

# Mesozoic plant remains from Samu, Barmer District, Rajasthan

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The plant assemblage includes pteridophytic as well as gymnospermic remains. Amongst the pteridophytes *Phlebopteris* is common with rare presence of *Cladoplebis*, whereas, of the gymnosperms *Otozamites* is frequent with rare occurrence of *Pachypteris*, *Pagiophyllum* and *Brachyphyllum*. The assemblage is somewhat similar to the fossil assemblage of Pariwar Formation, Jaisalmer District. On the basis of plant assemblage an Upper Jurassic age has been suggested for the Samu Hill Formation.

**Key-words**—Plant megafossils, Pteridophytes, Gymnosperms, Samu Hill Formation, Upper Jurassic (India).

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## सारांश

राजस्थान के बाड़मेर जनपद में सारनु से मध्यजीवी पादप-अवशेष

जयश्री बैनर्जी एवं पंकज कुमार पाल

इस पादप-समुच्चय में टेरीडोफाइटी एवं अनावृबीजी दोनों ही प्रकार के पादप-अवशेष मिलते हैं। टेरीडोफाइटीयों में क्लेडोप्लेबिस की असामान्य उपस्थिति के साथ-साथ फ्लीबॉप्टेरिस सामान्यतः मिलता है जबकि अनावृतबीजीयों में ओटोजमाइटिस प्रचुर संख्या में मिलता है तथा पैकिप्टेरिस, पैजियोफिल्लम एवं ब्रेकिफिल्लम अत्यन्त अल्प मात्रा में मिलते हैं। यह समुच्चय जैसलमेर जनपद के परिवार शैल-समूह से कुछ-कुछ मिलती-जुलती है। पादप-समुच्चय के आधार पर सारनु गिरि शैल-समूह की उपरि क्रीटेशी आयु प्रस्तावित की गई है।

THE sandstone-siltstone sequence interbedded with ferruginous shales exposed in the hilly range adjacent to the Samu Village (25° 40' N : 71° 47' E) has been named as Samu Hill Formation (Das Gupta, 1975; Baksi & Naskar, 1981). From this formation Baksi and Naskar (1981) have described *Phlebopteris athgarbensis* Jain, *Spbenopteris* sp. and *Ptilophyllum acutifolium* Morris. A number of specimens collected by one of us (J.B.) from the same locality is described below.

## DESCRIPTION

**Genus—*Phlebopteris* Brongniart**

*Phlebopteris* sp. cf. *P. athgarbensis* Jain

Pl. 1, figs 1-5; Text-fig 1A-B

**Description**—Detached pinnae, largest available specimen 14 cm long, 7.4 cm wide. Pinna-rachis 2.5-3 mm wide, gradually narrowing towards apex. Pinnules opposite or subopposite, arising at an angle of 70°-90°,

attached by entire base, linear, 0.35-3.5 cm long and 1.5-4 mm wide, gradually becoming shorter and narrower towards apex, often slightly bending downwards, margins entire, apex acute to obtuse. Midrib 0.5 mm wide, distinct up to apex; lateral veins arising at an angle of 50°-65°, mostly bifurcating 1-3 times, forming distinct polygonal meshes along both sides of midrib, veins 4-6 per mm near margin. Fertile pinnules more or less similar to the sterile ones; Sori arranged in rows, usually 1 mm apart on either side of midrib, number of sori in a row varies from 14 to 30, two rows of sori converging towards apex. Sorus almost circular, about 0.6 mm in diameter with a circular depression at the centre, other details obscure.

**Remarks**—Both sterile and fertile fronds are well represented. Out of 30 specimens in our collection none shows a bipinnate nature. Baksi and Naskar (1981) mentioned that the number of sporangia in a sorus is 5-7. But we were unable to find out any trace of sporangia in any of our specimens. In the Samu Hill specimens the sori are more contiguous than those in the type •

specimen of *Phlebopteris athgarbensis* Jain. Moreover, number of sporangia in a sorus is not known in the present specimens.

**Genus—*Cladophlebis* Brongniart**

*Cladophlebis* sp.

Pl. 1, fig. 6; Text-fig. 1C

**Description**—Detached pinnae, largest fragment 3.7 cm long, 1 cm wide, linear-lanceolate, pinna rachis 0.5 mm wide, finely striated, imparipinnate. Pinnules alternate or subopposite, arising at an angle of 60°-90°, often falcate, 1.5-6 × 1.2-5 mm in size, attached by broad base; margins entire, apex acute to broadly rounded. Midrib distinct, lateral veins simple or forked, mostly forking once.

**Remarks**—The collection includes only two imperfectly preserved specimens, out of which one (Pl. 1, fig. 7) has both part and counterpart. In gross morphology the specimens come closer to *Cladophlebis daradensis* described by Bose and Banerji (1984).

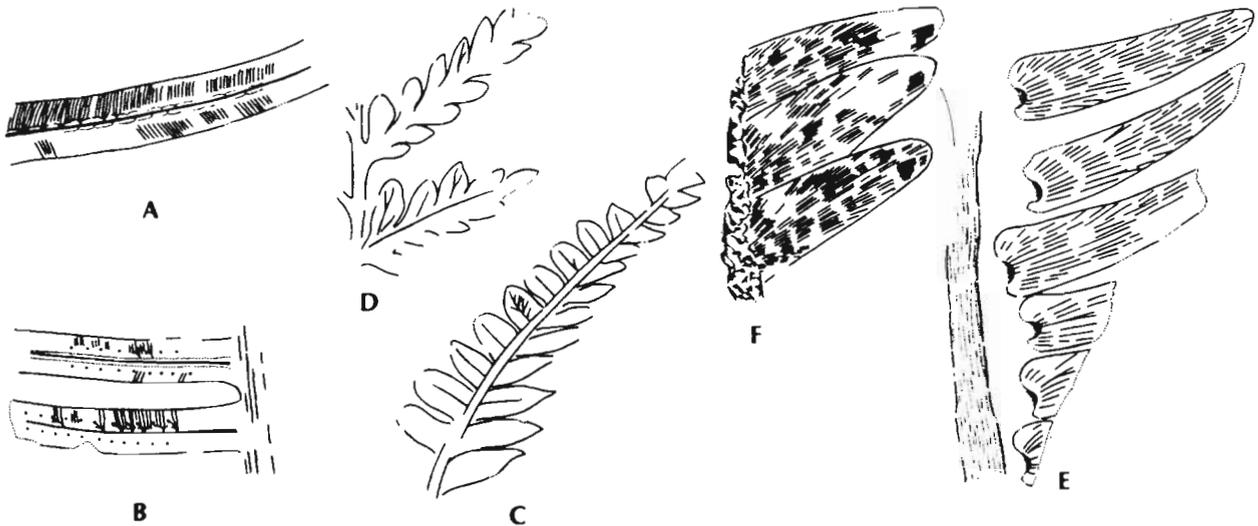
**Genus—*Pachypteris* Brongniart**

*Pachypteris haburensis* Bose, Kumaran & Banerji

Pl. 1, fig. 7; Text-fig. 1D

**Description**—Of two bipinnate fronds, the larger measured specimen 3 cm in length and 2.7 cm in width. Primary rachis 0.5 mm wide, medianly grooved. Pinnae alternate, emerging at an angle of 50°-60°, linear-lanceolate. Pinnules alternate-subopposite, attached at an angle of about 40°, lanceolate-obovate, 2-4 mm long and 1-1.5 mm wide (typically 2.5 × 1.2 mm), acroscopic margin towards base slightly constricted, basiscopic basal margin decurrent on the pinna-rachis; lateral margins entire; apex acute-obtuse. Veins rarely preserved; midrib distinct up to apex; secondary veins usually 1 or 2, rarely 3; mostly unforked, rarely in basal pinnules forking once.

**Remarks**—The two specimens in gross features and venation pattern of pinnules match exactly with *Pachypteris haburensis*.



**Text-fig. 1** — A, B. *Phlebopteris* sp. cf. *P. athgarbensis* Jain : A, sterile pinnule showing venation, specimen no. BSIP 35898. × 2; B, part of a pinna with fertile pinnules showing single row of sori on either side of midvein, specimen no. BSIP 35809. × 2. C. *Cladophlebis* sp., specimen no. BSIP 35797. × 2. D. *Pachypteris haburensis* Bose et al., specimen no. BSIP 35797. × 2. E, *Otozamites* sp. cf. *O. imbricatus* Feistmantel, specimen no. BSIP 35810. × 2. F. *Otozamites* sp. B., specimen no. BSIP 35799. × 1.

**PLATE 1**

1-5. *Phlebopteris* sp. cf. *P. athgarbensis* Jain

1. Apical part of the sterile pinna; Specimen no. BSIP 35791 × 1.
2. Sterile pinna, Specimen no. BSIP 35792. × 1.
3. Fertile fronds showing sori; Specimen nos. BSIP 35793, 35795, 35796 × 1.
6. *Cladophlebis* sp. 1; Specimen no. BSIP 35797. × 1.
7. *Pachypteris haburensis* Bose et al.; Specimen no. BSIP 35797. × 1.
8. *Otozamites* sp. B.; Specimen no. BSIP 35799. × 1.

9. *Otozamites* sp. A.; Specimen no. BSIP 35800. × 1.
- 10-12. *Otozamites* cf. *imbricatus* Feistmantel; Specimen nos. BSIP 35801, 35802, 35803 all. × 1.
- 13, 14. *Pagiophyllum* sp., Specimen nos. BSIP 35804 and 35805, both × 1.
- 15, 16. *Brachyphyllum* sp.; Specimen nos. BSIP 35806 and 35807, both × 1.
17. ?*Coniferoaulon* sp.; Specimen no. BSIP 35808. × 1.

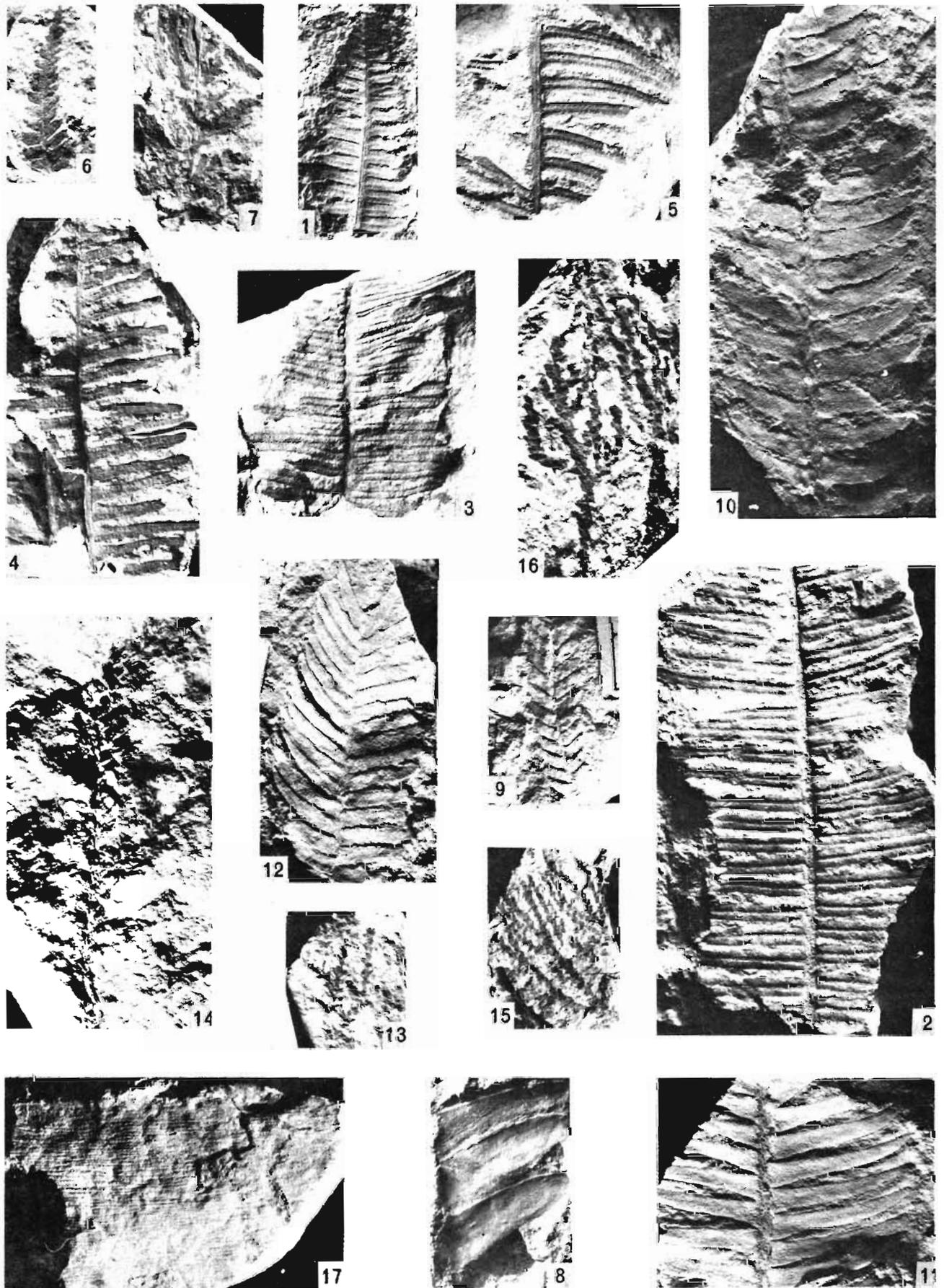


PLATE 1

**Genus—*Otozamites* Braun***Otozamites* sp. cf. *O. imbricatus* Feistmantel

Pl. 1, figs 10-12; Text-fig. 1E

*Description*—Leaf imparipinnate, largest available specimen about 8.5 cm long, 2.7 cm wide, rachis 2.5-3 mm wide; pinnae arising at an angle of 60°-75°, alternate, contiguous, linear falcate, pinnae attached on upper surface of rachis slightly below middle of base, base distinct, arcuate, basal acroscopic margin slightly auriculate, basal basiscopic margin rounded, apex acute-subacute; rarely obtuse, margin entire. Pinnae 0.3-3.1 × 0.1-0.5 cm, typically 2 cm long, 4.5 mm wide, 7-12 veins radiating from pinna base, simple or forked 1-3 times at various levels.

*Remarks*—The species is common at Samu. In gross features the specimens match the specimens of *Otozamites imbricatus* Feistmantel described by Bose (1974, pl. 46, figs 1, 2).

*Otozamites* sp. A

Pl. 1, fig. 9

*Description*—Fragmentary pinnate leaves, rachis 1 mm wide, pinnae subopposite, attached on upper surface of rachis at an angle of 50°-70°, 5.7 × 2.3-5 mm, ovate-falcate, contiguous, basal acroscopic margin slightly auriculate, basal basiscopic margin somewhat curved inwards, lateral margins entire; apex obtuse. Veins 8-10 per pinnae nearer base, slightly diverging towards margin, veins unforked or once forked, forking at different levels.

*Comparison*—Only two specimens were collected. Out of them one clearly shows the asymmetrical nature of the base. In gross features the specimens resemble most *Otozamites kachchbensis* Bose & Banerji (1984).

*Otozamites* sp. B

Pl. 1, fig. 8; Text-fig. 1F

*Description*—Largest available fragment showing only three pinnae attached on one side of rachis at an angle of 70°-75°, oblong in shape, size 2.7 × 0.9 cm, margin entire, thick, basal acroscopic margin very slightly auriculate, apex obtuse, veins 35-40 per cm at base; slightly diverging at distal end, veins unforked-forked.

*Comparison*—In shape, size and concentration of veins *Otozamites* sp. B may be compared with *Otozamites graphicus* (Leckenby) Harris, *O. thomasi* Harris and *O. parallelus* Phillips described by Harris (1969).

**Genus—*Brachyphyllum* Brongniart***Brachyphyllum* sp.

Pl. 1, figs 15, 16

*Description*—Twigs profusely branched in all directions, largest specimen 4.7 cm in length, leaves

spirally borne, appressed, closely placed; gradually becoming smaller and slightly spreading towards distal ends of twigs, triangular-rhomboidal, generally 1.5-2 × 1.5-2 mm in size; margin entire; apex acute; distinctly keeled.

*Remarks*—In gross features the specimens are not comparable with any of the species of *Brachyphyllum* so far known to us. However, refrain from assigning them to a new species because epidermal features are not known.

**Genus—*Pagiophyllum* Heer***Pagiophyllum* sp.

Pl. 1, figs 13, 14

*Description*—Branched shoot, 8.3 cm in length, leaves spirally attached, laterally spreading, ovate-falcate in shape, measuring 4.4-5 × 1.5-2 mm, margin entire; base decurrent; apex acute; distinctly keeled.

*Comparison*—The specimens resemble somewhat *Pagiophyllum* sp. A described by Bose *et al.* (1982). The specimens exhibit a wide range of variation in leaf-size. But altogether they appear to represent a natural population of continuous range of variations though the two extremities are distinct from each other.

**DISCUSSION**

In addition to plant fossils earlier described by Baksi and Naskar (1981) some more species have been described in this paper. Besides, our collection also includes a specimen doubtfully assignable to the genus *Coniferocaulon* Fliche (Pl. 1, fig. 17). The assemblage is dominated by *Plebeopteris* sp. cf. *P. atgarhensis* Jain and *Otozamites* cf. *imbricatus* Feistmantel. *Brachyphyllum* sp. is next in abundance. *Cladophlebis* sp., *Pachypteris haburensis* Bose *et al.* and *Pagiophyllum* sp. are rare.

The assemblage is somewhat similar to the assemblage described from the Pariwar Formation by Maheshwari and Singh (1976) and Bose *et al.* (1982). The assemblage from Habur also has forms like *Plebeopteris*, *Pachypteris*, *Otozamites*, *Pagiophyllum* and *Brachyphyllum*. However, so far *Taeniopteris*, *Pterophyllum* and *Anomozamites* have not been found at Samu. Baksi and Naskar (1981) have suggested a Lower Cretaceous age for the Samu fossiliferous beds. In the absence of any definite Cretaceous forms like *Weichselia* and *Onychiopsis*, it is difficult to say whether the Samu beds are exactly of Lower Cretaceous age. However, the overall assemblage is more suggestive of Upper Jurassic age.

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