

CHAPTER - IV

OBSERVATIONS

FAMILY - TILIACEAE

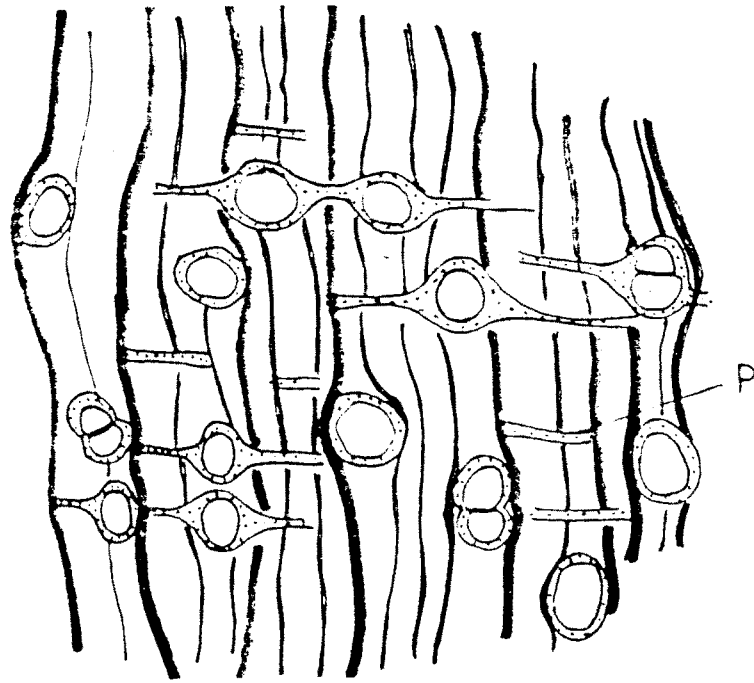
Genus - Tiliaceoxylon gen. nov.

Tiliaceoxylon nawarqaoense Gen. et.sp.nov.

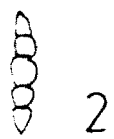
(Text Figure - 1 to 6 ; Plate - 1, Figures - 1 to 9)

EXTERNAL FEATURES : The fossil specimen is a large sector of decorticated wood measuring 14 cms in length and 22 cms in diameter at its broadest. It is brownish externally and yellowish brown internally.

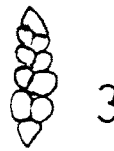
TOPOGRAPHY : Wood diffuse porous (Text Fig. - 1 ; Pl. 1 ; Fig. 1). Growth rings are present delimited by thick walled fibres and often by tangential congestion of vessels. Vessels are visible to the naked eye as small dot like structures, medium sized to large, mostly solitary or in radial multiples of two elements very rarely of three, 6 - 12 per sq.mm., some vessels are tylosed. Parenchyma : both apotracheal and paratracheal, paratracheal parenchyma vasicentric, aliform to aliform confluent (Text Fig. - 1 ; Pl. - 1 ; Fig.2), apotracheal parenchyma banded forming short tangential bands ending blindly (Pl.1, Fig.2) Xylem rays : 2 - 7 seriate, mostly 3 - 4 seriate (Text Fig. - 2 ; Pl. 1 ; Fig. 4 & 5), 28 - 98 μ in width, ray tissue heterogeneous and heterocellular (Pl.1, Fig.8),



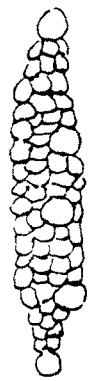
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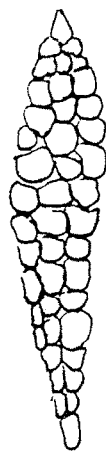
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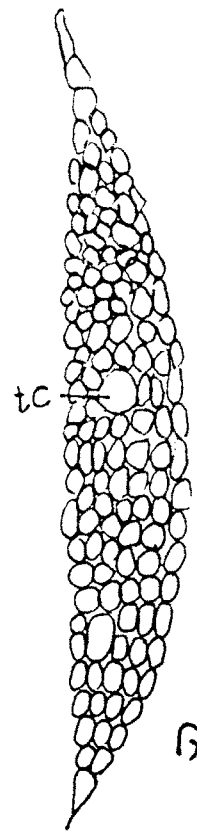
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uniseriate rays very few, biseriate rays two celled and 28 μ in width and 6 - 7 celled or 168 μ in height, triseriate rays 10 celled and 210 μ in height and 56 μ in width, multiseriate rays 7 celled and 98 μ in width and 18 - 31 cells or 280 μ - 588 μ in height. (Text Fig. 5 & 6) Some of the rays contain Pterospermum type of tile cells (Text Fig. - 6 ; Pl. 1, Fig.5), 4 - 6 rays per sq.mm. Fibres : aligned in radial rows between two rays, occasionally septate and non-libriform (Pl. 1, Fig.6).

ELEMENTS : Vessels thin walled, oval to rounded in cross section when solitary, those in groups are flattened at the place of contact, t.d. - 98 μ to 252 μ , r.d. - 168 μ to 322 μ , vessel members - short, 98 μ to 280 μ in length, perforation plate simple, transverse porous to simple oblique porous (Pl.1 ,Fig. 7) , intervessel pit pairs well preserved (Pl.1 Fig.9), simple alternate contiguous, slightly thick walled, 6 - 8 μ in diameter, vessel parenchyma pit not seen, vessel ray pits similar to intervessel pits, diameter of the pit 2 μ Parenchyma - cells thin walled barrel shaped in cross section, -52 μ in length and 12 μ in width. Ray cells - upright ray cells 44 μ in tangential height, 20

μ in radial length, procumbent cells 20μ in tangential height and 48μ in radial length. Fibres - Occasionally septate, nonlibriform .

DIAGNOSTIC FEATURES OF THE WOOD :

1. Wood diffuse porous, growth rings present, delimited by thick walled fibres and often by tangential congestion of vessels, vessels medium sized to large, 6 to 12 per sq.mm., mostly solitary, perforation plates oblique to transverse and porous, intervessel pits simple, alternate, contiguous, polygonal in shape.
2. Xylem parenchyma both paratracheal and apotracheal, paratracheal parenchyma aliform to aliform confluent, apotracheal parenchyma in short tangential bands.
3. Xylem rays 2 - 7 seriate, heterogeneous, heterocellular, uniseriate rays very few, some of the rays contain pterospermum type of tile cells.
4. Fibres occasionally septate, nonlibriform.

AFFINITIES AND DISCUSSION :

Comparison with the moderns woods :

The above mentioned type of parenchyma and pterospermum type of tile cells together are found only in some genera of the family Tiliaceae (Metcalf and Chalk, 1950). The detailed comparison of the woods, of the different genera, of Tiliaceae with the present fossil reveals that the fossil shows the maximum characters of the two genera viz. Grewia and Erinocarpus. In Erinocarpus, however, uniseriate rays are very common where as in the present fossil the uniseriates are very few. In the genus Grewia the different species show large amount of variation in the parenchyma type, both predominantly apotracheal banded and paratracheal vasicentric to aliform are found in different species of Grewia. Therefore the present fossil has maximum resemblances with the species of Grewia having aliform confluent and banded type of parenchyma.

Present day distribution of genus Grewia :

It is distributed in Konkan, Malbar Hill, Bombay and ever green forests of N. Kanara also distributed in Java, East tropical Africa and Ceylon.

Comparison with the fossil :

The only fossil wood of Tiliaceae described from the Deccan Intertrappean beds so far is Grewioxylon. All the described species of Grewioxylon lack banded parenchyma (Shallom 1963 a, Prakash and Dayal 1963, Prakash and Dayal 1964, Prakash and Dayal, Lakhnapal, Prakash and Bande, 1976, Trivedi 1976 and Rao 1988) characteristic feature of the present fossil. Hence the fossil wood has been placed in the new genus Tiliaceoxylon as T. nawargaoense gen. et.sp.nov. Specific epithet is after the name of forest village Nawargaoon from where fossil was collected.

GENERIC DIAGNOSIS :

Tiliaceoxylon Gen.nov. :

Wood diffuse porous, Growth rings present, vessels medium sized to large, mostly solitary sometimes in radial multiples of two elements, tylosis present. Parenchyma : Both paratracheal and apotracheal, paratracheal parenchyma vasicentric, aliform to aliform confluent, apotracheal parenchyma in short tangential bands. Rays uniseriate rays very few or absent, multiseriate rays 2 - 7 seriate with pterospermum type of tile cells, ray tissue heterogeneous and heterocellular. Fibres - nonlibriform occasionally septate.

SPECIFIC DIAGNOSIS :

Tiliaceoxylon nawargaoense Gen.et.sp.nov.

Growth rings present, vessels medium sized to large, t.d. - 98 μ to 252 μ , r.d. - 168 μ to 322 μ , mostly solitary, few in radial multiples of two, vessel members short, perforation simple, transverse to oblique porous, intervessel pitting simple, alternate, contiguous, polygonal in shape, 6 μ - 8 μ in diameter, vessel parenchyma pit similar to intervessel pitting, 2 μ in diameter, tylosis present. Parenchyma - paratracheal, vasicentric, aliform to aliform confluent, aliform extensions 3 - 6 cells broad near the vessels apotracheal parenchyma forming short tangential bands. Rays - Heterogeneous, heterocellular uniseriates very few, multiseriates 2 - 7 cells or 98 μ in width and 22 - 31 cells or 280 μ - 588 μ in height, some of the ray cells contains pterosperm type of tile cells. Fibres - nonlibriform, thin walled, occasionally septate, polygonal to oval in cross section, lumen 12 μ .

Holotype - Department of Botany,
Smt.K.W.College, Sangli.

Museum No. - F.N.11

Locality - Nawargaon, Wardha District, Maharashtra

Horizon - Deccan Intertrappean Series

Age - Early Tertiary (Probably Eocene)

FAMILY - ANACARDIACEAE

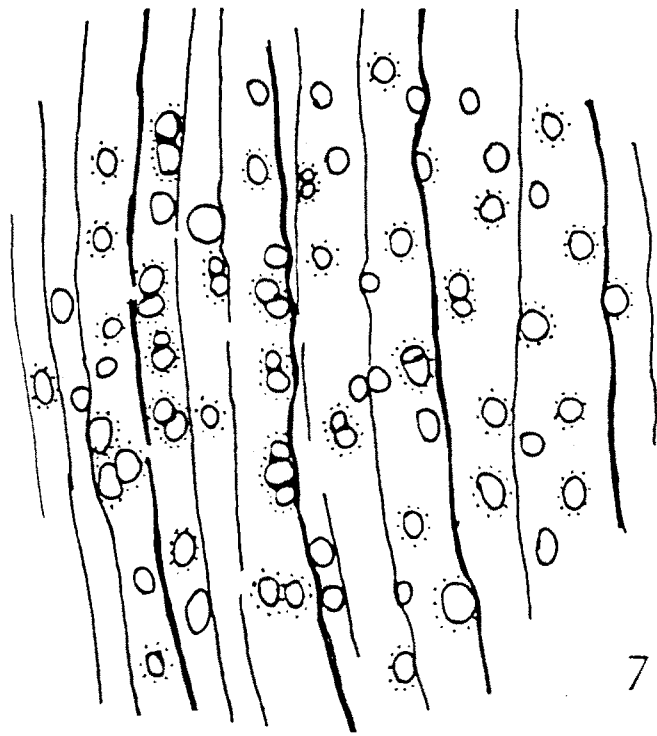
Genus - Lanneoxylon Prakash and Tripathi (1967)

Lanneoxylon indicum sp.nov.

(Text Figures 7 - 11 ; Plate - 2 ; Figures - 10 to 15)

EXTERNAL FEATURES : The fossil specimen is small piece of petrified decorticated wood measuring 11.5 cms in length and 3 cms in diameter at its broadest. It shows branching. It is brownish externally and blackish internally.

TOPOGRAPHY : Wood - diffuse porous (Text Fig. 7 ; Pl.2 ; Fig. 10) Growth rings not seen, Vessels - not visible to the naked eye but seen under pocket lense as a small dot like structures, small size mostly solitary or in radial multiples of 2 - 3 elements, very rarely 4, 9 - 19 per sq. mm., some vessels are filled with dark brownish contents, tylosis are seen. Parenchyma - paratracheal, scanty, vasicentric, 1 - 2 layered round the vessels (Text Fig. - 7 ; Pl. - 2 ; Fig. - 11), apotracheal parenchyma absent. Xylem rays - Fine to broad, 1 - 7 seriate, (mostly 2 - 3 seriate) (Pl.2, Figs. - 12 & 13), 14 - 185 μ in width, ray tissue heterogeneous, heterocellular, uniseriate rays very few (Text Fig. - 8) upto 3 cells and 113 μ in height, some cells filled with brownish contents, made up of only



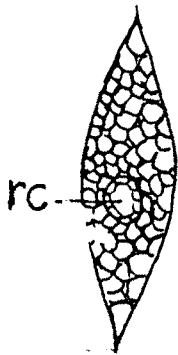
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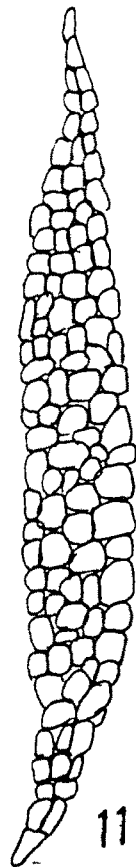
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11

upright cells, multiseriate rays are mostly confined to the branching region, (Text Fig. - 11) 6 - 39 cells or 852 μ - 1179 μ high and 2 - 7 cells or 142 μ - 185 μ wide, multiseriate rays are of two types, fusiform and non-fusiform, the later being very less as compared to the former and occasionally containing radial canals (Text Fig.- 10 ; Pl. - 2 ; Fig. - 12), rays 5 - 6 per sq.mm. Fibres - aligned in radial rows between two rays, libriform with simple pits on their radial walls, septate with 3 - 4 septa per fibre.

ELEMENTS : Vessels - thin walled, 2 μ - 3 μ thick, t.d. - 71 μ - 99 μ , r.d. - 99 μ - 126 μ , oval to round in shape when solitary, short, 60 μ - 128 μ in length, perforation plate simple, oblique to transverse and porous, intervessel pits alternate, bordered (Pl. 2, Fig.14), vessel parenchyma pits similar to intervessel pits, vessel ray pits not seen. Parenchyma - cells thin walled, flattened in cross section, rectangular in longitudinal section, 99 μ in length and 16.5 μ in diameter. Rays - cells thin walled, procumbent cell 24 μ in tangential height and 24 μ in radial length, upright cells 44 μ in tangential height and 24 μ in radial length. Fibres - moderately thin walled, walls 3 μ

- 4 μ thick, septate with 3 - 4 septa per fibre, angular to circular in cross section, 264 μ - 280 μ , in length, interfibre pits simple, uniseriate with circular lumen.

DIAGNOSTIC FEATURES OF THE WOOD :

1. Wood diffuse porous, vessels small sized, 9 - 19 per sq. mm., mostly solitary and in radial multiples of 2 - 3, perforation plate oblique to transverse and porous, intervessel pits large, bordered, alternate, vessel end plate simple, oblique to transverse, porous.
2. Xylem parenchyma only paratracheal, scanty, vasicentric, 1 - 2 layered round the vessel.
3. Xylem rays 1 - 7 seriate, heterogeneous, heterocellular, uniseriate rays very few, rays are of two types - fusiform and nonfusiform, fusiform rays are few in number, and some fusiform rays occasionally contain traumatic radial canals.
4. Fibres libriform with simple pits on their radial walls, septate with 3 - 4 septa per cell.

AFFINITIES AND DISCUSSION :

Comparison with the modern woods :

The combination of the above mentioned diagnostic features is found only in the members of family - Anacardiaceae. The comparison of wood anatomical features of various genera of Anacardiaceae with the features of fossil wood (Metcalf and Chalk, 1950) shows that species of genus Lannea share maximum features of the fossil like -

1. Small sized vessels distributed solitarily as well as in multiples of 2 - 3 elements.
2. Paratracheal vasicentric parenchyma
3. Rays 1 - 7 seriate, two distinct types - fusiform and nonfusiform, the later being very less as compared to the former and occasionally containing radial canal.

However, bands of terminal parenchyma seen in some species of Lannea are not found in the present fossil.

Comparison with the fossil :

A fossil wood of Lannea has already been described from Neogene beds of Assam, by Prakash and Tripathi

(1967). The present wood compares favourably with this fossil in most of its anatomical features except for the vessel size which ranges from $74 \mu - 230 \mu$, t.d.in Lanneoxylon grandiosum as against the $71 \mu - 99 \mu$ t.d. in the present fossil (Table - 1). The anatomical features given by Tomlinson indicate that the most species of Lannea have smaller vessels, therefore, the present fossil has been placed in the same genus Lanneoxylon Prakash and Tripathi (1967), but under distinct species Lanneoxylon indicum sp.nov. Specific epithet is after the name of the country India.

SPECIFIC DIAGNOSIS :

1. Growth rings absent
2. Small sized vessels, t.d. $71 \mu - 99 \mu$, r.d. $- 99 \mu - 126 \mu$, 9 - 19 per sq.mm. vessel member short, $60 \mu - 128 \mu$ perforation plate simple, oblique to transverse porous.
3. Paratracheal vasicentric parenchyma
4. 1 - 7 seriate, 8 rays per sq. mm. rays of two distinct type, fusiform and nonfusiform. Some fusiform rays occasionally contains radial canals, ray tissue heterogeneous and heterocellular,

consisting of procumbent cells in the middle and 1
- 2 rows of upright cells at one or both the ends.

5. Fibres thin walled, septate, libriform.

Holotype : Department of Botany
Smt.Kasturbai Walchand College,Sangli.

Museum No. : F.N. - 26

Locality : Nawargaon, Wardha District,
Maharashtra.

Horizon : Deccan Intertrappean Series

Age : Early tertiary (Probably Eocene)

FAMILY - OLEACEAE

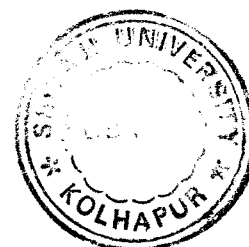
Genus - Schrebroylon Trivedi and Srivastva (1982 b)

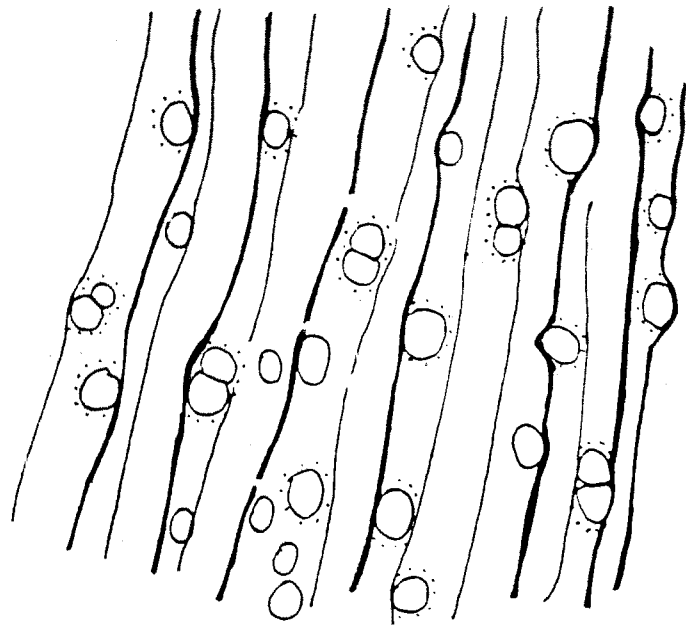
Schrebroylon deccanense sp.nov.

(Text Figures - 12 to 16 ; Plate - 3 ; Figures - 16 to 22

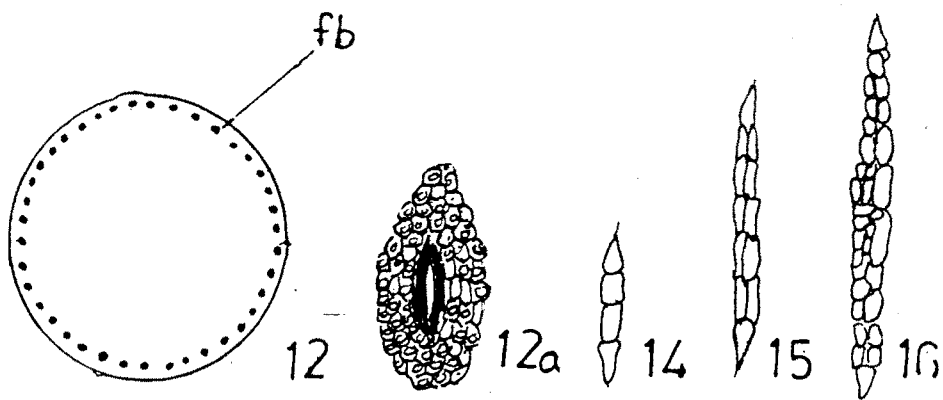
EXTERNAL FEATURES : A specimen is a small piece of laterally compressed silicified wood measuring 10.5 cm in length and 5.5 cm in diameter. It is whitish brown externally and blackish internally. Bark - It is multilayered in thickness and 700 μ in radial extent with squarish to brick shaped cells arranged in the tangential rows. There is a single row of large oval fibre bundles, (Text Fig. - 12) 200 μ - 250 μ in size arranged more or less equidistantly in this zone. (Pl.3, Fig. 21). The fibres are polygonal in cross section with highly thick walls. Wall thickness is 4 μ , lumen is reduced to narrow slit.

TOPOGRAPHY : Wood - diffuse porous (Text Fig. - 13 ; Pl.- 3 ; Fig.- 16), Growth rings are seen delimited by thick walled fibres. Vessels are seen with the naked eye, mostly solitary, rarely in radial multiples of two elements, some vessels are filled with dark contents (Pl. 3 , Fig.17), few vessels are tylosed





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12a

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(Pl.3, Fig.19), 5 - 13 per sq.mm. Paarenchyma - only paratracheal, vasicentric, single layered sheath, round the vessel. Rays - visible with hand lense as a prominent straight lines on the cross surface of wood, 1 - 3 seriate (Text Fig. 14 - 16 ; Pl.- 3 ; Fig.- 19) 42 μ in width, 10 - 15 per sq. mm. , ray tissue heterogeneous and heterocellular (Pl. 3, Fig. 22), uniseriate rays 3 - 5 cells in height, and about 15 μ in width composed mostly of upright cells, biseriates are 6 - 40 cells or 168 μ to 298 μ in height and about 28 μ - 42 μ in width composed of procumbent and upright cells. Triseriate rays 42 - 72 cells or 966 μ - 1820 μ height composed of mostly procumbent cells with 1 or 2 marginal rows of upright cells. Crysteliferous cells are occasionally seen in these rays (Pl.3, Fig.19). Fibres - well preserved aligned in radial rows between the consecutive rays ,septate (Pl. 3, Fig.18) as well as non septate, septate fibres are with 3 - 5 septa per cell, 350 μ in length, lumen 8 μ , wall thickness 3 μ , semilibriform. Pith present, compressed, parenchymatous, some cells filled with dark brown contents .

ELEMENTS : Vessels moderately thin walled, wall thickness 4 μ , oval to round in cross section when solitary, those in groups flattened at places of

contacts, t.d. $84\ \mu$ - $196\ \mu$, r.d. $98\ \mu$ - $280\ \mu$, vessel member short, $182\ \mu$ - $322\ \mu$ in length, perforation plate simple, oblique to transverse and porous, intervessel pits well preserved, alternate, contiguous, bordered, polygonal in shape (Pl.3, Fig.20), $6\ \mu$ in diameter, vessel parenchyma pit similar to intervessel pit, vessel ray pit not observed. Parenchyma - cells thin walled, oval to rounded in cross section and rectangular in longitudinal section, $56\ \mu$ in length and $10\ \mu$ in tangential width. Rays - thin walled, some filled with brownish contents, consists of procumbent and upright cells, procumbent cells are $16\ \mu$ in tangential height and $20\ \mu$ in radial length, upright cells $28\ \mu$ in tangential height and $16\ \mu$ in radial length. Fibres - thin walled, wall $3\ \mu$ in thickness, semilibriform, septate as well as nonseptate. $350\ \mu$ in length, polygonal in outline in cross section, interfibre pits not seen.

DIAGNOSTIC CHARACTERS OF THE WOOD :

1. Presence of ring of pericyclic fibre bundles
2. Wood diffuse porous, growth rings are seen delimited by thick walled fibres

3. Vessels medium sized, mostly solitary, few in radial multiples of 2 - 3 (mostly two element) intervessel pits alternate, contiguous, bordered.
4. Parenchyma predominantly paratracheal, vascentric scanty, single layered sheath, round the vessel.
5. Xylem rays 1 - 3 seriate mostly biseriate, uniseriate few, almost heterogeneous with 1 - 2 rows of marginal upright cells, crystaliferous cells occasionally seen in the rays.
6. Fibres septate, as well as nonseptate, semilibriform.

AFFINITIES AND DISCUSSION :

Comparison with the modern wood :

The detailed survey of literature with reference to the above mentioned characters especially the presence of pericyclic fibres, alternate, contiguous, bordered intervessel pits and the occurrence of septate fibres shows that these features are found in combination in families such as Cappariaceae, Euphorbiaceae, Lecythidaceae, and Oleaceae. In Cappariaceae septate fibres are present only in the

genus Morisonia but it lacks the pericyclic fibres which is the prominent feature of the present wood.

In the family Euphorbiaceae the only species of Euphorbia and Eupeca combine the characters of pericyclic fibres and septate wood fibres. However, in the species of Euphorbia vessels are very small (less than 50 μ t.d.) and intervessel pitting is opposite to scalariform type. In the genus Eupeca only few fibres are septate and rays are extremely heterogeneous having 4 - 10 marginal rows of upright cells whereas in the present fossil there are 2-3 rows of marginal upright cells in the rays.

In the family Lecythidaceae septate fibres are present only in the genus Planchonia andamanica where intervessel pits are horizontally elongated type and parenchyma is typically banded.

In Melastomaceae no genus combines the characters of pericyclic fibres and septate wood fibres. This leaves us with only family Oleaceae of which only three genera that is Ligustrum, olea, Schrebera contains the characters of pericyclic fibre bundles and septate wood fibres. Of this three genera in genus Olea and Schrebera

vessel multiples of 4 or more cells are very common. Whereas in the fossil and the genus Ligustrum the vessels are mainly solitary or in multiples of 2 - 3. Apart from these characters the present fossil resemble the Ligustrum in having

1. Tylosis and vessels with gummy deposits
2. Paratracheal scanty to vasicentric parenchyma
3. Rays 2 - 3 cells wide with few uniseriates
4. Occasional presence of crystaliferous cells in rays

Therefore, the affinities of the present fossil are more close to the species of Ligustrum. However, in most of the species of the Ligustrum vessels are reported to be coming under small range (less than 100 μ), but in the present fossil it comes under medium range. (84 μ - 196 μ)

Present day distribution of the genus Ligustrum :

It is distributed in Higher Ghats of Bombay Presidency and Amboli Ghat in Konkan. Also found in Mahabaleshwar, common in moist forest near Tinai Ghat of Kanara.

Comparison with the fossil :

Trivedi and Srivastava (1982) investigated a new fossil wood Schreberoxylon mohgaonsis gen.et.sp.nov. resembling modern taxon Schrebera swetenoides of the family Oleaceae from the Deccan Intertrappean beds of Mohgaonkalan, Distric Chhindwara, M.P., India. This is the only fossil record from the Deccan Intertrappean beds of India. Besides this Rao (1988) described a new species of Schreberoxylon - Schreberoxylon nawarqaonsis. In detailed anatomical characters the present fossil differs from both these species.(Table - 2). Hence the present wood is placed in a new species Schreberoxylon deccanense sp. nov. Specific epithet is after the Deccan Plateau.

SPECIFIC DIAGNOSIS :

Schreberoxylon deccanense sp.nov.

Wood diffuse porous, growth rings present, vessels medium sized, t.d.84 μ to 196 μ , and r.d. 182 μ - 322 μ , mostly solitary, few in radial multiples of two, rarely three, intervessel pit pairs alternate, contiguous, bordered, tylosis present, rays 1 - 3 cells wide mostly 2 - 3 cells with 1 - 3 rows of marginal upright cells, heterogeneous, heterocellular,

crystaliferous cells, occasionally seen in the rays, 10 - 15 per sq.mm. fibres semilibriform, septate as well as nonseptate.

Holotype : Department of Botany,
Smt. Kasturbai Walchand College,
Sangli.

Museum No. : F.N. 53

Locality : Nawargaon, Wardha District,
Maharashtra.

Horizon : Deccan Intertrappean Series

Age : Early Tertiary (Probably Eocene)

FAMILY - CYPERACEAE

Genus - Cyperaceocaulon Gen.Nov.

Cyperaceocaulon tomlinsonii Gen.et.sp.nov.

(Text Figures - 17 to 29 ; Plate - 4 ; Figures - 22 to 27

EXTERNAL FEATURES : The present description is based upon the study of single specimen of a petrified Monocotyledonous rhizome with numerous roots and basal portions of aerial branches clumped together (Pl.-4, Fig. -23).The specimen is brownish externally as well internally. It measures about 11 cms in length and 10 cms in width. The anatomical details of only one aerial erect branch coming out of rhizome complex has been described in the present work. This aerial branch measures 4 cms in length and 2.6 x 1.9 cms in diameter.

ANATOMICAL DESCRIPTION : The cross section of the aerial branch is trigonous to circular in outline. (Text Fig. - 17; Pl. - 4, Fig. - 24) and consists of 3 concentric rings of vascular bundles arranged in the homogeneous ground parenchymatous tissue. The epidermis and hypodermis are not preserved. The vascular bundles in outermost ring are arranged more closely than the bundles of inner rings. The outermost ring of vascular bundles is incompletely preserved in the fossil. Hence it was not possible to count the exact number of

vascular bundles in it. The distance between two neighbouring vascular bundles in the outermost ring is not constant. It varies between $168 \mu - 490 \mu$, the middle ring of vascular bundles is nearly triangular in shape (Text Fig. - 17) and contains 36 - 38 vascular bundles. The vascular bundles are $140 \mu - 350 \mu$ apart from each other. The innermost ring has 26 - 29 vascular bundles arranged more or less in broad "U" shaped pattern (Text Fig.- 17 ; Pl.- 4 ; Fig. - 25) which becomes continuous with the bundles of the middle ring. These are spaced $140 \mu - 420 \mu$ apart from each other.

Each vascular bundle is oval to circular (Text Figs. - 20 to 29) in outline and has a massive fibrous sheath which is 4 - 8 layered or $70 \mu - 140 \mu$ in thickness in cross section. The fibrous sheath is thicker towards the dorsal and ventral side of the vascular bundles than the lateral sides. The vascular bundles of the central ring ranges from $350 \mu \times 210 \mu$ to $700 \mu \times 420 \mu$ in diameter. The vascular bundles of the middle ring range from $280 \mu \times 210 \mu$ to $700 \mu \times 420 \mu$ in diameter while the vascular bundles of the outermost ring are $280 \mu \times 210 \mu$ to $840 \mu \times 350 \mu$ in diameter.

Each vascular bundle has patch of angular xylem elements which takes up various shapes like circular, triangular or broad arch fashion. The metaxylem elements are $70\ \mu$ in diameter and protoxylem elements are $28\ \mu$ in diameter. The metaxylem elements have scalariform lateral wall pitting (Text Fig.- 18 ; Pl.- 4, Fig. -28) and have extremely slanting scalariform end plates (Text Fig. - 19 ; Pl. - 4, Fig. - 29), with numerous bars. Rest of the space is presumably occupied by the phloem tissue. The vascular bundles can be broadly classified as colateral type but a few which have arch of xylem elements appear to be amphivessel also and some with central patch of xylem element surrounded by phloem appear to be hydrocentric type (Text Fig. - 21 & 22). Some vascular bundles are marginally fused. (Text Fig.- 26) Such a fused bundles are more in outer most ring. The ground tissue is homogeneous (Pl.-4, Fig.-26,27) and consists of elongated thin walled parenchyma cells which appear circular in trans section. The parenchyma cells are $168\ \mu$ in height and $56\ \mu$ in width in longitudinal section.

DIAGNOSTIC FEATURES :

1. Arrangement of vascular bundles in three concentric rings.
2. Each vascular bundle with a massive cylindrical fibrous sheath enclosing the vascular tissue.
3. The xylem elements angular and arranged in various fashion in cross section.
4. Most of the vascular bundles are of colateral type few amphivessel and few hydrocentric.
5. The largest xylem element with scalariform side wall pitting and extremely slanting perforation plates with numerous scalariform bars.
6. Fusion vascular bundles few, involving marginal fusion of vascular bundles, more common in the outermost ring.
7. Ground tissue homogeneous consisting of elongated parenchyma cells, a few containing tanin like deposits.

AFFINITIES WITH LIVING :

A critical survey of literature pertaining to anatomy of different Monocotyledonous groups (Metcalfe,

1960 ; Tomlinson 1961 ; Coultard 1967 ; Tomlinson 1967 ; Ayensu 1972 ; Zimmermann, Tomlinson, Leclarin 1974 ; Tomlinson 1982 ; etc.) reveals that the diagnostic features exhibited by the fossil are found in combination only in rhizomes and basal regions of the culms of a family Cyperaceae, though Cyperaceous. Culms are generally described as triangular, almost circular forms are also found in several genera (Metcalf 1971), prominent amongst these are Bulbostylis , Cyperus, Eleocharis, Fuirena, Hypolytrum, Lipocarpa, Pycnus, Rhynchospora, Carex, Schoenus, Scirpus. Generally, the culms are centrally hollow, but solid culms are also found in several genera.

The vascular bundle in Cyperaceous culms are distributed in various fashions as follows -

1. They are all found in peripheral ring not penetrating to the center.
2. Some vascular bundles penetrating into peripheral part of central ground tissue.
3. Vascular bundles extending towards and reaching the center of the ground tissue.

The vascular bundles distribution in the present fossil belongs to the second category. This category

belongs to the following genera - Bulbostylis, Carex, Cyperus, Fuirena, Lipocarpa, Pycneus, Rhynchospora, and Schoenus.

In Cyperaceous culms the vascular bundles are mostly colateral and amphivessel bundles are not found. However, in the present fossil some hydrocentric and some apparently amphivessel bundles are also found. Since amphivessel vascular bundles are common in rhizomes of several members of Cyperaceae, it can be said that the culm portion represented in the fossil belongs to the basal most part because the sections studied are only one inch away from the rhizomes.

Scalariform perforation plates with numerous bars are also found along with simple perforation plates in species of Carex, Fuirena, Hypolytrum, Lipocarpa and Scleria, exclusively scalariform plates have been reported only in species of Scleria and Hypolytrum.

This discussion therefore shows that though at present it is not possible to assign the fossil to any living genus of Cyperaceae, it combines most of the culm features of the family and therefore has been designated as Cyperaceocaulon gen.nov.

Comparison with the fossil :

There are only two well illustrated fossil reports of Cyperaceae from Tertiary of India. These are -

1. Cyperaceoxylon intertrappeum Gen.et.sp.nov.
described by Chitale and Patel (1970) from the Deccan Intertrappean beds of Mohagaonkalan, Chhindwara District, M.P. and
2. Scirpusoxylon indicum Gen.et.sp.nov. described by R.H.Shete (1986) from the Deccan Intertrappean beds of Nawargaon - Maragpur area of Wardha District, Maharashtra.

Of these Cyperaceoxylon intertrappeum differs from the present fossil in following respects -

1. The stem portion of Cyperaceoxylon intertrappeum shows closed vascular bundles scattered in the parenchymatous ground tissue in which outermost ring of vascular bundle is contiguous with the hypodermis. Whereas in the present fossil vascular bundles are arranged in three concentric rings.
2. The ground parenchyma of the stem in Cyperaceoxylon intertrappeum shows intercellular spaces. Whereas in the present fossil ground

parenchyma is homogeneous and lacks intercellular spaces.

3. The stem of Cyperaceoxylon intertrappeum is covered by thick leaf sheath which is well preserved with several roots embedded in its mesophyll. Such a leaf sheath is absent in the present fossil.

However, like Cyperaceoxylon intertrappeum present fossil contains collateral types of vascular bundles which are surrounded by massive fibrous sheath. But in the present fossil in addition to collateral vascular bundles there are few amphivessel, few hydrocentric and some fusion vascular bundles.

In Scirpusoxylon indicum the vascular bundles are scattered in the ground tissue and are of conjoint, collateral type. The central vascular bundles being larger than the outer ones. Similarly there are large air cavities in the cortex and ground parenchyma. The present fossil differs from Scirpusoxylon indicum in the arrangement of vascular bundles in three concentric rings and in the absence of air cavities in the ground parenchyma.

Therefore, the present fossil differs in its anatomical characters from the fossil Cyperaceous members described so far. Hence it is placed under the name Cyperaceocaulon tomlinsonii Gen.et.sp.nov.

Generic Diagnosis :

Cyperaceocaulon Gen.nov. -

Monocotyledonous culm, trigonous to circular in outline and measuring 4 cms in length and 2.6 x 1.9 cms in diameter. Vascular bundles are arranged in concentric rings. Each vascular bundle has a cylindrical fibrous sheath. Most of the vascular bundles are of colateral type with few hydrocentric and few amphivessel. Ground parenchyma lacks intercellular spaces.

Specific Diagnosis :

Cyperaceocaulon tomlinsonii Gen.et.sp.nov.

Vascular bundles are arranged in three concentric rings. Innermost ring of vascular bundles contains 26 to 29 bundles which are arranged in "U" shaped fashion while the second ring contains about 36 - 38 vascular bundles. Each vascular bundle is surrounded by 4 - 8

layered sclerenchymatous sheath. Most of the vascular bundles are of colateral type with few amphivessel and few hydrocentric type. The largest xylem element with scalariform side wall pitting and extremely slanting perforation plate with numerous bars. Metaxylem elements $70 \mu \times 56 \mu$ in diameter while protoxylem elements 28μ in diameter. Ground parenchyma cells thin walled, 56μ in width and 168μ in height.

Holotype : Department of Botany,
Smt.Kasturbai Walchand College,
Sangli.

Museum No. : F.N. 54

Locality : Nawargaon, Wardha District,
Maharashtra.

Horizon : Deccan Intertrappean Series

Age : Early Tertiary (Probably Eocene)