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Biogeographic analysis of Jurassic–Early Cretaceous wood assemblages from Gondwana

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Abstract

The terrestrial biogeography of Gondwana during Jurassic–Early Cretaceous times is poorly resolved, and the flora is usually considered to have been rather uniform. This is surprising given the size of Gondwana, which extended from the equator to the South Pole. Documenting Gondwanan terrestrial floristic provincialism in the Jurassic–Early Cretaceous times is important because it provides a historical biogeographic context in which to understand the tremendous evolutionary radiations that occurred during the mid-Cretaceous. In this paper, the distribution of Jurassic–Early Cretaceous fossil wood is analysed at generic level across the entire supercontinent. Specifically, wood assemblages are analyzed in terms of five climatic zones (summer wet, desert, winter wet, warm temperate, cool temperate) established on the basis of independent data. Results demonstrate that araucarian-like conifer wood was a dominant, cosmopolitan element, whereas other taxa showed a greater degree of provincialism. Indeed, several narrowly endemic morphogenera are recognizable from the data.

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Finally, comparisons with Laurasian wood assemblages indicate strong parallelism between the vegetation of both hemispheres.

Keywords: Gondwana; Fossil wood; Jurassic; Early Cretaceous; Continental ecosystems; Floristic provincialism

1. Introduction

Gondwana has retained a distinctive biota from Permian to modern times. Consequently, the evolution and biogeography of its flora and fauna have been sources of continuing interest to biologists and palaeontologists (Takhtajan, 1986; Briggs, 1995). Close relationships between taxa found on the now dispersed fragments of Gondwana have provided strong evidence in support of plate tectonics, yet, considerable debate continues concerning the role of other biogeographic processes such as dispersal across land bridges and oceanic bodies.

Fossils yield firm evidence for the presence of taxa on ancient landmasses and provide a minimum age for the antiquity of particular biological groups. Although many terrestrial biogeographic analyses have been undertaken for the Permian–Triassic interval in Gondwana (Artabe et al., 2003), surprisingly few studies have been carried out for the Jurassic–Early Cretaceous period (Vakhrameev, 1991). A better understanding of Gondwanan biogeography during this interval is especially important as it provides the historical context for the late Mesozoic radiation of birds, mammals, angiosperms and frogs, together with secondary radiations among many insect groups. These radiations were broadly coeval with the initial break-up of Gondwana and occurred in ecosystems that had maintained a relatively stable composition and distribution during the Jurassic (Vakhrameev, 1991; Anderson et al., 1999).

Fossil wood assemblages provide one of the best sources of data for assessing biogeographic patterns at the continental scale. This is true for three reasons. Firstly, woods are less mobile and less easily reworked than pollen, and yet they are also more durable and more widely distributed than leaf remains (Philippe et al., 1998, 2003). Secondly, they are commonly found in coastal sedimentary facies and, consequently, may be precisely dated by reference to marine biostratigraphic indices. Thirdly, the conservative rate of evolution and long stratigraphic ranges of many wood morphogenera allow us to use their distribution for analysing regional variations in the flora over prolonged intervals (tens of millions of years).

However, meaningful biogeographic analysis of Gondwana wood assemblages has been impeded previously by inadequate taxonomic resolution. This problem is due to the fact that Southern Hemisphere palaeoxylologists have had limited access to the holotypes of several taxa (most of them being in northern museums), and to the relevant literature (often in old and obscure publications). In contrast, their Northern Hemisphere colleagues have lacked access to some key southern holotypes and commonly have been unaware of current information on the age, stratigraphy and sedimentology of Gondwanan sequences.

To overcome these problems Bamford and Philippe (2001) carried out a nomenclatural and taxonomic reappraisal of Gondwanan Jurassic–Early Cretaceous wood genera. Here, we use the revised taxonomic framework to provide the first biogeographic analysis of Gondwanan wood assemblages.

2. Historical background

Fossil woods from Gondwana were among the very first studied. Nicol, who discovered that preserved anatomical details could be observed in thin sections of permineralized wood (Nicol, 1834), had in his collections some silicified samples from the Karoo Basin of South Africa (Nicol, 1835). At a later date, other European xylologists undertook anatomical investigations of fossil woods from Tasmania, South America and several Southern Hemisphere islands and erected several new taxa (e.g., Unger, 1850; Kraus, 1870; Conwentz, 1884; Crié, 1889; Gothan, 1908, 1925). However, it was only at the beginning of the twentieth century that Gondwana-based scientists began systematically describing Mesozoic fossil woods from their own countries (e.g., Shirley, 1902; Sahni, 1920).

Despite this auspicious beginning, few Gondwanan nations have maintained palaeoxylological research groups for sustained periods. The notable exceptions are India, which hosts the famous Birbal Sahni Institute, as well as Argentina and Brazil, where several groups have established a tradition of palaeobotanical research. Consequently, the Gondwanan Mesozoic fossil record is scanty and irregularly distributed. For example, 18% of the wood data for the Jurassic–Early Cretaceous interval is documented from India alone. Furthermore, woods have been described according to various conflicting nomenclatural and taxonomical frameworks. For example, Indian authors have widely used the invalid name *Mesembrioxylon* Seward for woods more appropriately referable to other genera (Bamford and Philippe, 2001). Biogeographic syntheses of wood assemblages have thus been impossible prior to a thorough taxonomic reappraisal.

3. Gondwanan fossil wood database

To analyse fossil wood biogeography we constructed a database containing all records of Gondwanan gymnosperm woods for the Early Jurassic–Early Cretaceous interval. Records were entered into the database using the revised and unified taxonomic and nomenclatural framework established by Bamford and Philippe (2001). At a time when great emphasis is put on the value of biodiversity, it may seem unappealing to assimilate old data into a revised framework that actually results in an apparent reduction in diversity. However, it must be emphasised that taxonomic revision has been carried out at the generic level, and that species-level diversity is little affected. Although the ICBN must be respected for provision of a system to organise biological data and to aid efficient communication, it is likely that different paleoxylologists will have idiosyncratic approaches to taxonomy and will not accept aspects of the nomenclatural system adopted here (Bamford and Philippe, 2001). Nevertheless, we stress that a unified system is essential for any meaningful biogeographic analysis.

3.1. Compilation of the database

Our database, which is complete as far as we are aware, contains 348 data entries, mostly taken from published literature, but 17 entries are unpublished (Appendix A). An entry represents the presence of a wood morphotaxon (either at specific or generic level) at one place and of one age. A single record can be based on several samples or even several species in the few cases of polytypic data. All records were systematically reappraised. Data in Appendix A are arranged according to the generic name used in the original description. Thus, the same taxon may be found under different original citations if it has been found at several places and reported under different synonyms. At this stage, it is not realistic to revise the taxonomy of the fossil woods at specific level.

We endeavoured to access the original material, and to review the holotypes wherever possible. This was accomplished for 48% of the entries. For 51% of the entries only the protologue (original description and illustration) was used. In rare cases where there was a discrepancy between the text and the figures of that protologue we decided to trust the authors' descriptions rather than the figures, which were commonly of indifferent quality and in some cases incorrectly numbered. For 1% of the 348 entries, we did not manage to access the protologue. These data have not been incorporated into the results and discussion.

3.2. Palaeogeographic and biostratigraphic framework for wood assemblages

All fossil wood records were carefully placed in their precise palaeogeographic context (Fig. 1). During the Jurassic–Early Cretaceous, most Gondwanan landmasses retained terrestrial connections. Among the exceptions, for which terrestrial links could have been ephemeral, were islands such as Madagascar, New Caledonia and New Zealand. Small terrains of uncertain palaeogeographic affinities (Iran, Shan-Thai, central America) were not taken into consideration in our analysis (cf. Vakhrameev, 1991). It is usually considered that North and South America split by the Bajocian or slightly earlier (Bartok et al., 1985; Aberhan, 2001).

All our fossil wood records were also placed precisely in their biostratigraphic context. However,

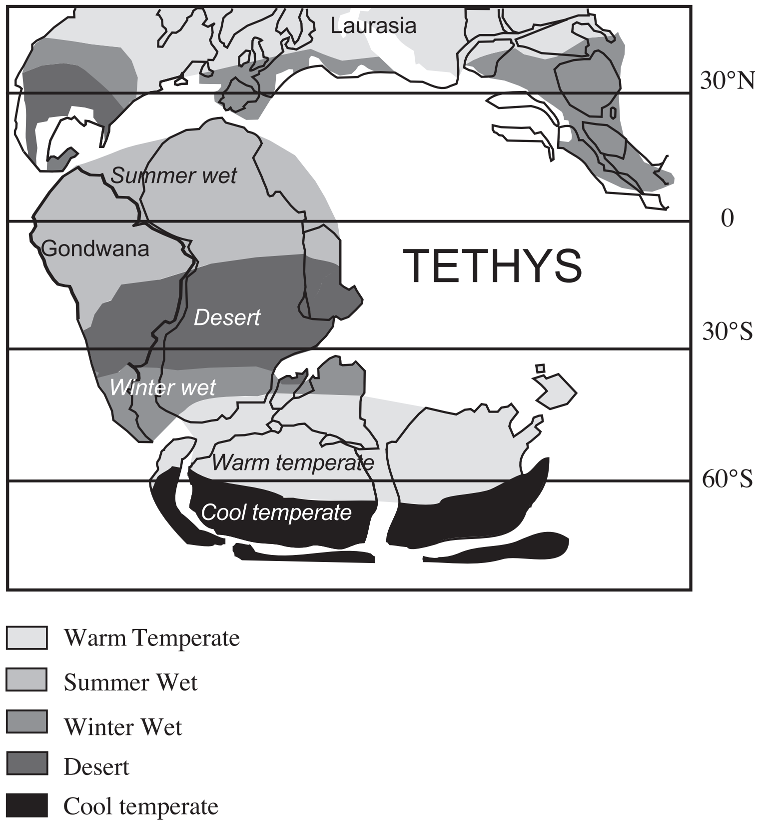

Fig. 1. The five climatic zones used to classify the wood data. Based on the palaeoclimatic reconstruction of Rees et al. (2000), for the Volgian times, Latest Jurassic.

we encountered problems in determining the age of certain wood assemblages from some regions. Woods found around Copiapo in northern Chile and described by Lutz et al. (1999) were said to be Triassic in age, but may be as young as Early Jurassic (Jensen, 1976; von Hillebrandt, 1973). Since at least some of these woods are definitely Triassic (Rafael Herbst in litt.), we did not take these woods into consideration. However, some of these Chilean woods are remarkably similar (Herbst in litt.) to those from Tanzania described by Giraud and Hankel (1985, 1986) and dated as Liassic. The age for the Nandanga Formation from which these Tanzanian woods come is also debatable (Wopfner, 2002). It rests on three pieces of evidence: (1) K/Ar ages of interspersed volcanics range from 186 to 164 Ma (Hankel, 1987); (2) the formation overlies strata with a Liassic microflora; and (3) the woods are attributed to taxa that were previously described from the Liassic of Morocco. The Liassic age for the Morocco woods has been recently confirmed (Milhi et al., 2002). In our database, both the Tanzanian and Moroccan woods have been dated as Liassic.

As for the woods from India, we follow Bose and Maheshwari (1974), who considered specimens from the Rajmahal Hills as Early Cretaceous in age (Bose et al., 1990); we followed Sengupta (2003) for the age of those from Pranhita–Godavari Basin (i.e., Early Jurassic for the Kota Formation and Early Cretaceous for the Gangapur Formation). Kota Formation, however, yields fossil woods resembling those from Early Cretaceous Rajmahal Formation, as well as charophytes and vertebrates, which are not age diagnostic (Vijaya and Prasad, 2001 ; Prasad and Manhas, 2001), and a revision of age of Kota Formation was recommended (Rajanikanth and Sukh-Dev, 1989).

In 1913, Halle (1913) published on some floras from Bahia Tekenika, Tierra del Fuego, floras to which he assigned a Jurassic age. Later, Kräusel (1924) studied the woods from Bahia Tekenika, and on the basis of his determination of *Nothofagoxylon* sp. suggested rather that a Tertiary age, for at least part of the flora, was tenable. One of us recently reviewed these woods from Bahia Tekenika in Stockholm' Naturhistoriska Riksmuseet. From this recent revision, what Kräusel had determined as *Nothofagoxylon* sp. is really a badly preserved araucarian wood. Furthermore, the wood assemblage includes *Agathoxylon* and *Protopodocarpoxylon*. This particular assemblage comes from the Tekenika Conglomerates, belonging to Yahgan Formation, and is Aptian/Albian in age (Halpern, 1973 ; Dott et al., 1977 ; Suárez et al., 1985 ; Olivero and Martinioni, 1996).

Some data that were obviously incorrect or doubtful have not been taken into consideration. As an example, Crémier (1969, p. 48), in a sentence with other errors, mentioned without a reference that ‘‘*Phyllocladoxylon gothanii* (Stopes) Shimakura’’ was found in ‘‘Antarctide’’. We never found, however, any other reference to support this statement. *Novoguineoxylon*, which is very similar to *Australoxylon*, is probably of Permian age (Bamford and Philippe, 2001), hence, it is excluded from our discussion.

3.3. Palaeoclimatic framework for wood assemblages

The wood assemblage database was then analysed within a palaeoclimatic context. Our palaeoclimatic framework was provided by the reconstructions of Rees et al. (2000), which are available at the following webpage (http://pgap.uchicago.edu/Jurassic.html); these reconstructions have proved to fit particularly well with biogeographic data for northern Gondwana (Philippe et al., 2003). Specifically, we analyzed our data in terms of the five climate zones established by Rees et al. (2000), these being the summer wet, desert, winter wet, warm temperate and cool temperate zones. These five climate zones were established on the basis of independent geological data, and do not use fossil wood evidence.

Each wood locality was assigned to a climate zone, and we have assumed that the continental positions and climatic zones remained broadly similar throughout the Early Jurassic to Early Cretaceous (Scotese, 1997), although we are aware that short-term climatic oscillations very probably occurred during this interval. For example, Liassic climate zone distributions appear to have been noticeably different from those of the Middle Jurassic–Early Cretaceous (Rees et al., 2000). We assume, however, that no tremendous climatic shift took place after the Middle Jurassic, an assumption that is quite robust for the scale we consider (tens of million of years with morphogenera that are quite stable).

We could have used statistical approaches to determine clusters of data (e.g., drawing similarity trees for locality occurrence lists) as this would have avoided the need to use independently derived palaeoclimatological assumptions (i.e., the partition into five climate zones). However, at generic level the taxa lists are small for any locality, which strongly limit the validity of such quantitative approaches. Furthermore, it must be emphasised that our database is likely to contain many taphonomic and geological biases, which limit the possible palaeoclimatological inferences. Specifically, unequal sampling or uneven exposure for each stage could bias observed diversity patterns.

4. Results

The raw data from Appendix A have been organised according to localities and are listed in the Jurassic–Early Cretaceous climate zones in which they occurred. These data are summarised in Table 1 with the number of records shown for each genus. The distribution of taxa from the Early Jurassic to Early Cretaceous is discussed below.

4.1. Cosmopolitian araucarian-like woods

Agathoxylon is ubiquitous across Gondwana and comprises at least 50% of our entries. This genus is also widespread in the Northern Hemisphere. The long time range and cosmopolitan distribution of this ancient and plesiomorphic wood type (araucarian tracheid pitting and araucarioid cross-field pits) implies that the parent plants colonised much of Pangaea before the fragmentation of the landmass. Furthermore, the genus was able to survive in all the climatic zones during the Early Jurassic to Early Cretaceous. In contrast, the distribution patterns of

Table 1
Distribution of the wood morphogenera in five climatic zones, with the number of corresponding records

	Summer wet	Desert	Winter wet	Warm temperate	Cool temperate
Early Cretaceous	*Agathoxylon* 49 *Brachyoxylon* 16 *Metapodocarpoxylon* 28 *Protocircoporoxylon* 3 *Protophyllocladoxylon* 4 *Protopodocarpoxylon* 3	*Agathoxylon* 2	*Agathoxylon* 3 *Brachyoxylon* 3 *Cupressinoxylon* 1 *Ginkgoxylon* 1 *Podocarpoxylon* 11	*Agathoxylon* 26 *Brachyoxylon* 7 *Circoporoxylon* 2 *Cupressinoxylon* 1 *Podocarpoxylon* 15 *Protocircoporoxylon* 4 *Protocupressinoxylon* 3 *Protopodocarpoxylon* 4 *Sahnioxylon* 9 *Taxaceoxylon* 5	*Agathoxylon* 9 *Araucariopitys* 3 *Circoporoxylon* 1 *Podocarpoxylon* 3 *Protocircoporoxylon* 1 *Taxodioxylon* 1
	6 genera 103 records (30%)	1 genus 2 records (0.57%)	5 genera 19 records (5.46%)	10 genera 76 records (21.84%)	6 genera 18 records (5.17%)
Late Jurassic	*Agathoxylon* 3 *Brachyoxylon* 1 *Metapodocarpoxylon* 5	*Agathoxylon* 1 *Brachyoxylon* 1	*Agathoxylon* 1 *Taxaceoxylon* 1	*Circoporoxylon* 1	*Agathoxylon* 1
	3 genera 9 records (2.59%)	2 genera 2 records (0.57%)	2 genera 2 records (0.57%)	1 genus 1 record (0.29%)	1 genus 1 record (0.29%)
Middle Jurassic	*Agathoxylon* 4 *Brachyoxylon* 10 *Metapodocarpoxylon* 7	no data	*Agathoxylon* 7 *Protelicoxylon* 1 *Prototaxoxylon* 2	*Agathoxylon* 4 *Brachyoxylon* 2 *Podocarpoxylon* 1	*Agathoxylon* 7 *Protopodocarpoxylon* 6
	3 genera 21 records (6.03%)		3 genera 10 records (2.87%)	3 genera 7 records (2.01%)	2 genera 13 records (3.74%)
Early Jurassic	*Agathoxylon* 4 *Brachyoxylon* 5	*Agathoxylon* 1 *Baieroxylon* 1 *Protopodocarpoxylon* 1	*Agathoxylon* 4 *Brachyoxylon* 2	*Agathoxylon* 4 *Cupressinoxylon* 1 *Ginkgoxylon* 1 *Podocarpoxylon* 3 *Taxaceoxylon* 4	*Agathoxylon* 3
	2 genera 9 records (2.59%)	3 genera 3 records (0.86%)	2 genera 6 records (1.72%)	5 genera 13 records (3.74%)	1 genus 3 records (0.86%)

other coeval and younger wood genera are most likely to have been climatically controlled. It would be of palaeobiogeographic interest to distinguish morphospecies of *Agathoxylon*, as some endemism seems to exist, but the anatomy of this morphogenus is so uniform that this is a difficult task. Among extant conifers only the Araucariaceae have wood of the *Agathoxylon* type, but in the Jurassic–Early Cretaceous, other plant groups may have had wood of this type, e.g., Pteridospermales and Cheirolepidiaceae.

4.2. Distribution of wood genera according to palaeoclimatic zones

Considering the remaining morphogenera, several biogeographic patterns are evident. The summer wet zone of Gondwana (northern South America, north and western Africa, western Middle East; see Fig. 1) is characterised by the endemic wood *Metapodocarpoxylon* (Philippe et al., 2003). In our survey, *Protophyllocladoxylon* is another genus found only in the summer wet zone, but it also occurs in the Northern Hemisphere (see, e.g., Philippe, 1995). *Brachyoxylon* is common in all epochs, and even dominant in the Early and Middle Jurassic; it is most abundant in the summer wet zone. Its importance decreases southwards, and it is absent in the southern cool temperate regions. In our survey *Brachyoxylon* frequency is an inverse function of latitude, and this distribution is symmetrical to that of the Northern Hemisphere. As a whole, *Brachyoxylon* is far less common, however, in Gondwana than in boreal areas.

The desert zone (central South America, central Africa, eastern Middle East, northernmost Madagascar; see Fig. 1) has generally yielded very little fossil wood, and had an apparently low floristic diversity. *Baieroxylon* is widespread in the Lower Jurassic of Europe, but occurs only in the Lower Jurassic of the desert zone in Gondwana. Early Jurassic woods of the Northern and Southern hemispheres are amazingly similar, a floristic signature previously noted among leaf assemblages (Vakhrameev, 1991). The restriction of *Baieroxylon* to the Lower Jurassic emphasises this epoch's floristic distinction from the rest of the Mesozoic.

The winter wet zone (southern South America, southern Africa except for the south and east coast, central Madagascar and western India; see Fig. 1) has a slightly more diverse wood flora than the desert zone. There are no distinctive endemic genera, although in our survey, two genera are found only in this region, namely *Protelicoxylon* and *Prototaxoxylon* (these genera also occur in Laurasia). These woods are closely related to *Taxaceoxylon*, which is also represented in the winter wet zone and the adjacent warm temperate belt. The Early Cretaceous winter wet zone was dominated by *Podocarpoxylon* in contrast to most other regions and times that were dominated by *Agathoxylon*. *Podocarpoxylon* was also present in the adjacent warm temperate zone but did not dominate assemblages. It is pertinent to note that this fossil distribution corresponds strongly to that of the extant Podocarpaceae, whose distribution is controlled mainly by climate.

The warm temperate zone (Antarctic Peninsula north of Alexander Island, southernmost Africa, east India, east Antarctica, west and north Australia; see Fig. 1) clearly had the greatest diversity of woods during all epochs discussed here. *Sahnioxylon* and *Protocupressinoxylon* are restricted to this area within Gondwana, but they are also known from Laurasia (Philippe, 1995; Philippe et al., 1999). *Cupressinoxylon*, *Ginkgoxylon* and *Taxaceoxylon* occurred only in the warm temperate and winter wet zones. There are some strong similarities between these zones although *Protocircoporoxylon* and *Protopodocarpoxylon* are notably absent from the latter.

The cool temperate zone (southeast Australia, western Antarctica, New Zealand; see Fig. 1) has an apparent low diversity of fossil woods. There are no records of *Brachyoxylon*, *Cupressinoxylon* or Taxaceae-like wood in this zone. The only endemic genus is *Araucariopitys*, which is of special interest owing to its peculiar anatomy. With its distinctive thickened ray cell walls and abietineous pitting on transverse ray cell walls, it is indeed reminiscent of the Pinaceae. Surprisingly, this anatomical feature appears at the same time (but in different genera) in both the austral and boreal polar woods during the Early Cretaceous. The cool temperate zone is the only one in our survey containing *Taxodioxylon*, although this genus is known from the Late Jurassic onward in Laurasia (Philippe, 1994).

5. Discussion

The wood assemblages for each zone have sufficient taxonomic resolution to be used for palaeoclimatologic interpretation. Here, however, we focus on palaeobiogeographic patterns. Our results contrast with Vakhrameev's (1991) view of a Southern Hemisphere with only two sharply divided zones: an equatorial belt and an austral province, with a subtropical climate extending almost to the southern pole. The data from fossil wood suggest that northern Gondwana constitutes a distinct biogeographic zone and that, south of the desert zone, assemblages show strong latitudinal variations.

5.1. Stratigraphic distribution of wood diversity

Species diversity for any particular epoch or region is not necessarily reflected by the diversity of morphogenera. Such a taxonomic bias is exemplified by *Agathoxylon*, for which many more species have been described than for any other genus. Gondwanan wood species require taxonomic reassessment, hence, biogeographic comparisons based on species diversity are unsound. For the rest of the discussion, the number of wood morphogenera will be considered as a proxy of floristic diversity.

Gondwanan wood diversity increased from eight genera in the Early Jurassic to fifteen in the Early Cretaceous (Fig. 2). It is difficult to determine whether this represents a true increase in diversity or is an artefact of sampling or preservation. The leaf floras known from this interval display a similar rise in

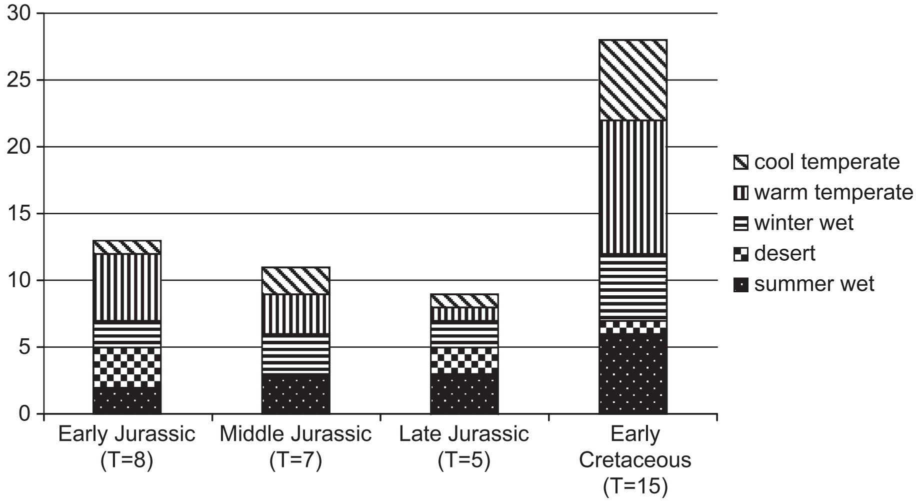

Fig. 2. Changes in the number of genera in each of the five climatic zones from Early Jurassic to Early Cretaceous. *T* is the number of genera represented for the whole Gondwana during the considered interval.

diversity (Vakhrameev, 1991), hence, the observed figure could be genuine. Early Cretaceous wood diversity is astonishing, even when it is considered that the Early Cretaceous is usually more wood-rich than the Jurassic in Southern Hemisphere. For most regions, the Early Cretaceous has wood diversity at least twice that of the Middle Jurassic, and it marks the first appearance of several key genera in Gondwana.

For the desert zone, the diversity is low (three morphogenera) in the Early Jurassic, then very low for the remainder of our record. Floristic impoverishment could be linked to drying after a relatively wet Early Jurassic, but the few data points prevent conclusive interpretations. In a symmetrical way, the generic diversity in the cool temperate zone increases from the Early Jurassic to Early Cretaceous (Philippe, 1996), a pattern compatible with a global warming during this interval.

5.2. Global patterns of wood diversity

Comparison of changes in generic diversity between Laurasia and Gondwana might provide evidence for global forcing of land plant evolution, i.e., the control of evolutionary patterns by environmental factors. Laurasian woods, however, require nomenclatural, taxonomic and systematic revision, hence, only superficial comparisons of global diversity and distribution patterns can be made. During the Early Jurassic to Early Cretaceous, there are more endemic wood genera in the Northern Hemisphere than in the southern (Table 2). Only two Laurasian endemics are widely distributed; the others are regionally restricted.

Pinaceae-like wood genera appeared simultaneously in both polar regions during the Early Cretaceous. They dominate the list of northern endemics but are much rarer in the Southern Hemisphere. The boreal Pinaceae-like woods diversified during the Early Cretaceous and persist to the present, whereas their austral counterpart, *Araucariopitys*, did not radiate and disappeared by the Late Cretaceous. The boreal Pinaceae-like woods never reached equatorial regions in the geological past, although *Pinus merkusii* occurs today in Sumatra. We consider the record of *Paleopinuxylon* from Brazil (Mussa, 1974) to be doubtful. A bipolar distribution for wood morphogenera is also shown here for *Podocarpoxylon* and *Taxodioxylon*. Interestingly this bipolar distribution is comparable to those recognised for many marine invertebrate groups during the Mesozoic (Briggs, 1995), and for extant conifers (Florin, 1940) within the Cupressaceae (*Tetraclinis*/*Callitris*), the Taxodiaceae (*Taiwania*/*Athrotaxis*) and the Taxaceae (*Taxus*/*Austrotaxus*). Although strong cases can be made for long-distance

Table 2
Comparison of Gondwanan and Laurasian endemic woods

	Genera endemic for Gondwana	Genera endemic for Laurasia
Widely distributed genera	*Araucariopitys* *Metapodocarpoxylon*	*Simplicioxylon* *Xenoxylon*
Local genera		Pinaceae-like woods *Keteleerioxylon* *Palaeopiceoxylon/Protopiceoxylon* *Piceoxylon* *Pityoxylon/Pinoxylon/Pinuxylon*
		Woods restricted to northern high latitudes *Yatsenkoxylon* *Phoroxylon* *Anomaloxylon*
		Cupressaceae-like woods *Protoglyptostroboxylon* *Protosciadopityoxylon* *Tetraclinoxylon*
		Other *Lhassoxylon*

dispersal of a few taxa (Kershaw and Wagstaff, 2001), many conifer genera have probably long remained faithful to the circumlocation of their drifting tectonic rafts (Page, 1990).

Several northern endemic genera (*Yatsenkoxylon*, *Phoroxylon*, *Lhassoxylon*) appear to be distinctive and robust taxa. Although sampling biases may influence the apparent temporal or geographic patterns of diversity and although we cannot ascertain the validity of several form-genera, conifer woods appear to have been significantly more diverse in Laurasia than Gondwana. Greater disjunction between palaeoenvironmental provinces north of the Tethys might have been responsible for the heightened diversity in Laurasia. For example, three distinct northern winter wet provinces have been proposed (Fig. 1), each hosting an endemic genus or group of genera: a type of Protopinaceae in SE Asia with particular radial pits, so flattened that they become divided (Serra, 1966); *Simplicioxylon* in Europe; and a new genus from the Jurassic of Fork Creek, California (MP, work in progress). A palaeobiogeographic study has not yet been undertaken for Northern Hemisphere woods, which inhibits further global comparisons.

5.3. Diversity gradients

Apparent generic diversity in Gondwana is greatest in both the northern summer wet zone and the temperate zones. These regions also host woods, such as *Metapodocarpoxylon* and *Araucariopitys*, containing the most novel anatomical features (e.g., rays with different types of cross-field pits or with thickened walls). Latitudinally controlled diversity gradients are commonly considered to be time-invariant features of the Earth, possibly driven by differential biome size. However, our results indicate that the latitudinal apparent-diversity gradient for Gondwanan conifer woods has changed during the Early Jurassic to Early Cretaceous, and that the Mesozoic diversity patterns differ from the present.

Taphonomical biases and a dearth of studies in some regions may confound any general statement on Mesozoic diversity trends. The Middle Jurassic desert region probably had a reduced vegetation cover and less than ideal conditions for wood preservation. The Jurassic–Early Cretaceous interval in Southern Africa saw the onset of extensive volcanism and this region's overall fossil record is very poor. In contrast, the numerous rapidly subsiding basins in the Jurassic–Cretaceous warm temperate belt and the more extensive palaeoxylological studies from this area may partly account for the higher wood diversity identified in this region. Warm temperate region, however, cannot be easily blamed on poor preservation potential.

Using a uniformitarian approach, climate is probably the main factor controlling wood diversity patterns. On the basis of diversity trends alone, it is not possible to separate the impacts of temperature and precipitation on the flora because a cooling gradient typically influences plant diversity in the same way as a precipitational gradient. Humidity could be the most important factor driving continental plant diversity, with the limiting factor of frost. These influences cannot be resolved without specific palaeoecological and palaeophysiological studies of the plant taxa.

5.4. Comparisons with other palaeobotanical data

Vakhrameev (1991) recognised only two Gondwanan zones based on a review of published leaf remains: an equatorial one and an austral one. Our data indicate that significant additional intra-Gondwanan provincialism was present for the Jurassic–Early Cretaceous. At least four zones are apparent and are essentially delimited by palaeolatitude: one distinguished by the presence of *Metapodocarpoxylon* (summer wet zone), one with low relative diversity (desert zone), one with *Podocarpoxylon* and *Taxaceoxylon* or other Taxaceae-like woods (winter wet and warm temperate zones) and one restricted to high latitudes (cool temperate zone) with *Araucariopitys*. These zones agree to some extent with preliminary revised intra-Gondwanan macrofloral zones proposed by McLoughlin (2001).

The level of provincialism recognised in the distribution of woods is at odds with the biogeographic zones based on palynomorphs described by Herngreen and Chlonova (1981). These authors distinguished only two Southern Hemisphere palaeogeographic zones based on palynomorphs, namely the WASA (West Africa–South America) and Gondwana ones. However, more recent palynological studies (e.g., Helby et al., 1987; Dettmann, 1992) suggest that the Southern Hemisphere vegetation was more variable between regions, in accordance with the current wood data. Doyle (1999), in his study of African Cretaceous pollen record, draw six latitudinal vegetation belts across Gondwana, although his boundaries do not fit exactly with ours. Recent quantitative regional analyses of spore–pollen assemblages have also indicated significant variations in the parent vegetation across Australia throughout the Cretaceous (Nagalingum et al., 2002).

6. Conclusions

A thorough study of the distribution of Early Jurassic to Early Cretaceous Gondwanan fossil woods has only been possible now that a uniform taxonomic framework for these fossils is available. After critically evaluating 346 entries in our database, the distributions of the taxa, plotted on the palaeoclimatic maps of Rees et al. (2000), reveal at least four intra-Gondwanan regions characterised by distinctive genera or associations and constrained principally by palaeolatitude. Gondwanan wood assemblages are generally less diverse than their Laurasian counterparts, but this may be due in part to less intensive sampling and study. Furthermore, some bipolarity is evident among wood assemblages with several high latitude taxa from both hemispheres sharing key anatomical traits. The Jurassic–Early Cretaceous terrestrial biogeographic zonation based on fossil wood has now to be tested with data for other plant or animal groups, before delimitation of biochores (Cecca and Westermann, 2003) could be envisaged. A comparable taxonomic revision and biogeographic analysis of Northern Hemisphere woods would also provide useful comparative information on floristic distributions for the mid-Mesozoic.

7. Literature corresponding to Appendix A

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Appendix A

The general table of the database, with 348 entries and their generic attribution in the system described by Bamford and Philippe (2001).

Genus	Species	Reference	Date	Age	Locality	Country	Type	Attribution
Agathoxylon	sp. A	Ottone and Medina	1998	Albian	James Ross Island	Antarctic Peninsula	seen	*Agathoxylon*
Agathoxylon	sp.	Philippe et al.	1995	Early Cretaceous	South Shetland	Antarctic Peninsula	seen	*Agathoxylon*
Agathoxylon	sp.	Dobruskina and Philippe	unpublished	Middle Jurassic	Makhtesh Ramon	Israel	seen	*Agathoxylon*
Agathoxylon	sp.	Philippe et al.	1999	Middle Jurassic	Tataouine area	Tunisia	seen	*Agathoxylon*
Agathoxylon	sp.	Philippe et al.	1999	Late Jurassic	Tataouine area	Tunisia	seen	*Agathoxylon*
Agathoxylon	sp.	Philippe et al.	1999	Barremian–Hauterivian	Tataouine area	Tunisia	seen	*Agathoxylon*
Agathoxylon	sp.	Philippe et al.	1999	Aptian	Tataouine area	Tunisia	seen	*Agathoxylon*
Agathoxylon	sp.	Philippe, Quiroz and Torres	2000	Aptian–Albian	Aisen	Chile	seen	*Agathoxylon*
Agathoxylon	*liguaensis*	Torres and Philippe	2002	Liassic	La Ligua	Chile	seen	*Agathoxylon*
Agathoxylon	sp.	Philippe and Sengbusch	unpublished	Early Cretaceous	Bayuda	Sudan	seen	*Agathoxylon*
Agathoxylon	sp.	Philippe, Gomez and Bamford	unpublished	Early Cretaceous, Kirkwood Fn	Algoa Basin	South Africa	seen	*Agathoxylon*
Agathoxylon	sp.	Philippe, Bamford and De Klerk	unpublished	Early Cretaceous, Sunday River Fn.	Algoa Basin	South Africa	seen	*Agathoxylon*
Agathoxylon	sp.	Barale et al.	2003	Neocomian	Beskintaa	Lebanon	seen	*Agathoxylon*
Agathoxylon	sp.	Philippe	unpublished	Middle Jurassic	Valparaiso	Australia	seen	*Agathoxylon*
Agathoxylon	sp.	Bandel	in litt.	Aptian/Albian	Zerqa River	Jordan	no	*Agathoxylon*
Agathoxylon	sp.	Philippe	unpublished	Early Cretaceous	Hoggar	Algeria	seen	*Agathoxylon*
Agathoxylon	sp.	Philippe	unpublished	Early Cretaceous	Khargo Oasis	Egypt	seen	*Agathoxylon*
Araucaria	*grandifolia*	Del Fueyo and Archangelsky	2002	Early Cretaceous	Patagonia	Argentina	no	*Agathoxylon*
Araucaria	sp.	Panza et al.	1995	Middle Jurassic	Puerto San Juliàn	Argentina	no	*Agathoxylon*
Araucariopitys	*leonardiana*	Charrier	1959	Middle Jurassic	Alpes	Italy	no	*Brachyoxylon*
Araucariopitys	sp.	Falcon-Lang and Cantrill	2000	Late Albian	Alexander Island	Antarctica	seen	*Araucariopitys*
Araucarioxylon	*aegyptiacum*	Fliche	1889	Early Cretaceous	Algeria	Algeria	no	*Agathoxylon*
Araucarioxylon	*aegyptiacum*	Schenk	1880	Cretaceous	Libya	Libya	no	*Agathoxylon*
Araucarioxylon	*aegyptiacum*	Principi	1932	Cretaceous	Murzuk	Libya	no	*Agathoxylon*
Araucarioxylon	*agathioides*	Gnaedinger	unpublished	Middle Jurassic	Bajo de San Julian	Argentina	seen	*Agathoxylon*
Araucarioxylon	*amraparense*	Manik and Srivastava	1991	Early Cretaceous	Pranhita/Godavari, Andhra Pradesh	India	seen	*Agathoxylon*

Araucarioxylon	*amraparense*	Gnaedinger	unpublished	Middle Jurassic	Bajo de San Julian	Argentina	seen	*Agathoxylon*
Araucarioxylon	*arayii*	Torres et al.	1982	Early Cretaceous	Cerro Negro, Byers Peninsula, Livingston Island, South Shetland	Antarctic Peninsula	seen	*Agathoxylon*
Araucarioxylon	*arayii*	Torres et al.	1997	Early Cretaceous	President Head, Snow Island	Antarctic Peninsula	seen	*Agathoxylon*
Araucarioxylon	*australe*	Crié	1889	Late Jurassic	Mataura Falls	New Zealand	no	*Agathoxylon*
Araucarioxylon	*australe*	Crié	1889	Liassic	Teremba	New Caledonia	no	*Agathoxylon*
Araucarioxylon	*ettingshauseni*	Stopes	1914	Middle to Upper Cretaceous	Amuri Bluff	New Zealand	no	*Agathoxylon*
Araucarioxylon	*floresii*	Torres et al.	1982	Early Cretaceous	South Shetland	Antarctic Peninsula	seen	*Agathoxylon*
Araucarioxylon	*giftii*	Jeyasingh and Kumarasamy	1994	Early Cretaceous	East Coast, Tamil Nadu	India	seen	*Agathoxylon*
Araucarioxylon	*jurassicum*	Bhardwaj	1953	Early Cretaceous	Rajmahal hills, Jharkhand	India	no	*Agathoxylon*
Araucarioxylon	*mahajambyense*	Fliche	1905	Liassic	West coast	Madagascar	no	*Agathoxylon*
Araucarioxylon	*mosurense*	Jeyasingh and Kumarasamy	1994	Early Cretaceous	East Coast, Tamil Nadu	India	no	*Agathoxylon*
Araucarioxylon	*nepalensis*	Barale et al.	1978	Middle Jurassic	Kaligandaki	Nepal	seen	*Agathoxylon*
Araucarioxylon	*novae-zeelandiae*	Stopes	1914	Early or Middle Cretaceous	Amuri Bluff	New Zealand	no	*Agathoxylon*
Araucarioxylon	*cf. novae-zeelandii*	Parrish et al.	1998	Late Albian–Early Cenomanian	Clarence Valley	New Zealand	no	*Agathoxylon*
Araucarioxylon	*paumierii*	Loubière	1935b	Early Cretaceous	Sahara	Algeria	no	*Agathoxylon*
Araucarioxylon	*pranhitaensis*	Rajanikanth and Sukhdev	1989	Early Jurassic	Pranhita/Godavari, Andhra Pradesh	India	seen	*Agathoxylon*
Araucarioxylon	*rajivii*	Jeyasingh and Kumarasamy	1995	Early Cretaceous	East Coast, Tamil Nadu	India	seen	*Agathoxylon*
Araucarioxylon	*randsii*	Shirley	1898	Middle Jurassic	Maryborough, Queensland	Australia	seen	*Agathoxylon*
Araucarioxylon	*santalense*	Rajanikanth and Sukhdev	1989	Early Jurassic	Pranhita/Godavari, Andhra Pradesh	India	seen	*Agathoxylon*
Araucarioxylon	*santalense*	Gnaedinger	unpublished	Middle Jurassic	Bajo de San Julian	Argentina	seen	*Agathoxylon*
Araucarioxylon	*scarabellii*	Clerici	1902	Cretaceous	Reworked from the Cretaceous into Quaternary gravels	Italy	no	*Agathoxylon*
Araucarioxylon	*termierii*	Gnaedinger	unpublished	Middle Jurassic	Bajo de San Julian	Argentina	seen	*Agathoxylon*
Araucarioxylon	*wynnei*	Borkar and Bonde	1966	Early Cretaceous	Kutch Basin, Gujarat	India	seen	*Agathoxylon*

(continued on next page)

Appendix A (*continued*)

Genus	Species	Reference	Date	Age	Locality	Country	Type	Attribution
Araucarioxylon	*zeelandicum*	Crié	1889	Jurassic–Early Cretaceous	Pakawan	New Zealand	seen	*Planoxylon*
Araucarioxylon	sp.	Chapman	1909	Aptian	Archie's Creek	Australia	no	*Agathoxylon*
Araucarioxylon	sp.	Gothan in Jaworski	1926a and b	Early Liassic	Portezuelo Ancho	Argentina	seen	*Agathoxylon*
Araucarioxylon	sp.	Bertolani Marchetti	1963	Early Cretaceous ?	Guiglia, Modena	Italy	no	*Agathoxylon*
Araucarioxylon	sp.	Mahabale	1967	Middle Jurassic	Andhra Pradesh	India	no	*Agathoxylon*
Araucarioxylon	sp.	Biondi	1976	Aptian p.p. / Albian.	Apennini	Italy	no	*Agathoxylon*
Araucarioxylon	sp.	Deiana and Pieruccini	1974	Aptian p.p. / Albian	Appennino Marchigiano	Italy	no	*Agathoxylon*
Araucarioxylon	sp.	Torres et al.	1982	Early Cretaceous	South Shetland	Antarctic Peninsula	seen	*Agathoxylon*
Araucarioxylon	sp.	Torres	1993	Early Cretaceous ?	Caho Shireff, Livingston Island	Antarctic Peninsula	seen	*Agathoxylon*
Araucarioxylon	sp.	Arber	1917	Middle Jurassic	Curio Bay area, South Island	New Zealand	no	*Agathoxylon*
Araucarioxylon	sp.	Pole	1999	Middle Jurassic	Curio Bay area, South Island	New Zealand	seen	*Agathoxylon*
Araucarioxylon	sp.	Rajanikanth and Sukhdev	1989	Early Jurassic	Pranhita/Godavari, Andhra Pradesh	India	seen	*Agathoxylon*
Araucarioxylon	sp.	Shoemaker	1982	Early Cretaceous	Puyango	Ecuador	seen	*Agathoxylon*
Araucarioxylon	sp.	Falcon-Lang and Cantrill	2000	Late Albian–Early Cenomanian	Alexander Island	Antarctica	seen	*Agathoxylon*
Araucarioxylon	sp.*1*	Falcon-Lang and Cantrill	2001	Mid Aptian	Byers, Livingston Island, South Shetland	Antarctica	seen	*Agathoxylon*
Araucarioxylon	sp.*2*	Falcon-Lang and Cantrill	2001	Mid Aptian	Byers, Livingston Island, South Shetland	Antarctica	seen	*Agathoxylon*
Araucarioxylon	sp. 1	Peters	1985	Albian	Queensland	Australia	seen	*Protocirco-poroxylon*
Araucarioxylon	sp. 2	Peters	1985	Albian	Queensland	Australia	seen	*Agathoxylon*
Araucarioxylon	sp. 3	Peters	1985	Albian	Queensland	Australia	seen	poor
Araucarioxylon	sp. 4	Peters	1985	Albian	Queensland	Australia	seen	*Agathoxylon*
Araucarioxylon	sp. 5	Peters	1985	Albian	Queensland	Australia	seen	poor
Araucarioxylon	sp.	Selmeier	1992	Late Middle to Late Jurassic	Cerro Alto	Argentina	no	poor
Araucarioxylon	sp. A	Torres et al.	1997	Early Cretaceous	President Head, Snow Island	Antarctic Peninsula	seen	*Agathoxylon*

Araucarites	*santaecrucis*	Calder	1953	Late Middle to Late Jurassic	Cerro Cuadrado	Argentina	seen	*Agathoxylon*
Baieroxylon	*chilense*	Torres and Philippe	2002	Liassic	La Ligua	Chile	seen	*Baieroxylon*
Brachyoxylon	*brachyphylloides*	Boureau	1952b	Middle Jurassic	Tataouine area	Tunisia	no	*Brachyoxylon*
Brachyoxylon	*brachyphylloides*	Veillet-Bartoszewska	1954	Early Cretaceous	Aïr	Nigeria	no	*Brachyoxylon*
Brachyoxylon	*brachyphylloides*	Gazeau and Koeniguer	1970	Early Cretaceous ?	Tunisia	Tunisia	no	*Brachyoxylon*
Brachyoxylon	*brachyphylloides*	Laudoueneix	1973	Cretaceous	Chad	Chad	no	*Brachyoxylon*
Brachyoxylon	*hervei*	Torres et al.	1982	Early Cretaceous	South Shetland	Antarctic Peninsula	seen	*Brachyoxylon*
Brachyoxylon	*lagonense*	Dupéron-Laudoueneix	1991a and b	Cretaceous	Lagon	Chad	no	*Brachyoxylon*
Brachyoxylon	sp.	Dupéron-Laudoueneix	1991a and b	Cretaceous		Cameroon	no	*Brachyoxylon*
Brachyoxylon	sp.	Boureau and Lapparent	1951	Bathonian	South	Tunisia	no	*Brachyoxylon*
Brachyoxylon	sp.	Philippe et al.	1995	Early Cretaceous	South Shetland	Antarctic Peninsula	seen	*Brachyoxylon*
Brachyoxylon	sp. B	Torres et al.	1997	Early Cretaceous	President Head, Snow Island	Antarctic Peninsula	seen	*Brachyoxylon*
Brachyoxylon	sp.	Barale et al.	1998	Late Jurassic	Southern	Tunisia	seen	*Brachyoxylon*
Brachyoxylon	sp.	Barale et al.	1998	Early Cretaceous	Southern	Tunisia	seen	*Brachyoxylon*
Brachyoxylon	sp.	Philippe et al.	1999	Middle Jurassic	Tataouine area	Tunisia	seen	*Brachyoxylon*
Brachyoxylon	sp.	Philippe et al.	1999	Aptian	Tataouine area	Tunisia	seen	*Brachyoxylon*
Brachyoxylon	sp.	Philippe, Gomez and Bamford	unpublished	Early Cretaceous, Kirkwood Fn.	Algoa Basin	South Africa	seen	*Brachyoxylon*
Brachyoxylon	sp.	Philippe, Bamford and De Klerk	unpublished	Early Cretaceous, Sunday River Fn.	Algoa Basin	South Africa	seen	*Brachyoxylon*
Brachyphyllum	*spiroxylum*	Bose	1952	Ealry Cretaceous	Rajmahal hills, Jharkhand	India	no	*Podocarpo-xylon*
Cedroxylon	*pancheri*	Loubière	1935a	Cretaceous ?	Main island	New Caledonia	no	poor
Cedroxylon	*sellheimi*	Shirley	1898	Cretaceous ?	near Brisbane	Queensland	no	*Agathoxylon*
Cedroxylon	sp.	Chudeau in Fritel	1920	Early Cretaceous	Sahara	Algeria	no	poor
Cedroxylon	sp.	Simpson	1912	Barremian–Aptian	Dandaragan, Western Australia	Australia	seen	*Podocarpo-xylon*
Circoporoxylon	sp.	Philippe et al.	1995	Early Cretaceous	South Shetland	Antarctic Peninsula	seen	*Circoporoxylon*
Circoporoxylon	sp. C	Torres et al.	1997	Early Cretaceous	President Head, Snow Island	Antarctic Peninsula	seen	*Circoporoxylon*

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Appendix A (*continued*)

Cupressinoxylon	*alternans*	Sahni	1931	Early Cretaceous	Andhra Pradesh, East coast	India	no	*Protocu-pressinoxylon*
Cupressinoxylon	*camponovensis*	Oliveira	1936	Early Cretaceous	Matto Grosso	Brazil	no	*Agathoxylon*
Cupressinoxylon	*camponovensis*	Dolianiti	1948	Early Cretaceous	Matto Grosso	Brazil	no	*Agathoxylon*
Cupressinoxylon	*coromandelinum*	Sahni	1931	Early Cretaceous	East Coast, Tamil Nadu	India	no	*Protocu-pressinoxylon*
Cupressinoxylon	*dunstanii*	Sahni	1920	Middle Jurassic	Harrisville, Queensland	Australia	seen	*Protopodo-carpoxylon*
Cupressinoxylon	*kotaense*	Rajanikanth and SukhDev	1989	Early Jurassic	Pranhita/Godavari, Andhra Pradesh	India	seen	*Cupressino-xylon*
Cupressinoxylon	*rajmahalense*	Bhardwaj	1953	Early Cretaceous	Rajmahal hills, Jharkhand	India	seen	*Cupressino-xylon*
Cupressinoxylon	*walkomii*	Sahni	1920	Middle Jurassic	Engelsburg, Queensland	Australia	seen	*Agathoxylon*
Cupressinoxylon	sp.	Gothan	1915	Liassic	Chacay Melehue	Argentina	no	poor
Cupressinoxylon	sp.	Principi	1932	Cretaceous	Tripolitania, Scek-Sciuk near Fessato	Libya	no	*cf. Metapodo-carpoxylon*
Cupressinoxylon	sp.	Kahlert et al.	1999	?Aptian	Tendaguru	Tanzania	no	*Cupressinoxylon*
Dadoxylon	*agathioides*	Baksi	1967	Middle Jurassic	Raghavapuram	India	no	*Agathoxylon*
Dadoxylon	*aegyptiacum*	Unger	1859	Cretaceous	several localities	Egypt	seen	polytypic
Dadoxylon	*aegyptiacum*	Kraüsel	1939	Cretaceous	several localities	Egypt	no	*Agathoxylon*
Dadoxylon	*aegyptiacum*	Edwards	1926a	Early Cretaceous, probably Albian	El Fasher, Darfour	Sudan	no	*Agathoxylon*
Dadoxylon	*aegyptiacum*	Chiarugi	1928, 1929	Cretaceous	Fezzan	Libya	no	*Agathoxylon*
Dadoxylon	*aegyptiacum*	Boureau	1948a	Early Cretaceous	Aderké Lulu	Algeria	no	*Agathoxylon*
Dadoxylon	*agathoides*	Kräusel and Jain	1964	Early Cretaceous	Rajmahal hills, Jharkhand	India	no	*Agathoxylon*
Dadoxylon	*amboensis*	Lemoigne, Naryan and Schyfsma	1971	Wealdien ?	Ambo	Ethiopia	seen	*Agathoxylon*
Dadoxylon	*amboensis*	Lemoigne, Naryan and Schyfsma	1971	Wealdien ?	Ambo	Ethiopia	seen	*Brachyoxylon*
Dadoxylon	*amraparense*	Sah and Jain	1964	Early Cretaceous	Rajmahal hills, Jharkhand	India	no	*Protopodo-carpoxylon*
Dadoxylon	*benderi*	Mussa	1959	Early Cretaceous	Borborema dome, Malhada dos Bois, Sergipe	Brazil	no	*Agathoxylon*
Dadoxylon	*bindrabunense*	Sah and Jain	1964	Early Cretaceous	Rajmahal hills, Jharkhand	India	no	*Agathoxylon*
Dadoxylon	*boureaui*	Lanteaume	1950	Jurassic or Triassic	Page Island	New Caledonia	no	poor
Dadoxylon	*chevalierii*	Boureau	1950a	Early Cretaceous	Reggan, Algeria	Algeria	no	*Agathoxylon*
Dadoxylon	*aff. chevalierii*	Koeniguer	1968, 1972	Early Cretaceous	Sahara, Libya	Libya	no	*Agathoxylon*

Dadoxylon	*dallonii*	Boureau	1948a	Early Cretaceous	South of Toummo, South Fezzan	Libya	no	*Agathoxylon*
Dadoxylon	*dallonii*	Dupéron-Laudoueneix	1976a	Cretaceous		Chad	no	*Agathoxylon*
Dadoxylon	*dallonii*	Dupéron-Laudoueneix and Lejal-Nicol	1981	Jurassic or Triassic		Egypt	no	*Agathoxylon*
Dadoxylon	*dallonii*	Lejal-Nicol	1981	Late Jurassic	Wadi Wahedia	Egypt	no	*Agathoxylon*
Dadoxylon	*dantzii*	Potonié	1902	Early Cretaceous?	Makondé	Tanganyka	no	*Brachyoxylon*
Dadoxylon	*distichum*	Veillet-Bartoszewska	1957	Early Cretaceous	Erdi-Ma	Chad	no	*Agathoxylon*
Dadoxylon	*aff. distichum*	Veillet-Bartoszewska	1957	Early Cretaceous	Erdi-Ma	Chad	no	*Agathoxylon*
Dadoxylon	*aff. distichum*	Koeniguer	1968	Early Cretaceous		Sudan	no	*Agathoxylon*
Dadoxylon	*furonii*	Veillet-Bartoszewska	1955	Early Cretaceous	South	Tunisia	no	*Agathoxylon*
Dadoxylon	*guermessaense*	Giraud	1975	Early Cretaceous		Tunisia	no	*Agathoxylon*
Dadoxylon	*kaiparaense*	Edwards	1926b	Cretaceous	Kaipara	New Zealand	no	*Agathoxylon*
Dadoxylon	*kilianii*	Batton	1965	Early Cretaceous	Libya	Libya	no	*Agathoxylon*
Dadoxylon	*aff. kilianii*	Gazeau and Koeniguer	1970	Early Cretaceous	In-Salah, Sahara	Algeria	no	*Agathoxylon*
Dadoxylon	*koufraense*	Batton	1965	Early Cretaceous	South	Libya	no	*Agathoxylon*
Dadoxylon	*lagadaense*	Boureau	1948c	Early Cretaceous	Waddi Lagada, Fezzan	Libya	no	*Agathoxylon*
Dadoxylon	*lagonense*	Laudoueneix	1973	Early Cretaceous	?	Chad	no	*Brachyoxylon*
Dadoxylon	*lugriense*	Boureau	1948b	Early Cretaceous	Lugri, South of Fezzan	Libya	no	*Agathoxylon*
Dadoxylon	*aff. lugriense*	Veillet-Bartoszewska	1957	Early Cretaceous	Erdi-Ma	Chad	no	*Agathoxylon*
Dadoxylon	*mandroense*	Sah and Jain	1964	Early Cretaceous	Rajmahal hills, Jharkhand	India	seen	*Agathoxylon*
Dadoxylon	*mugherensis*	Lemoigne and Beauchamp	1972	Kimmeridgian–Cretaceous	Mugher River, in between Addis-Abéba and Debre-Marcos	Ethiopia	seen	*Agathoxylon*
Dadoxylon	*parafuronii*	Boureau and Koeniguer	1965, 1966	Early Cretaceous	Talak, Aïr	Niger	no	*Agathoxylon*
Dadoxylon	*parafuronii*	Giraud	1977	Bathonian	Southern	Tunisia	no	*Agathoxylon*
Dadoxylon	*parasahariense*	Dupéron-Laudoueneix	1991a and b	Early Cretaceous	Northern	Cameroon	no	*Agathoxylon*
Dadoxylon	*aff. parasa-hariense*	Dupéron-Laudoueneix	1991a and b	Early Cretaceous	Northern	Cameroon	no	*Agathoxylon*
Dadoxylon	*paumierii*	Loubière	1935b	Early Cretaceous	Nubia	Sudan	no	*Agathoxylon*
Dadoxylon	*pseudoparen-chymatosum*	Kräusel	1924	Aptian/Albian	Tierra del Fuego	Argentina	seen	*Agathoxylon*
Dadoxylon	*rajmahalense*	Sahni	1931	Early Cretaceous	Rajmahal hills, Jharkhand	India	seen	*Agathoxylon*

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Appendix A (*continued*)

Genus	Species	Reference	Date	Age	Locality	Country	Type	Attribution
Dadoxylon	*rajmahalense*	Yadav and Bhatta	1996	Middle Jurassic	Tamil Nadu	India	no	*Agathoxylon*
Dadoxylon	*rajmahalense*	Suryanarayana	1956	Early Jurassic	Pranhita/Godavari, Andhra Pradesh	India	no	*Agathoxylon*
Dadoxylon	*sahariense*	Veillet-Bartoszewska	1956	Early Cretaceous	Emi-Fezzan	Libya	no	*Agathoxylon*
Dadoxylon	*aff. sahariense*	Gazeau	1969	Liassic	Atlas	Morocco	no	*Agathoxylon*
Dadoxylon	*santalense*	Sah and Jain	1964	Early Cretaceous	Rajmahal hills, Jharkhand	India	no	*Agathoxylon*
Dadoxylon	*septatum*	Boureau	1951a	Early Cretaceous	Sudanese Sahara, Iouallaouallène, Timétrine	Mali	no	*Agathoxylon*
Dadoxylon	*teixeirae*	Boureau	1951b	Middle Jurassic–Late Cretaceous	Anoual, Atlas	Morocco	no	*Brachyoxylon*
Dadoxylon	*termieri*	Attims and Cremier	1969	Liassic	Sidi M'Guid, Atlas	Morocco	no	*Agathoxylon*
Dadoxylon	*termieri*	Giraud and Hankel	1985	Liassic	Southern	Tanzania	no	*Agathoxylon*
Dadoxylon	*aff. termieri*	Attims and Cremier	1969	Pliensbachian, Liassic	Sidi M'GuidAtlas	Morocco	no	*Agathoxylon*
Dadoxylon	*vraconiensis*	Omer	1978	Early Cretaceous		Sudan	no	*Agathoxylon*
Dadoxylon	*zuffardii*	Negri	1914	Cretaceous	Tripolitania, Scek-Sciuk near Fessato	Libya	no	*Agathoxylon*
Dadoxylon	type of wood	Thorn	2001	Middle Jurassic	North Island	New Zealand	no	*Agathoxylon*
Dadoxylon	sp.	Meijs	1960	Liassic	Lesotho	Southern Africa	no	*Agathoxylon*
Dadoxylon	sp.	Williams	1930	Early Cretaceous	Aïr, Sahara	Niger	no	*Agathoxylon*
Dadoxylon	sp.	Sahni	1931	Early Cretaceous	Uttatur, Tiruchir apalli Tamil Nadu	India	no	*Agathoxylon*
Dadoxylon	sp.	Jacob	1938	Early Cretaceous	Rajmahal hills, Jharkhand	India	no	*Agathoxylon*
Dadoxylon	sp.	Edwards	1929a	Jurassic	Sardinia	Italy	no	*Agathoxylon*
Dadoxylon	sp.	Edwards	1934	Middle Jurassic	Curio Bay area, South Island	New Zealand	no	*Agathoxylon*
Dadoxylon	sp.	Brynmor	1948	Early Cretaceous	Nigeria	Nigeria	no	*Agathoxylon*
Dadoxylon	sp.	Gothan	1950	Middle to Late Jurassic	Cerro Alto	Argentina	no	*Agathoxylon*
Dammaroxylon	*natalense*	Erasmus	1976	Cretaceous	Natal	South Africa	seen	*Agathoxylon*
Gingkoxylon	*dixitii*	Biradar and Mahabale	1980	Early Jurassic	Pranhita/Godavari, Andhra Pradesh	India	seen	*Gingkoxylon*
Gingkoxylon	sp.	Kahlert et al.	1999	Aptian ?	Tendaguru	Tanzania	no	*Ginkgoxylon*
Ginkgomyeloxylon	*tanzanii*	Giraud and Hankel	1986	Liassic	Luwegu	Tanzania	no	*Agathoxylon*
Glyptostroboxylon	*tendagurense*	Süss and Schultka	2001	Upper Kimmeridgian	Kitukituki, Tendaguru	Tanzania	no	*Brachyoxylon*
Glyptostroboxylon	sp.	Heinrich + C207	2001	Early Cretaceous	Tendaguru	Tanzania	no	*Brachyoxylon*

Homoxylon	*rajmahalense*	Sahni	1932	Early Cretaceous	Rajmahal hills, Jharkhand	India	no	*Sahnioxylon*
Juniperoxylon	*barbaricinum*	Charrier	1961	Triassic or Early Jurassic	Sardinia	Italy	no	cf. *Brachyo-xylon*
Mesembrioxylon	*aegyptiacum*	Boureau	1950b	Early Cretaceous	Toummo	Libya	no	*Protopodo-carpoxylon*
Mesembrioxylon	*fluviatile*	Sahni	1920	Jurassic	Fairy Meadow, Condamine River near Chinchilla, Walloon Coal Measures	Australia	seen	*Agathoxylon*
Mesembrioxylon	*fusiforme*	Sahni	1920	Jurassic	Fairy Meadow, Condamine River near Chinchilla, Walloon Coal Measures	Australia	seen	*Agathoxylon*
Mesembrioxylon	*godavarianum*	Sahni	1931	Middle Jurassic	Pranhita/Godavari, Andhra Pradesh	India	no	*Brachyoxylon*
Mesembrioxylon	*indicum*	Bhardwaj	1953	Early Cretaceous	Rajmahal hills, Jharkhand	India	no	poor
Mesembrioxylon	*libanoticum*	Edwards	1929	Late Jurassic	Mount Sannin	Libanon	seen	*Metapodo-carpoxylon*
Mesembrioxylon	*malerianum*	Sahni	1931	Jurassic	Tiki, Rewah	India	no	*Brachyoxylon*
Mesembrioxylon	*parthasarthyi*	Sahni	1931	Early Cretaceous	Sriperumbudur, east coast	India	no	*Brachyoxylon*
Mesembrioxylon	*parthasarthyi*	Rajanikanth and Sukh-Dev,	1989	Early Cretaceous	Andhra Pradesh	India	seen	*Brachyoxylon*
Mesembrioxylon	*rajmahalense*	Jain	1965	Early Cretaceous	Rajmahal hills, Jharkhand	India	no	*Protocirco-poroxylon*
Mesembrioxylon	*sahnii*	Bamford and Corbett	1994	Cretaceous	?	Namaqualand	no	*Podocarpoxylon*
Mesembrioxylon	*sarmai*	Varma	1954	Cretaceous	Uttatur, Tamil Nadu	India	no	*Podocarpoxylon*
Mesembrioxylon	*sewardii*	Sahni	1920	Middle Jurassic	Chinghee Creek, Lamington	Australia	seen	poor
Mesembrioxylon	*stokesii*	Bamford and Corbett	1995	Early Cretaceous	Namaqualand	South Africa	seen	*Podocarpoxylon*
Mesembrioxylon	*tirumangalense*	Suryanarayana	1953	Jurassic	Sripermatur, Southern India	India	no	*Podocarpoxylon*
Mesembrioxylon	*trichipoliense*	Varma	1954	Cretaceous	Uttatur, Tamil Nadu	India	no	*Podocarpoxylon*

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Genus	Species	Reference	Date	Age	Locality	Country	Type	Attribution
Mesembrioxylon	*woburnense*	Bamford and Corbett	1995	Early Cretaceous	Namaqualand	South Africa	seen	*Podocarpoxylon*
Mesembrioxylon	*cf. stokesii*	Bamford and Corbett	1994	Early Cretaceous	Namaqualand	South Africa	seen	*Podocarpoxylon*
Mesembrioxylon	*cf. sahnii*	Bamford and Corbett	1994	Early Cretaceous	Namaqualand	South Africa	seen	*Podocarpoxylon*
Mesembrioxylon	*cf. woburnense*	Bamford and Corbett	1994	Early Cretaceous	Namaqualand	South Africa	seen	*Podocarpoxylon*
Mesembrioxylon	sp.	Mahabale	1967	Early Jurassic	Pranhita/Godavari, Andhra Pradesh	India	no	poor
Mesembrioxylon	sp.	Sahni	1931	Early Cretaceous	Tamil Nadu	India	no	*cf. Sahnioxylon*
Mesembrioxylon	sp.	Bamford and Corbett	1994	Early Cretaceous	Namaqualand	South Africa	seen	*Podocarpoxylon*
Mesembrioxylon	sp.	Bamford and Corbett	1995	Early Cretaceous	Namaqualand	South Africa	seen	*Podocarpoxylon*
Mesembrioxylon	sp.	Arber	1917	Middle Jurassic	Curio Bay area, South Island	New Zealand	seen	*Protopodo-carpoxylon*
Mesembrioxylon	sp.	Edwards	1934	Middle Jurassic	Curio Bay area, South Island	New Zealand	seen	*Protopodo-carpoxylon*
Mesembrioxylon	sp.	Pole	1999	Middle Jurassic	Curio Bay area, South Island	New Zealand	seen	*Protopodo-carpoxylon*
Mesembrioxylon	sp.	McLoughlin	1996	Latest Hauterivian–Barremian	Cardabia, Perth area	Australia	no	*Circoporoxylon*
Metapodo-carpoxylon	*aff. libanoticum*	Dupéron-Laudoueneix	1991a	Early Cretaceous		Cameroon	no	*Metapodo-carpoxylon*
Metapodo-carpoxylon	*libanoticum*	Brunet et al., 1986, 1988, 1990	1990	Early Cretaceous	Hama-Koussou	Cameroun	no	*Metapodo-carpoxylon*
Metapodo-carpoxylon	*libanoticum*	Dejax and Brunet	1995	Early Cretaceous	Hama-Koussou	Cameroun	no	*Metapodo-carpoxylon*
Metapodo-carpoxylon	*libanoticum*	Dupéron-Laudoueneix	1991 a and b	Early Cretaceous	Hama-Koussou	Cameroun	no	*Metapodo-carpoxylon*
Metapodo-carpoxylon	*libanoticum*	Flynn et al.	1987	Early Cretaceous	Hama-Koussou	Cameroun	no	*Metapodo-carpoxylon*
Metapodo-carpoxylon	*libanoticum*	Benest et al.	1998, 1999	Kimmeridgian	Atlas	Algeria	seen	*Metapodo-carpoxylon*
Metapodo-carpoxylon	*libanoticum*	Pons	1988	Aptian		Colombia	no	*Metapodo-carpoxylon*
Metapodo carpoxylon	*libanoticum*	Bamford et al.	2002	Early Cretaceous		Mali	seen	*Metapodo-carpoxylon*
Metapodo carpoxylon	*libanoticum*	Dupéron and Pons	1986	Early Cretaceous		Mali	no	*Metapodo-carpoxylon*
Metapodo-carpoxylon	*libanoticum*	Dupéron and Pons	1986	Middle Jurassic		Morocco	no	*Metapodo-carpoxylon*
Metapodo-carpoxylon	*libanoticum*	Bellion et al.	1990	Early Cretaceous		Mali	no	*Metapodo-carpoxylon*
Metapodo-carpoxylon	*libanoticum*	Barale et al.	1998	Late Jurassic	Tataouine	Tunisia	seen	*Metapodo-carpoxylon*

Metapodo-carpoxylon	*libanoticum*	Barale et al.	1998	Barremian–Hauterivian	Tataouine	Tunisia	seen	*Metapodo-carpoxylon*
Metapodo-carpoxylon	*libanoticum*	Philippe et al.	1999	Aptian	Tataouine	Tunisia	seen	*Metapodo-carpoxylon*
Metapodo-carpoxylon	*libanoticum*	Barale et al.	2000	Middle Jurassic	Tataouine	Tunisia	seen	*Metapodo-carpoxylon*
Metapodo-carpoxylon	sp.	Philippe et al.	2003	Kimmeridgian	Daia Mountains	Algeria	seen	*Metapodo-carpoxylon*
Metapodo-carpoxylon	sp.	Philippe et al.	2003	Middle Jurassic	Maktesh Ramon	Israel	seen	*Metapodo-carpoxylon*
Metapodo-carpoxylon	sp.	Philippe et al.	2003	Middle Jurassic to Early Cretaceous	South-East	Libya	seen	*Metapodo-carpoxylon*
Metapodo-carpoxylon	sp.	Philippe et al.	2003	Kimmeridgian	In'salha, Tamenghest	Algeria	seen	*Metapodo-carpoxylon*
Metapodo-carpoxylon	sp.	Philippe et al.	2003	Aptian/Albian	Bir Miteur	Tunisia	seen	*Metapodo-carpoxylon*
Metapodo-carpoxylon	sp.	Philippe et al.	2003	Early Cretaceous	Bayuda	Sudan	seen	*Metapodo-carpoxylon*
Metapodo-carpoxylon	sp.	Philippe et al.	2003	Early Albian	Lancones	Peru	seen	*Metapodo-carpoxylon*
Metapodo-carpoxylon	sp.	Philippe et al.	2003	Early Albian	Puyango	Ecuador	seen	*Metapodo-carpoxylon*
Metapodo-carpoxylon	sp.	Philippe et al.	2003	Early Cretaceous	Hoggar	Algeria	seen	*Metapodo-carpoxylon*
Metapodo-carpoxylon	sp.	Philippe et al.	2003	Aptian/Albian	Agadez	Nigeria	seen	*Metapodo-carpoxylon*
Metapodo-carpoxylon	sp.	Philippe et al.	2003	Neocomian	Beskintaa	Lebanon	seen	*Metapodo-carpoxylon*
Metapodo-carpoxylon	sp.	Philippe et al.	2003	Early Cretaceous	Gombe	Nigeria	seen	*Metapodo-carpoxylon*
Metapodo-carpoxylon	sp.	Philippe et al.	2003	Neocomian	Beskintaa	Lebanon	seen	*Metapodo-carpoxylon*
Metapodo-carpoxylon	sp.	Philippe et al.	2003	Early Cretaceous	Ad-Dhana	Saudi Arabia	seen	*Metapodo-carpoxylon*
Nothofagoxylon	sp.	Kräusel	1924	Aptian/Albian	Tierra del Fuego	Argentina	seen	*Agathoxylon*
Novoguineoxylon	*lacunosum*	Boureau and Jongmans	1955	Permian to Jurassic ?	Vogelkopf	New Guinea	seen	*Australoxylon*
Palaeopinuxylon	*josuei*	Mussa	1974	Early Cretaceous	Uberlândia, Minas Gerais	Brazil	no	poor
Peuce	*australis*	Unger	1850	unknown	Van Diemen Island	Tasmania	seen	*Protopodo-carpoxylon*
Peuce	*huegeliana*	Unger	1850	Jurassic ?	Wanguoe, Terra Van Diemen	Tasmania	seen	*Australoxylon*

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Genus	Species	Reference	Date	Age	Locality	Country	Type	Attribution
Phyllocladoxylon	*antarcticum*	Kräusel	1924	Aptian/Albian	Tierra del Fuego	Argentina	seen	*Protopodo-carpoxylon*
Phyllocladoxylon	*atlasicum*	Attims and Cremier	1969	Jurassic	Sidi Bel Kacem	Morocco	no	*Protophyllo-cladoxylon*
Phyllocladoxylon	*capense*	Walton	1925	Early Cretaceous	Sunday River	South Africa	no	*Protocirco-poroxylon*
Planoxylon	*hectorii*	Stopes	1916	Middle or Upper Cretaceous	Amuri Bluff	New Zealand	no	*Araucariopitys*
Podocarpoxylon	*aegyptiacum*	Boureau	1948c	Early Cretaceous	South of Toummo, Fezzan	Libya	no	*Protopodo-carpoxylon*
Podocarpoxylon	*chandrapurensis*	Rajanikanth and SukhDev	1989	Early Jurassic	Pranhita/Godavari, Andhra Pradesh	India	seen	*Podocarpoxylon*
Podocarpoxylon	*fuenzalidai*	Torres et al.	1982	Early Cretaceous	South Shetland	Antarctic Peninsula	seen	*Podocarpoxylon*
Podocarpoxylon	*indicum*	Bhardwaj	1953	Early Cretaceous	Rajmahal hills, Jharkhand	India	seen	*Podocarpoxylon*
Podocarpoxylon	*kraeuselii*	Rajanikanth and SukhDev	1989	Early Jurassic	Pranhita/Godavari, Andhra Pradesh	India	seen	*Podocarpoxylon*
Podocarpoxylon	*parthasarathyi*	Manik and Srivasta	1991	Early Cretaceous	Pranhita/Godavari, Andhra Pradesh	India	seen	*Podocarpoxylon*
Podocarpoxylon	*parthasarathyi*	Sahni	1931	Early Cretaceous	East Coast, Tamil Nadu	India	seen	*Podocarpoxylon*
Podocarpoxylon	*rajmahalense*	Jain	1965	Early Cretaceous	Rajmahal hills, Jharkhand	India	seen	*Podocarpoxylon*
Podocarpoxylon	*rajmahalense*	Rajanikanth and SukhDev	1989	Early Jurassic	Pranhita/Godavari, Andhra Pradesh	India	seen	*Podocarpoxylon*
Podocarpoxylon	*tirumangalense*	Suryanarayana	1953	Early Cretaceous	East Coast, Tamil Nadu	India	seen	*Podocarpoxylon*
Podocarpoxylon	*trichinopoliense*	Varma	1954	Early Cretaceous	Garudamagalam, East Coast	India	seen	*Podocarpoxylon*
Podocarpoxylon	*cf. umzambense*	Bamford and Corbett	1994	Early Cretaceous	Namaqualand	South Africa	seen	*Podocarpoxylon*
Podocarpoxylon	*cf. umzambense*	Bamford and Corbett	1995	Early Cretaceous	Namaqualand	South Africa	seen	*Podocarpoxylon*
Podocarpoxylon	sp.	Sahni	1931	Early Cretaceous	East Coast, Tamil Nadu	India	seen	*Podocarpoxylon*
Podocarpoxylon	sp.	Francis and Coffin	1992	Albian	drilling	Kerguelen Plateau	no	*Podocarpoxylon*
Podocarpoxylon	sp.	Philippe, Quiroz and Torres	2000	Aptian–Albian	Aisen	Chile	seen	*Podocarpoxylon*
Podocarpoxylon	sp. 1	Falcon-Lang and Cantrill	2000	Late Albian	Alexander Island	Antarctica	seen	*Podocarpoxylon*

Podocarpoxylon	sp. 2	Falcon-Lang and Cantrill	2000	Late Albian	Alexander Island	Antarctica	seen	*Podocarpoxylon*
Podocarpoxylon	sp. 1	Falcon-Lang and Cantrill	2001, 2002	Early Aptian	Byers, Livingston Island, South Shetland	Antarctica	seen	*Podocarpoxylon*
Podocarpoxylon	sp. 2	Falcon-Lang and Cantrill	2001, 2002	Early Aptian	Byers, Livingston Island, South Shetland	Antarctica	seen	*Podocarpoxylon*
Podocarp wood		Dettman et al.	1992	Aptian–Albian	Curdimurka, northern South Australia	Australia	no	*cf. Podocar-poxylon*
Protocedroxylon	*paronai*	Negri	1914	Early Cretaceous	Tripolitano	Libya	no	poor
Protochamae-cyparixylon	*kliztschii*	Giraud and Hankel	1985	Liassic	Southern	Tanzania	no	*Brachyoxylon*
Protocirco-poroxylon	sp.	Philippe et al.	1995	Early Cretaceous	South Shetland	Antarctic Peninsula	seen	*Protocirco-poroxylon*
Protocirco-poroxylon	sp.	Philippe et al.	1999	Barremian–Hauterivian	Tataouine area	Tunisia	seen	*Protocirco-poroxylon*
Protocirco-poroxylon	sp.	Philippe et al.	1999	Aptian	Tataouine area	Tunisia	seen	*Protocirco-poroxylon*
Protocirco-poroxylon	sp.	Philippe et al.	1999	Albian	Tataouine area	Tunisia	seen	*Protocirco-poroxylon*
Protocirco-poroxylon	sp. D	Torres et al.	1997	Early Cretaceous	President Head, Snow Island	Antarctic Peninsula	seen	*Protocirco-poroxylon*
Protocupressi-noxylon	*choubertii*	Attims and Cremier	1969	Jurassic, post Callovian	Skoura	Morocco	no	*Brachyoxylon*
Protocupressi-noxylon	*aff. choubertii*	Attims and Crémier	1969	Liassic	Tazioualt	Morocco	no	*Brachyoxylon*
Protocupress-inoxylon	*cf. purbeckensis*	Bamford and Corbett	1994	Early Cretaceous	Namaqualand	South Africa	seen	*Protocu-pressi-noxylon*
Protophyllo-cladoxylon	*chudeaui*	Batton	1965	Early Cretaceous	Aïr, Sahara	Niger	no	*Metapodo-carpoxylon*
Protophyllo-cladoxylon	*curitiense*	Pons	1978	Early Cretaceous		Colombia	no	*Metapodo-carpoxylon*
Protophyllo-cladoxylon	*diphtericum*	Batton and Boureau	1965	Early Cretaceous		Cameroon	no	*Metapodo-carpoxylon*
Protophyllo-cladoxylon	*leuchsii*	Kräusel	1939	Cretaceous	Djebel Dadadîb	Egypt	no	*Protophyllo-cladoxylon*
Protophyllo-cladoxylon	*aff. libanoticum*	Attims and Cremier	1969	Early Cretaceous	Atlas	Morocco	no	*Metapodo-carpoxylon*
Protophyllo-cladoxylon	*madamaense*	Boureau	1948c	Early Cretaceous	Madama	Algeria	no	*Protophyllo-cladoxylon*

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Appendix A (*continued*)

Genus	Species	Reference	Date	Age	Locality	Country	Type	Attribution
Protophyllo-cladoxylon	*maurianum*	Gazeau	1969	Dogger	Mount M'semrir	Morocco	no	*Metapodo-carpoxylon*
Protophyllo-cladoxylon	*rosablancaense*	Pons	1971	Early Cretaceous	Magdalena	Colombia	no	*Protophyllo-cladoxylon*
Protophyllo-cladoxylon	*subdiphtericum*	Dupéron-Laudoueneix	1976b + D312	Early Cretaceous		Cameroon	no	*Metapodoc-arpoxylon*
Protophyllo-cladoxylon	*aff. subdiphtericum*	Biondi	1980	Aptian/Albian	Apennini	Italy	no	*Metapodo-carpoxylon*
Protophyllo-cladoxylon	sp.	Pons	1983	Upper Jurassic		Colombia	no	*Metapodo-carpoxylon*
Protophyllo-cladoxylon	*aff. libanoticum*	Attims and Cremier	1969	Early Cretaceous	Tanntane	Morocco	no	*Metapodo-carpoxylon*
Protopodo-carpoxylon	*dantzii*	Dupéron-Laudoueneix and Dupéron	1995	Cretaceous		Chad	no	*Brachyoxylon*
Protopodo-carpoxylon	*dantzii ?*	Dupéron-Laudoueneix and Dupéron	1995	Cretaceous		Cameroon	no	*Brachyoxylon*
Protopodo-carpoxylon	*cf. dantzii*	Dupéron-Laudoueneix and Dupéron	1995	Cretaceous		Cameroon	no	*Brachyoxylon*
Protopodo-carpoxylon	*dariae*	Biondi	1983	Middle Jurassic	Bergame Alps	Italy	no	*Brachyoxylon*
Protopodo-carpoxylon	*guidense*	Attims and Cremier	1969	Liassic	Sidi M'Guid, Atlas	Morocco	no	*Brachyoxylon*
Protopodo-carpoxylon	*aff. guidense*	Giraud and Hankel	1986	Liassic	southern	Tanzania	no	*Brachyoxylon*
Protopodo-carpoxylon	*lamtharii*	Gazeau	1969	Liassic	Middle Atlas	Morocco	no	*Brachyoxylon*
Protopodo-carpoxylon	*pedrottii*	Biondi	1978a and b	Albian	Vervo, Trento, Alps	Italy	no	*Protopodo-carpoxylon*
Protopodo-carpoxylon	*rochii*	Boureau	1952	Cretaceous	Lagon, along the road from Pala to Léré	Chad	no	*Brachyoxylon*
Protopodo-carpoxylon	*aff. rochii*	Dupéron-Laudoueneix	1991a and b	Early Cretaceous		Chad	no	*Brachyoxylon*
Protopodo-carpoxylon	*cf. rochii*	Dupéron-Laudoueneix	1991a and b	Early Cretaceous		Cameroon	no	*Brachyoxylon*
Protopodo-carpoxylon	*solignacii*	Giraud	1973	Midlle Jurassic	South	Tunisia	no	*Brachyoxylon*

Protopodo-carpoxylon	*subdantzii*	Koeniguer in Gazeau and Koeniguer	1970	Cretaceous		Chad	no	*Brachyoxylon*
Protopodo-carpoxylon	*subrochii*	Attims and Cremier	1969	Bathonian	Midelt, Atlas	Morocco	no	*Brachyoxylon*
Protopodo-carpoxylon	*teixeirae*	Boureau	1957	Early Cretaceous	Djebel Baoula, Mateur, Tunis	Tunisia	no	*Brachyoxylon*
Protopodo-carpoxylon	*teixeirae*	Attims and Cremier	1969	Middle Jurassic		Morocco	no	*Brachyoxylon*
Protopodo-carpoxylon	*teixeirae*	Boureau	1957	Middle Jurassic		Morocco	no	*Brachyoxylon*
Protopodo-carpoxylon	sp.	Philippe et al.	1995	Early Cretaceous	South Shetland	Antarctic Peninsula	seen	*Protopodo-carpoxylon*
Protopodo-carpoxylon	sp. E	Torres et al.	1997	Early Cretaceous	President Head, Snow Island	Antarctic Peninsula	seen	*Protopodo-carpoxylon*
Protopodo-carpoxylon	sp.	Hillebrandt, Torres and Philippe	unpublished	Late Sinemurian	Traunque Lautaro	Chile	seen	*Protopodo-carpoxylon*
Prototaxodioxylon	*choubertii*	Giraud and Hankel	1985	Liassic	Southern	Tanzania	no	*Brachyoxylon*
Prototaxoxylon	*intertrappeum*	Gnaedinger	unpublished	Middle Jurassic	Bajo de San Julian	Argentina	seen	*Prototaxoxylon*
Prototaxoxylon	*uniseriale*	Gnaedinger	unpublished	Middle Jurassic	Bajo de San Julian	Argentina	seen	*Prototaxoxylon*
Protelicoxylon	*feriziense*	Gnaedinger	unpublished	Middle Jurassic	Bajo de San Julian	Argentina	seen	*Protelicoxylon*
Sahnioxylon	*andrewsii*	Bose and Sah	1954	Early Cretaceous	Rajmahal hills, Jharkhand	India	no	*Sahnioxylon*
Sahnioxylon	*rajmahalense*	Bose and Sah	1954	Early Cretaceous	Rajmahal hills, Jharkhand	India	no	*Sahnioxylon*
Sahnioxylon	sp.	Sah and Jain	1964	Early Cretaceous	Mandro, Bihar	India	no	*Sahnioxylon*
Sahnioxylon	sp.	Falcon-Lang and Cantrill	2001, 2002	Early Aptian	Byers, Livingston Island, South Shetland	Antarctica	seen	*Sahnioxylon*
Sahnioxylon	sp.	Kumarasamy and Jeyasingh	1995	Early Cretaceous	Sriperumbudur, Tamil Nadu	India	no	*Sahnioxylon*
Sahnioxylon	sp.	Torres et al.	1995	Valanginian–Hauterivian	Snow Island	Antarctic Peninsula	seen	*Sahnioxylon*
Sahnioxylon	sp. F	Torres et al.	1997	Early Cretaceous	President Head, Snow Island	Antarctic Peninsula	seen	*Sahnioxylon*
Taxaceoxylon	*cupressoides*	Sharma	1970	Early Cretaceous	Rajmahal hills, Jharkhand	India	no	*Taxaceoxylon*
Taxaceoxylon	*rajmahalense*	Kräusel and Jain	1964	Early Cretaceous	Rajmahal hills, Jharkhand	India	no	*Taxaceoxylon*
Taxaceoxylon	sp. *cf. rajmahalense*	Kräusel and Jain	1964	Early Cretaceous	Rajmahal hills, Jharkhand	India	no	*Taxaceoxylon*

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Appendix A (*continued*)

Genus	Species	Reference	Date	Age	Locality	Country	Type	Attribution
Taxaceoxylon	*sahnii*	Rajanikanth and Sukhdev	1989	Early Jurassic	Pranhita/Godavari, Andhra Pradesh	India	seen	*Taxaceoxylon*
Taxaceoxylon	sp. A	Rajanikanth and Sukhdev	1989	Early Jurassic	Pranhita/Godavari, Andhra Pradesh	India	seen	*Taxaceoxylon*
Taxaceoxylon	sp. B	Rajanikanth and Sukhdev	1989	Early Jurassic	Pranhita/Godavari, Andhra Pradesh	India	seen	*Taxaceoxylon*
Taxaceoxylon	sp.	Mahabale	1967	Early Jurassic	Pranhita/Godavari, Andhra Pradesh	India	seen	*Taxaceoxylon*
Taxaceoxylon	sp.	Kahlert et al.	1999	Kimmerigian	Tendaguru	Tanzania	no	*Taxaceoxylon*
Taxodioxylon	*rajmahalense*	Bhardwaj	1953	Early Cretaceous	Rajmahal hills, Jharkhand	India	no	poor
Taxodioxylon	sp.	Bhardwaj	1952a	Early Cretaceous	Rajmahal hills, Jharkhand	India	no	poor
Taxodioxylon	sp.	Falcon-Lang and Cantrill	2001	Late Albian	Alexander Island	Antarctica	seen	*Taxodioxylon*
Taxoxylon	*indicum*	Bhardwaj	1952a	Early Cretaceous	Rajmahal hills, Jharkhand	India	no	*Taxaceoxylon*
Taxoxylon	*rajmahalense*	Bhardwaj	1952b	Early Cretaceous	Rajmahal hills, Jharkhand	India	no	*Taxaceoxylon*
Xenoxylon	sp.	Mahabale	1967	Early Jurassic	Pranhita/Godavari, Andhra Pradesh	India	no	poor
Xenoxylon	*saadawii*	Youssef	2002	Late Jurassic to Early Cretaceous	Gebel Kâmil	Egypt	no	*Metapodo-carpoxylon*
Gymnospermae	wood	Alves and Koutsoukos	1998	Late Jurassic–Early Cretaceous, Serraria Fn.	Malhada dos Bois, Sergipe	Brazil	seen	poor
Protopinaceae type	wood	Thorn	2001	Middle Jurassic	North Island	New Zealand	no	*Protopodo-carpoxylon*

undertermined wood	Torres et al.	1982	Early Cretaceous	South Shetland	Antarctic Peninsula	seen	poor
Undetermined wood	Halle	1913	Jurassic or Cretaceous	Bahia Tekenika, Tierra del Fuego	Argentina	no	poor
Undetermined wood	Genize and Hazeldine	1995	Late Middle Jurasic to Early Late Jur.	Cerro Quadrado	Argentina	seen	coniferous wood
Undetermined wood	Backhouse et al.	1995	Early Cretaceous	Perth	Australia	no	poor
Undetermined wood	Del Valle et al.	1997	Middle Jurassic	Jason Peninsula	Antarctica	seen	coniferous wood
Undetermined wood	Walkom	1929	Early Aptian–Late Albian	Eromanga, South Australia	Australia	seen	poor
Undetermined wood	White	1961	Neocomian	Carpenteria, Northern Territories	Australia	no	poor
Undetermined wood	Hancox et al.	2002	Aptian–Albian	Rovuma basin	Mozambique	seen	coniferous wood
Undetermined wood	Ferguson	1909	Aptian	Gippsland Basin	Australia	no	coniferous wood
Undetermined wood	Gill	1957	Early Jurassic	Cape Paterson	Australia	no	*Agathoxylon*
Undetermined wood	Duarte	1989	Early Cretaceous	North-East	Brazil	no	*Agathoxylon*

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