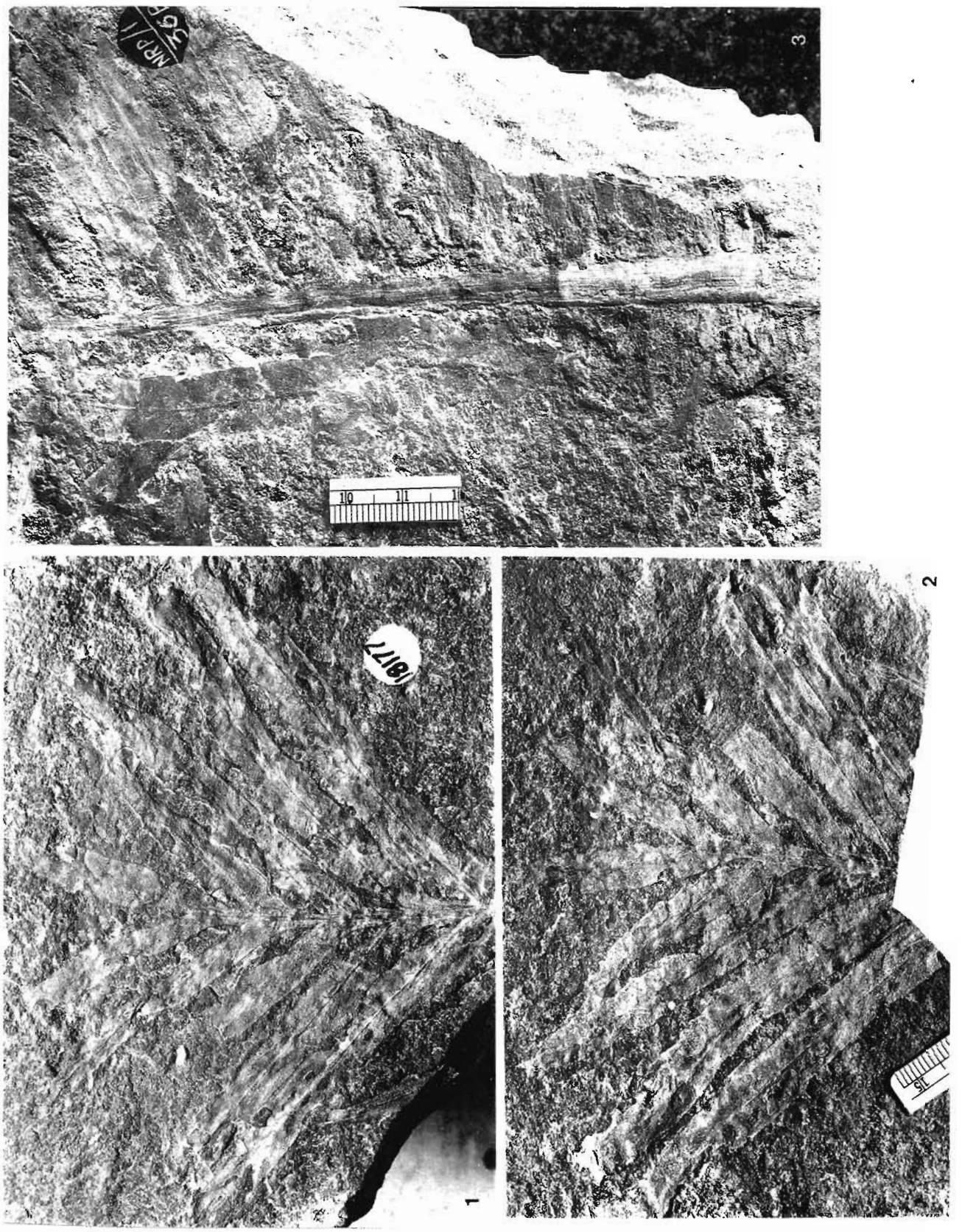


PLATE 2

***Diplasiophyllum* Frenguelli 1943**

Diplasiophyllum hughesii (Feistmantel 1882) Frenguelli 1943
Daeniopsis hughesi Feistmantel 1882
Dicroidium hughesi (Feistmantel 1882) Gothan 1912
Protoblechnum hughesi (Feistmantel 1882) Halle 1927
Thinnfeldia (Daeniopsis) hughesi (Feistmantel 1882) Seward 1932
Comsopteris hughesii (Feistmantel 1882) Zalessky 1934
Dicroidium hughesii (Feistmantel 1882) Anderson & Anderson 1983

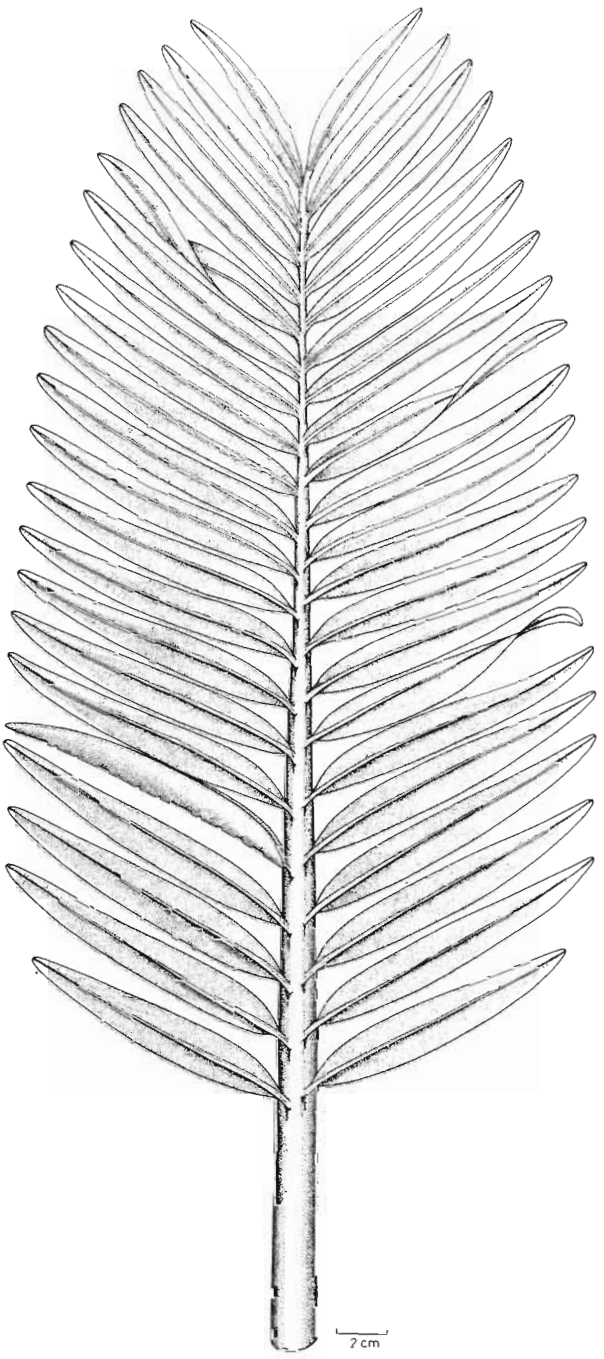
The genus *Protoblechnum* was also instituted for a pinnatifid frond in which the pinnae were decurrent on to the rachis and the concurrent portion of the lamina received veins directly from the rachis, besides from the pinnae midrib. Sze (1955) has reported that the rachis in *Protoblechnum wongii* Halle was forked.

The most important character in the genus *Glenopteris* Sellard 1900 from the Permian of North America, is that the pinnae are reduced gradually towards the apex of the frond, at last uniting with the terminal pinnule.

The genus *Comsopteris* was instituted by Zalessky (1934) for a pinnate frond, earlier reported by him (Zalessky, 1914) as *Daeniopsis hughesii* Feistmantel. He also transferred *Protoblechnum wongii* Halle 1927 to his new genus. Gross morphological features of Gondwanan *Diplasiophyllum (Dicroidium) hughesii*, Cathaysian *Protoblechnum wongii*, and Angaran *Comsopteris adzvensis* are so overlapping that Meyen (1970) found it rather difficult to distinguish between different genera. The only worthwhile difference noticed was the imparipinnate apex in *Protoblechnum* and false paripinnate in *Comsopteris*. According to Lee *et al.* (1974), the two genera *Protoblechnum* and *Comsopteris* are synonymous. Broutin (1977) also believes that the two genera are more or less similar. Leaves of both these genera differ from that of *Kashmiropteris meyenii* in the venation pattern of the pinnae; in the former two, the pinnae receive a number of veins directly from the rachis also.

Supaia, a similar looking frond is distinguished by a dichotomously forking rachis, and the unequal development of the pinnae, the largest of which are on the outside of the frond.

It is thus evident that though fronds of remarkably similar morphology occur in the Permian sediments of Euramerica, Angara, Cathaysia and the Perigondwana, these perhaps represent different taxa and hence should preferably be given independent names. One of the three specimens from the present collection was earlier given the name *Kashmiropteris meyenii* by Kapoor (1979) who, however, did not give a 'diagnosis' either of the genus or of the species. He did illustrate the specimen. As the name *Kashmiropteris meyenii* has



Text-figure 3—A generalized reconstruction of the leaf of *Kashmiropteris meyenii*.

already been published, albeit invalidly, we hereby propose to validate it under Article 45 of the International Code of Botanical Nomenclature (Greuter *et al.*, 1988).

Genus—*Kashmiropteris* Kapoor 1979

Diagnosis—Leaf pinnate, large; rachis very stout, bearing linear, strap-shaped pinnae; pinnae alternate in the lower part, opposite to sub-opposite in the median and upper regions, arise from the rachis slightly towards the adaxial side; basal pinnae having a constricted base, almost simulating a petiole, elsewhere the pinnae attached by full basal width; each pinna with a distinct and fairly stout midrib; lateral veins usually not clear but in lower pinnae midrib giving off laterals at acute angles, veins dichotomizing twice or thrice, but never anastomosing.

Type species—Kashmiropteris meyenii Kapoor 1979.

Diagnosis—Same as for the genus.

Holotype—(designated here) : Specimen no. 18176 of the Geological Survey of India, Calcutta; Early Permian, Mamal Formation, near Mamal Village, Kashmir.

Syntypes—Specimen nos. 18177, 18178, NRP1/36B, Geological Survey of India, Calcutta.

Affinities—Singh, Maithy and Bose (1982, p. 204) considered the specimen figured by Kapoor (1979, pl. 169, figs 1, 2) as representing the apical portion of the arthrophyte *Lobatannularia ensifolia* Halle 1927. By no stretch of imagination the pinnatifid apical part of *Kashmiropteris meyenii* can be viewed to represent the apical portion of an arthrophyte that always has leaves in a whorl. Infact, the Cathaysian and Angaran species of the genus *Protoblechnum (Comsopteris)* to which our specimens show a certain resemblance, have already been proved to have gymnospermous affinities on the basis of cuticular features (Meyen & Migdissova, 1969; Meyen, 1971).

In general appearance, the Kashmir specimens closely resemble leaves of some cycads. Pinnae of two genera of extant cycads, viz., *Cycas* and *Stangeria* have a midrib. Lateral veins are, however, present only in the pinnae of the genus *Stangeria*. In *Kashmiropteris meyenii* the pinnae are apparently inserted into two grooves on the adaxial surface of the rachis (Text-figure 3) as in *Cycas circinalis*. Thus it is probable that our specimens represent an early cycadalean taxon. An assertive conclusion has to wait discovery of a fertile organ or of a leaf with cuticle. It may be remarked here that the presence of the cycads in the Permian strata has now conclusively been proved elsewhere (Mamay, 1976; Gao & Thomas, 1989).

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