

The ultimate constituents of matter

For over 25 centuries, human curiosity about the ultimate constituents of matter in the universe has remained without a satisfactory solution. Ancient scientists recognized five fundamental elements, viz. earth, water, fire, air and ether. Yet, most philosophers believed that there must be a single kind of homogeneous material that constitutes the universe. Much of the philosophical thinking is guided by this axiom. On this point the schism of intellectuals into the 'two cultures' is not of recent origin. With the progress of science, the count of chemical elements grew from five to over a hundred. Subatomic particles too are not of one kind. However, philosophers as well as some scientists expect to find homogeneity and uniformity in matter in its minutest form. This belief seems to be the main prop for the 'modern scientific' interpretation of the philosophy of the *Upanishads*. As K. V. L. Sarma has reviewed admirably (*Curr. Sci.*, 1995, 68, 605) the current state of knowledge, we now have a standard model (SM) of six quarks and six leptons, besides the gauge bosons, the transmitters of force.

Although Sarma does not discuss any

'philosophical' implications of the SM, any reader of the review will wonder if in ultimate analysis we might reach a paradigm of uniformity and homogeneity. Shall we conclude that philosophers' paradigm is only an idol of the tribe (*idola tribus*), to use Francis Bacon's terminology? In other words, can we conclude that uniformity of matter in its minutest form or in its primeval state at the Big Bang is a theoretical impossibility? If so, what could probably have guided ancient philosophers to their belief on the nature of matter?

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K. V. L. Sarma replies:

With regard to the comment of K. Vasudeva Rao, the speculation that there is some homogeneous stuff underlying the physical universe is perhaps quite natural and is indeed at the heart of the

reductionist approach. History has repeatedly shown that things become simple when we go to the next substratum – molecules, atoms, nuclei, nucleons, ... Maybe this is the only monotonous way Nature works, as we go on unravelling the successive onion layers.

There have been many attempts to construct composite models viewing the quarks and leptons, as well as the gauge bosons, as composites of the same fundamental objects, variously called as 'preons', 'rishons', 'subquarks'... These models are unsatisfactory because proliferation is still present in them although at a different level (postulating many kinds of preons and hyper colour forces to bind them), and they do not lend themselves to any meaningful experimental tests. However, as of now, there is no experimental evidence to suggest that quarks or leptons have any structure, leave alone a common one.

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Record of Upper Gondwana flora from Bairam–Belkher area of district Amravati, Maharashtra and district Betul, Madhya Pradesh

This note records the plant fossils from Gondwana succession of Bairam (21°22'–77°37')–Belkher (21°22'–77°31') area, falling partly in Amravati district of Maharashtra and partly in Betul district of Madhya Pradesh. The fossils are represented by *Ptilophyllum*, *Sphenopteris*, *Cladophlebis*, *Taeniopteris*, *Matonidium*, *Pagiophyllum*, *Elatocladus* and *Araucarites*.

In regional set-up the area is represented by the Archaean Gneisses, Gondwanas, Lametas and Deccan Trap^{1,2} (Figure 1, Table 1), however, the Archaean Gneisses is not exposed in the area. The Gondwana rocks are exposed in the form of isolated patches in the widespread Deccan Trap.

It is about 100 m sequence represented by clastic sediments of arenaceous and argillaceous nature, having variable thicknesses (Figure 2). Pinching of the strata is frequently noticed in the beds of sandstones and clays in the upper part of the sequence. Clay is noticed to be of variable colours, viz. grey, dark grey, red, violet and brown to yellowish brown. Incidentally, grey to dark grey clays have been found productive for megafossil remains.

The age of the sequence is still a matter of debate. On the basis of lithological similarities, stratigraphic position, absence of fossils, it was earlier considered equivalent to Kamthi and (?) Mahadeva^{1,3}

In the same way, Pachmari and Malari of Upper Triassic have also been correlated⁴. However, the age and correlation proposed, so far, were very casual and no macropalaeontological criteria have been taken into consideration. In recent years, the sequence has been ranked Neocomian–Aptian⁵ on the basis of palynology.

The present assemblage is dominated by species of *Ptilophyllum* though *Taeniopteris* and *Matonidium* are very common, followed by *Sphenopteris* and *Cladophlebis* (Figure 3). The rest are poorly recorded. The recorded assemblage is comparable with Early Cretaceous assemblage of the Upper Gondwana

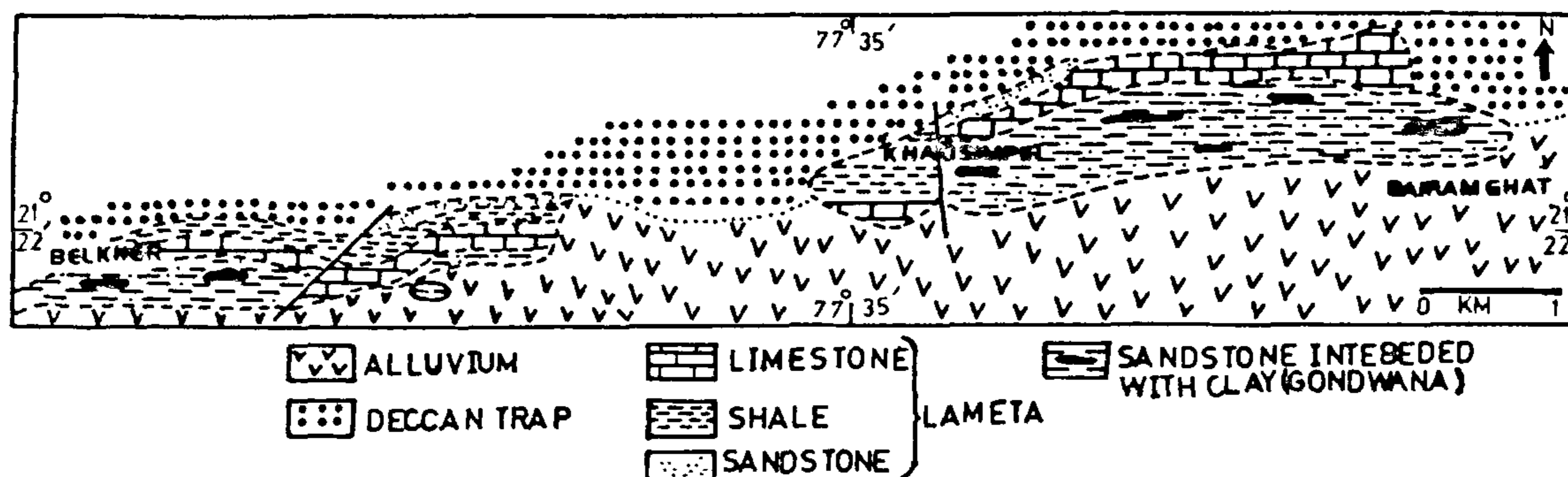


Figure 1. Geological map of the area (after ref 2).

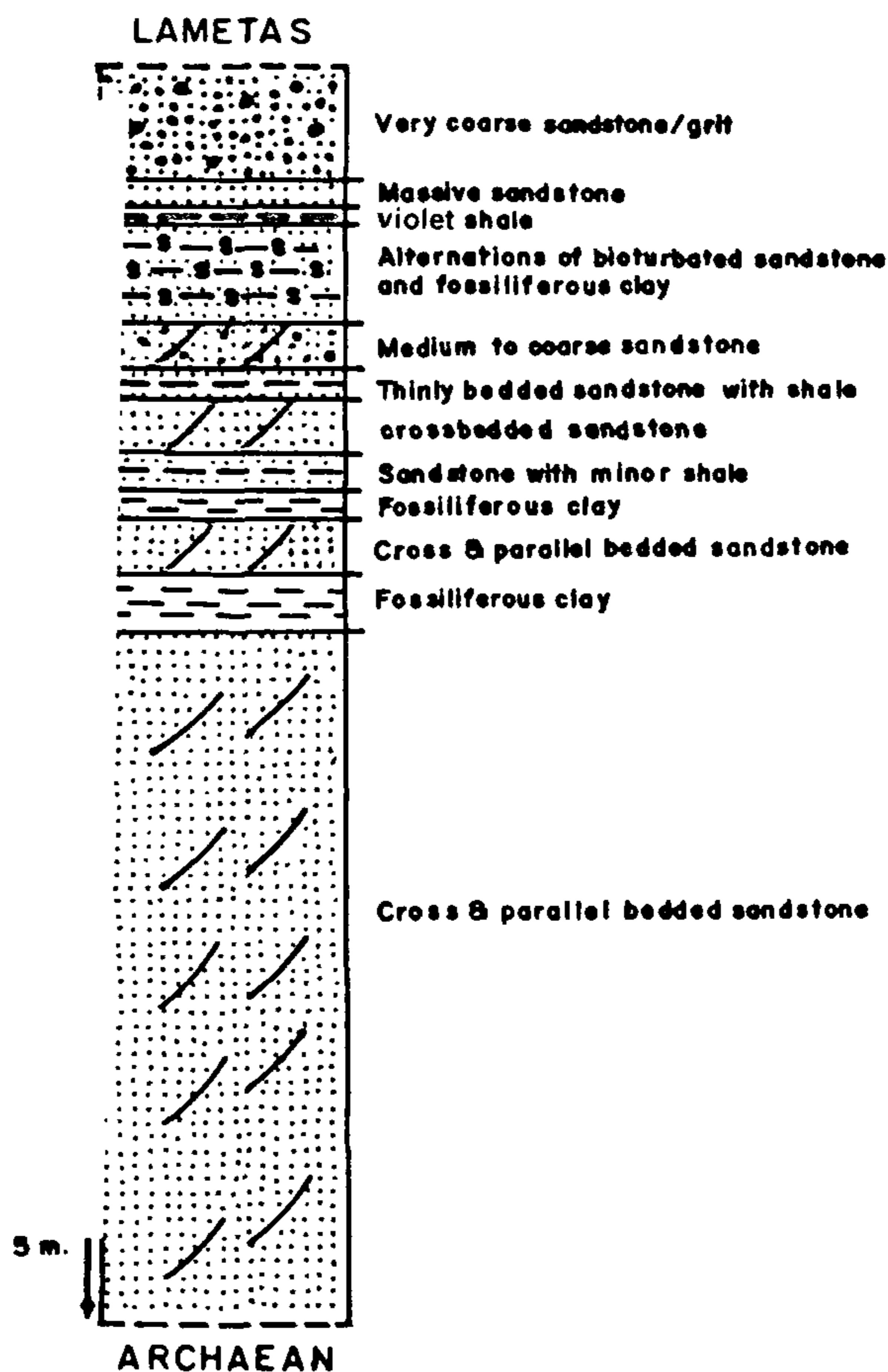


Figure 2. Lithological succession of the Gondwana sediments.

Formations of peninsular India (Table 2). However, the dominance of *Ptilophyllum* and *Taeniopteris* makes it more closer to

Dubrajpur, Gollapalli and Jabalpur flora, which are Late Jurassic to Early Cretaceous in age^{1,8-12}. The frequent occurrence of

Matonidium is also comparable with Early Cretaceous of Himmatnagar^{11,13}. The palynological evidences are also support-

Table 1. Generalized stratigraphy of the area

Age	Formation/Group	Lithology
Quaternary		Soil and alluvium
	Unconformity	
Miocene to Late Cretaceous	Deccan Trap	Nonporphyritic to porphyritic basalt
	Unconformity	
Late Cretaceous	Lametas	Shale, limestone and sandstone
	Disconformity	
Early Cretaceous	Upper Gondwana	Clay, shale, sandstone and conglomerate
	Unconformity	
Archaean		Quartzofeldspathic gneiss

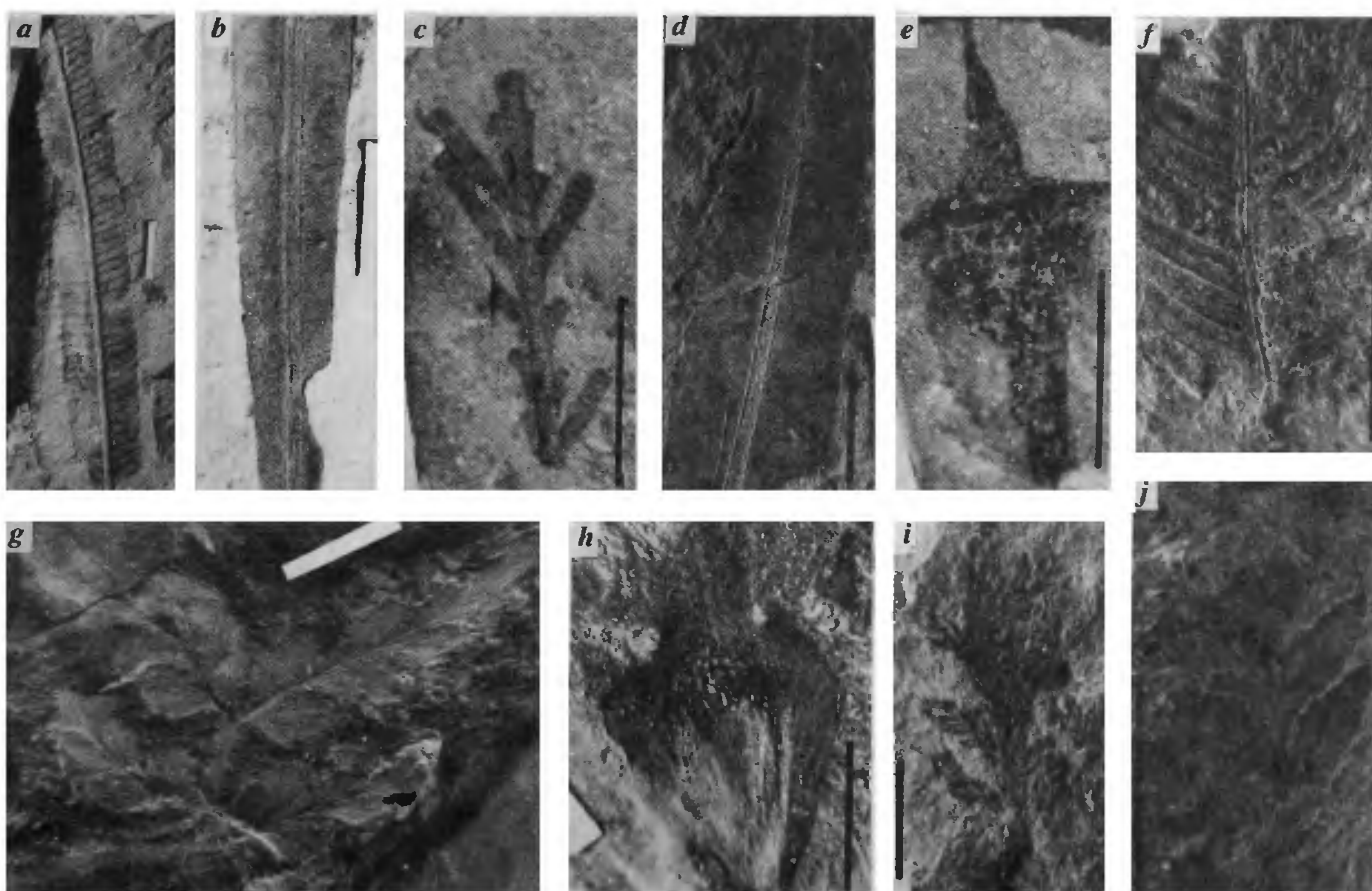


Figure 3. Photographs showing: a, *Ptilophyllum*; b, *Taeniopteris*; c, *Elatocladus*; d, *Taeniopteris*; e, *Araucarites* scale; f, *Matonidium*; g, *Sphenopteris*; h, *Araucarites*; i, *Pagiophyllum*; j, *Cladophlebis* (scale: 1 cm).

tive of Early Cretaceous age of the sequence⁵. Hence, the age and correlation proposed so far by the earlier workers is rejected and Early Cretaceous age is assigned.

The climate was warm and humid, as represented by luxuriant growth of Bennettitales and Cycadales¹⁴. This is also supported by pollen and spores reported from the area⁵. The dominance of

cycadophytes over the conifers is also suggestive of tropical to subtropical climate as proposed for Early Cretaceous megafossil assemblage of Dubrajpur⁸.

The samples are preserved in the P.G.

SCIENTIFIC CORRESPONDENCE

Table 2. Comparison of the Amravati plant fossil assemblage with that of other localities known from peninsular India

Genus/Locality	Present locality	Gardeshwar ⁶ (Early Cret)	Gangapur ⁷ (Early Cret)	Dubrajpur ⁸ (Late Jura to Early Cret)	Gollapalli ⁹ (Early Cret)	Jabalpur ^{1,10,12} (Late Jura to Early Cret)	Umia ^{1,10,12} (Early Cret)
<i>Ptilophyllum</i>	Abundant	—	+	Abundant	+	Very Common	+
<i>Taeniopteris</i>	Common	—	+	+	Abundant	Abundant	+
<i>Cladophlebis</i>	+	+	+	+	+	Common	+
<i>Sphenopteris</i>	+	+	—	—	+	+	—
<i>Pagiophyllum</i>	+	Abundant	+	+	+	+	+
<i>Elatocladus</i>	+	—	Abundant	—	+	+	+
<i>Matonidium</i>	Common	—	—	—	—	—	—
<i>Araucarites</i>	+	+	—	—	+	Common	+

+, Present
—, Absent

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First report of the Late Permian sporangiate fructification *Nesowalesia* Pant from India

Nesowalesia edwardsii, a Late Permian, sporangiate, monotypic fructification, is instituted by Pant¹ for concave disc-like organs from Newcastle, New South Wales, Australia. *Arberiella* type of sporangia are found attached on the concave side of the disc, while the convex side is smooth. Later on Rigby and Chandra² presented additional information concerning *Nesowalesia edwardsii* Pant on the basis of carbonized specimens

found from the Late Permian Illawara Coal Measures of the Western Sydney Basin, New South Wales. They also found well-preserved taeniate bisaccate pollen *Striatopodocarpites solutus* (Bharadwaj and Saluja) Foster³ from the *Arberiella* type of sporangia obtained from a thick crust of carbonaceous concave discs of *Nesowalesia edwardsii*. Rigby and Chandra² also proposed a peltate disc type of restoration for this Australian male fructification.

Two such discs having *Arberiella* type of sporangia are recorded for the first time from Late Permian bed exposed in Hinjrida Ghati near Handapa village, district Angul, Orissa. The concave discs are 1.5 cm in diameter and bear a number of *Arberiella* type of sporangia. Since the specimens are in the form of impressions, further studies are not possible. A close comparison between Indian and Australian specimens is also not possible as the