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MORE FOSSIL WOOD FROM THE NAMAQUALAND COAST, SOUTH AFRICA; ONSHORE MATERIAL.

by

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ABSTRACT

Fossil wood was collected from a palaeo-beach sequence on the farms Sandkop, Oubeep and adjacent State land, on the Namaqualand (west) coast of South Africa. Of the 14 samples sectioned only 5 were well enough preserved to describe and identify to species level. The woods are podocarpaceous and have been assigned to the taxa *Podocarpoxylon cf. umzambense, Mesembrioxylon woburnense, M. stokesi* and *Mesembrioxylon sp.* The samples are Lower Cretaceous in age and were most probably reworked a number of times into successively younger palaeoshoreline deposits. The same species occurred in the offshore sediments, therefore indicating a wider area of "woodland" and further evidence of extensive shelf erosion by subsequent marine transgressions and regressions.

KEY WORDS: Podocarpaceae, Lower Cretaceous, South Africa.

INTRODUCTION

Fossil wood is abundant in southern African terrestrial deposits but has been little studied. Previously described gymnospermous wood has mainly been assigned to two genera, *Dadoxylon* Endlicher (Warren 1912, Walton 1925, 1956) and *Araucarioxylon* Kraus (Rodin 1951, Erasmus 1976a). A few woods have been placed in other genera, for example, *Dammaroxylon* (Schultze-Motel 1966, Marguerier 1973, Erasmus 1976b), *Australoxylon* (Marguerier 1973) *Podocarpoxylon* (Schultze-Motel 1966), and several genera with pith, *Rhexoxylon,* (Bancroft 1913), *Tordoxylon, Solenoxylon, Lobatoxylon, Megaporoxylon, Kaokoxylon* and *Phyllocladopitys* (Krausel 1956a,b,c).

The correct use of the genera *Dadoxylon* and *Araucarioxylon* has been discussed at length by several authors (Vogellehner 1964, Maheshwari 1972, Lepekhina 1972, Erasmus 1976a, Pant & Singh 1987) but there is no general consensus. There is a similar problem with the genera *Podocarpoxylon, Phyllocladoxylon* and *Mesembrioxylon. Podocarpoxylon* and *Phyllocladoxylon* were erected (Gothan 1905) for secondary xylem with uniseriate (occasionally biseriate and opposite) tracheid pitting, ray cell walls thin and smooth and podocarpoid crossfield pitting. The distinction between the two genera is based on the cross-field pitting. *Podocarpoxylon* has one, occasionally two, simple pits in the field. *Phyllocladoxylon* has one, occasionally two, large, simple pits in the field. *Mesembrioxylon* (Seward 1919) encompasses both genera because the pits are not always distinguishable (Seward 1919, p. 173). Different authors favour different genera and thus there is a great deal of overlap. The onshore woods belong to different species of two of these genera, *Podocarpoxylon* and *Mesembrioxylon*, but the usage of the genera will not be discussed here.

LOCALITY AND GEOLOGY

Clasts of fossil wood were collected from the surface of a raised palaeoshoreline on the farms Oubeep, Sandkop and adjacent State land, which is known locally within the De Beers offices as the Recent Emergent Terrace (Figure 1). The terrace is a composite feature, cresting between 12 to 9 metres above sea level (masl) in the vicinity of Oubeep. The palaeoshoreline from which the fossil wood comes, therefore, predates the Eemian (± 120 000 BP) palaeoshoreline which crests at about 4 masl. According to Hendey and Volman (1986) the palaeoshoreline at Oubeep predates the Late Pleistocene, and in Kensley and Pether's scheme (1986) it would be Middle Pleistocene.

The clasts of fossil wood occur within the palaeo-beach sequence as well-rounded and polished pebbles and cobbles, but one log of approximately 400mm x 200mm has been recovered. Some cobbles are discoidal, showing that they have spent a considerable time in the nearshore and beach environment. The presence of chattermarks on the surface of the clasts shows that the beach was subject to high-energy conditions.

MATERIALS AND METHODS

The silicified fossil wood was cut and polished to make petrographic thin sections in the normal manner. The sections are somewhat thicker because of the cell and crystal sizes. Three slides in different planes have

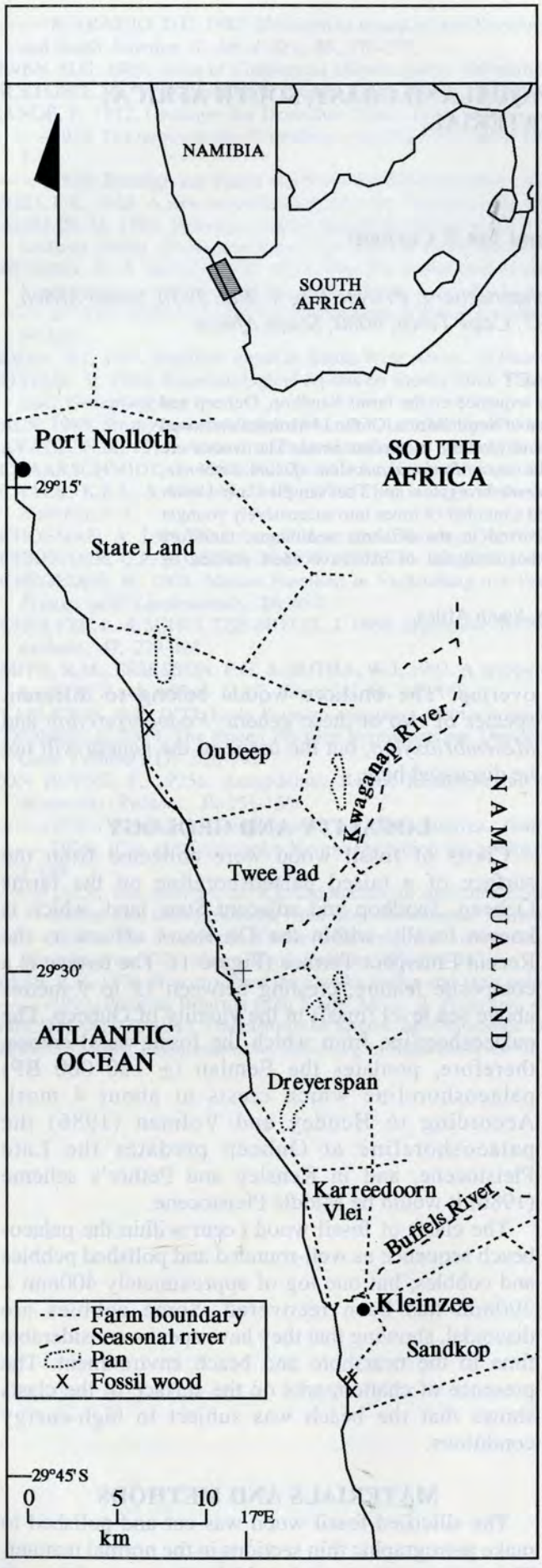


Figure 1: Locality map.

been made for each specimen. The planes are transverse, tangential longitudinal and radial longitudinal.

DESCRIPTION OF MATERIAL
Family Podocarpaceae

Podocarpoxylon cf. umzambense Schultze-Motel, 1966.

BPI Number: BP/16/228
Locality: Farm Oubeep, Namaqualand Coast.
Figures: 2-5
Other specimens: none.

Description

Growth rings are indistinct and comprise 3 - 4 rows of latewood cells with smaller radial diameters (Figure 2).

The tracheids are thin walled (average 7.5µm) and a little distorted. The tracheid mean tangential diameter of earlywood is 40µm (range 27-55µm). The mean radial diameter is 60µm (range 50-67µm). The latewood mean tangential diameter is 39µm (range 35-47µm) and mean radial diameter is 26µm (range 22-28µm). The tracheid bordered pitting is on the radial walls, uniseriate and separate (Figure 3). The pits are round with a diameter of 15µm, and round aperture of 6µm. Resin or gum deposits are common.

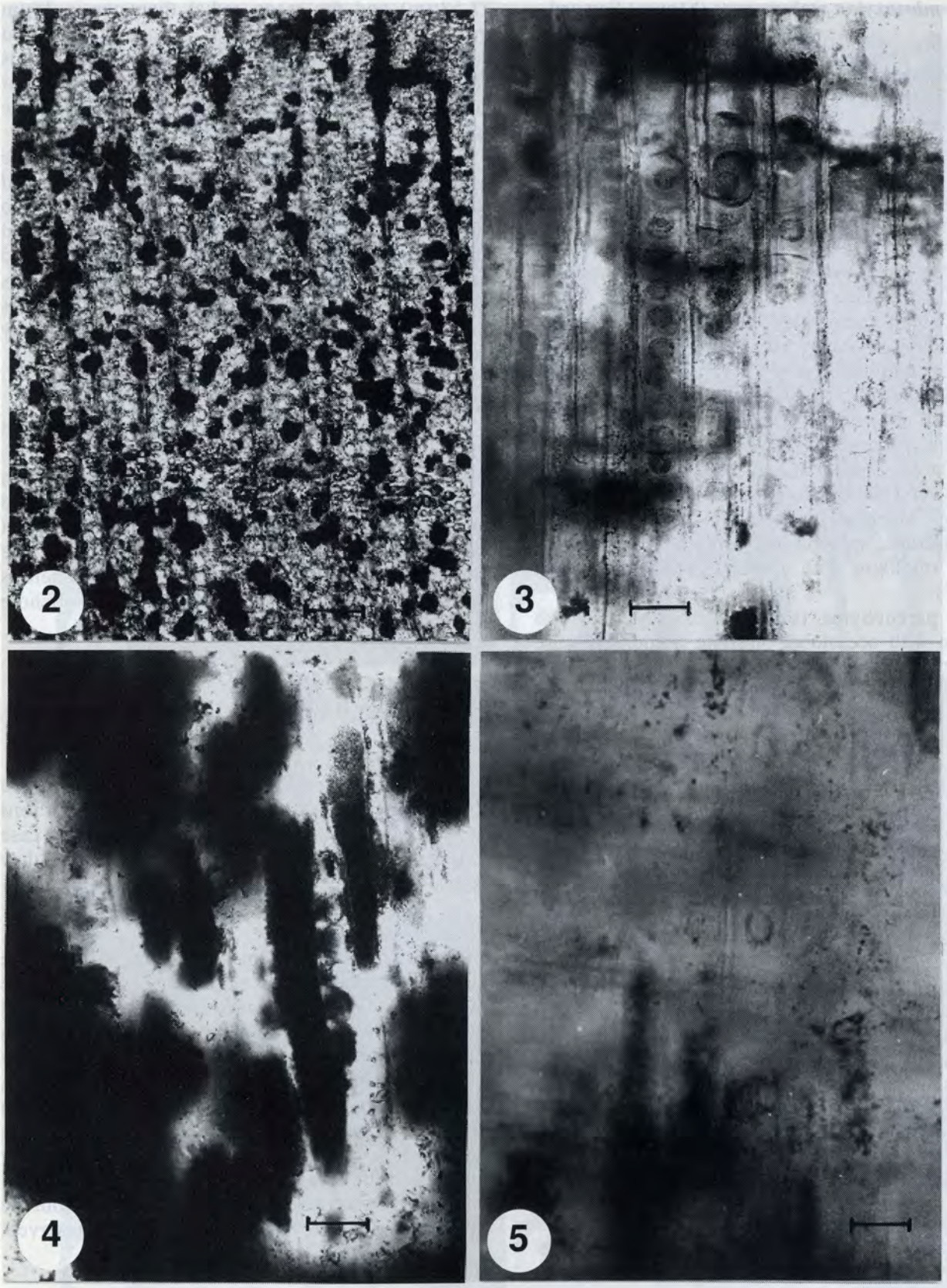
Axial parenchyma is very sparse. The rays are uniseriate and low; their total height is difficult to determine because of the gum deposits in the tracheids but their range is 3-8-18 cells (Figure 4). Ray parenchyma cell walls are thin and smooth, and the cross-field pits single, simple, round to oval and have an average diameter of 10µm. Ray tracheids and resin canals are absent.

Identification

This specimen has typical *Podocarpoxylon* features and is almost the same as *P. umzambense* from the Upper Cretaceous Umzamba beds of the south east coast of South Africa described by Schultze-Motel (1966). The latter specimen has 1-2 opposite tracheid pits on the radial walls, ray height of 1-25 cells and also 1-2 elliptic pits per cross-field. The sizes of all the pits in both specimens are almost the same but the incompleteness of the rays in the Namaqualand onshore specimen means that it cannot be placed in the described species with complete confidence.

This specimen is also similar to *M. gothani* (Seward 1919, Thayn & Tidwell 1984) from the Aptian of the Isle of Wight, except that the latter has very low rays. Both have quite small cross-field pits (*M. gothani*: 7µm).

BP/16/228 is also very similar to BP/16/244 from the Namaqualand Shelf (offshore) deposits (Bamford and Corbett 1994) and also called *P. cf. umzambense*.



Figures 2-5: *Podocarpoxylon cf. umzambense* BP/16/228. **2:** Transverse section. Tracheids are thin-walled and resin is abundant. Magn 50x. Scale bar = 200µm. **3.** RLS. Bordered pits on the radial walls of the tracheids. Magn 270x. Scale bar = 37µm. **4:** TLS. A few ray cells are visible on the right of the photograph but the rest have been obscured. Magn 225x. Scale bar = 44µm. **5:** RLS. Simple podocarpoid pits are just visible in the photograph. The ray cell walls are thin and smooth and some cells have resinous deposits. Magn 550x. Scale bar = 20µm.

Mesembrioxylon woburnense (Stopes) Seward 1919.

BPI Number: BP/16/227
Locality: Farm Oubeep, Namaqualand Coast
Figures: 6-9.
Other specimens: BP/16/231, 233.

Description

What appear to be growth rings on the hand specimen are seen to be cracks when viewed under the microscope. Only two real growth rings are evident on the slide and they are 9mm apart.

The tracheids are regularly aligned and the rays are prominent in transverse section. The tracheids are squarish in outline (Figure 6). The earlywood mean tangential diameter is 39µm (range 32-45µm) and mean radial diameter is 41µm (range 37-48µm). The latewood is inconspicuous and forms only 4-5 cell layers. The mean tangential diameter is 40µm (range 30-50µm) and mean radial diameter is 15µm (range 10-20µm). Tracheid pits occur on the radial walls only, uniseriate, separate and contiguous and have a diameter of 20µm with a round aperture of 12µm (Figure 7).

Axial parenchyma is very rare. The rays are uniseriate with occasional biseriate portions (Figure 8). Their average height is 9-15 cells but they range from 2-25 cells high. The cell walls are thin and smooth. Cross-field pits are single, simple, oval to rounded in outline and 12 x 8µm in size (Figure 9). Some pits are rounder with a thinner rim but this may be due to preservation. The oval pits have an oblique orientation. Resin occurs in tracheids and rays. No ray tracheids or resin canals are present.

Identification

BP/16/227 is *Mesembrioxylon woburnense* because it has the same tracheid pitting, rays and cross-field pitting as the type (Seward 1919). This specimen is very similar to BP/16/46 from the offshore deposits (Bamford and Corbett 1994) and the latter one has only been closely compared to *M. woburnense*. Both the Namaqualand onshore and offshore specimens have crossfield pits that fall within the size range of the original specimen described from the Aptian of England.

Mesembrioxylon stokesi Thayn and Tidwell 1984.

BPI Number: BP/16/223
Locality: State land adjacent to farm Oubeep, close to shore.
Figures: 10-14
Other specimens: none

Description

Growth rings are not visible but the preservation of cells is patchy.

The tracheids are squarish in outline. The mean tangential diameter of the earlywood is 48µm (range 27-58µm) and the mean radial diameter is 38µm (range 35-45µm). Latewood is absent. The tracheid bordered pitting is on the radial walls only and is uniseriate, separate and contiguous. The diameter of the pits is 18-19µm but the size and shape of the aperture is unknown.

Axial parenchyma is absent. The rays are uniseriate with occasional biseriate portions of 2-5 cells, and mostly 10-28 cells high but occasionally rays of up to 48 cells occur. Ray cell walls are thin and smooth and the cross-field pits are single, mostly simple, rounded and have a diameter of 10-13µm. Sometimes the pits have a vague aperture and so appear bordered. Resin is common in tracheids but no resin canals nor ray tracheids were found.

Identification

With the very high rays and podocarpoid cross-field pits this wood is indistinguishable from *Mesembrioxylon stokesi* from the Lower Cretaceous of Utah (Thayn & Tidwell 1988). The onshore Namaqualand specimen does not have the abundant parenchyma that the American specimen has although this may be due to poor preservation. The specimen described here is the same as BP/16/35 described from the offshore deposit (Bamford & Corbett 1994.)

Mesembrioxylon sp.

Specimens: BP/16/221, 222, 224, 225, 226, 229, 230, 232, 265.

The rest of the onshore samples show at least one podocarpoid feature but there is insufficient information to identify them further. This was the case with many of the offshore specimens as well and they have all been placed in this taxon.

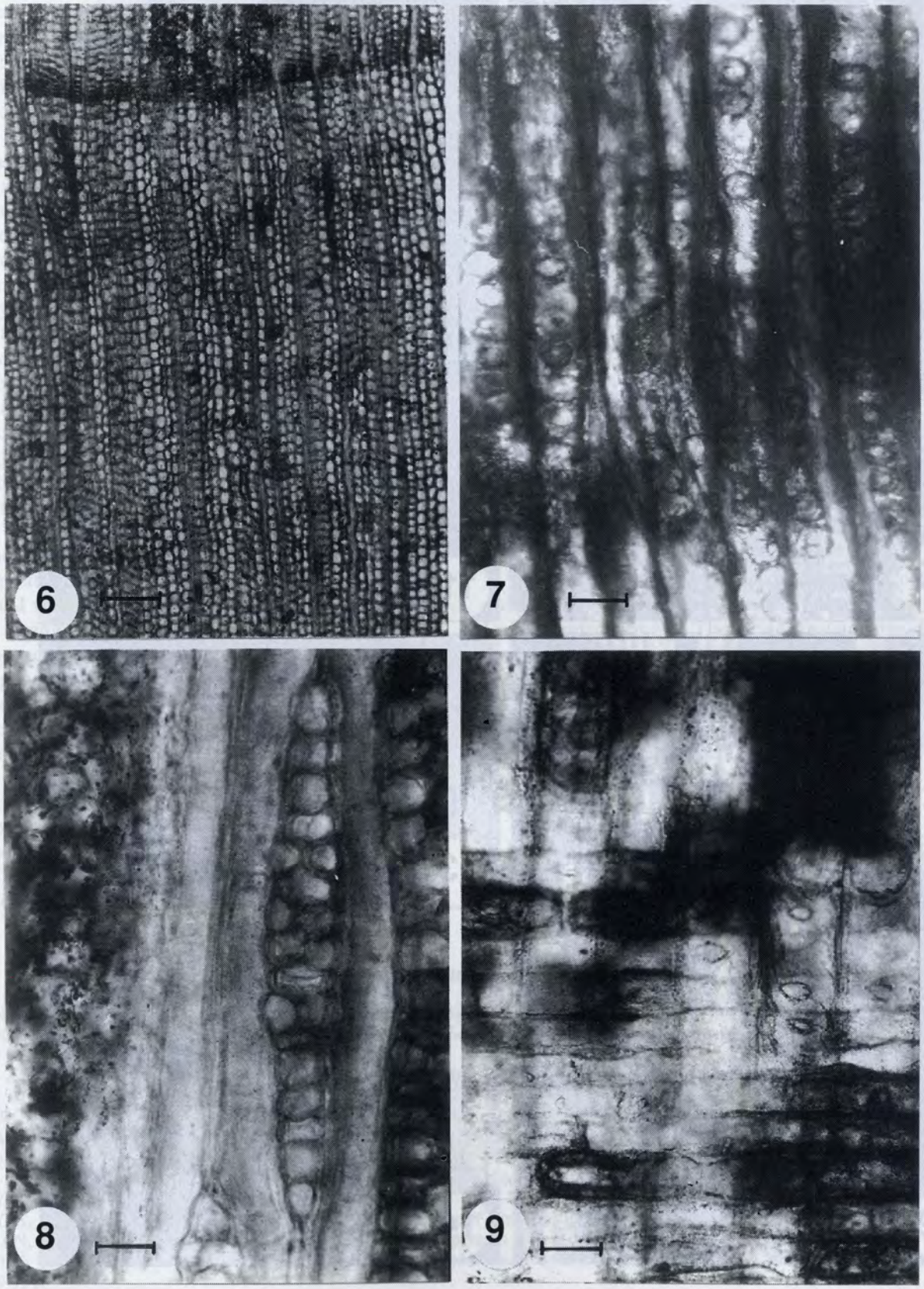
General Description

Growth rings vary from 1-3 mm in width or are absent. Latewood is never more than 4 cells wide. The tracheids are fairly thin-walled and range in tangential diameter from 17-60µm and radial diameter 24-62µm for the earlywood, and the latewood is usually crushed. The bordered pits are on the radial walls only, uniseriate, separate and contiguous and vary from 14-22µm in diameter. The presence of parenchyma is variable but it is never abundant. Rays are mostly uniseriate with occasional biseriate portions, and cell walls are thin and smooth. Ray height falls within the range 5-35 cells. The cross-field pits are not preserved.

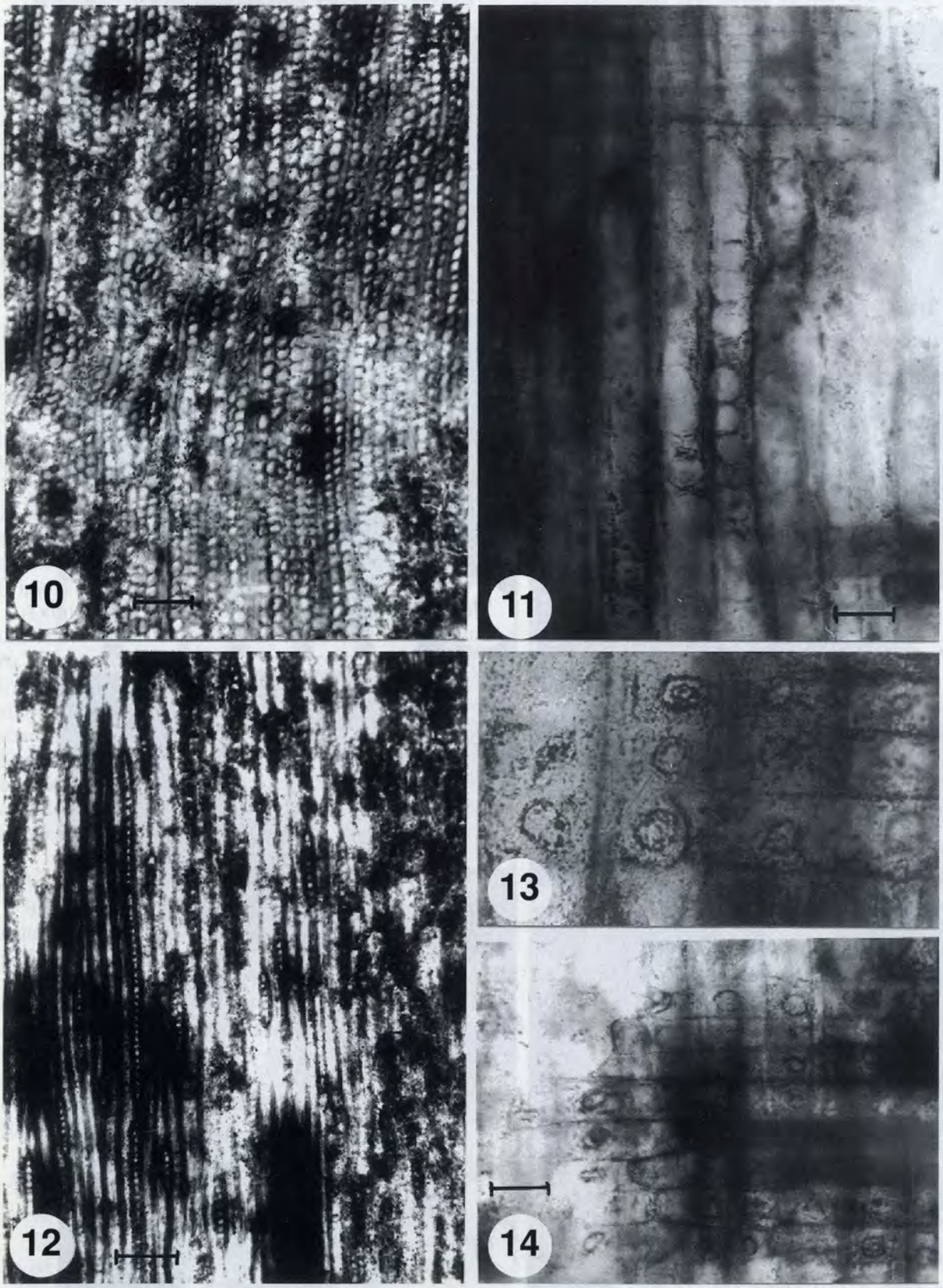
DISCUSSION

Age and Palaeoecology

The Namaqualand coast fossil woods described here are the same as those from the offshore (continental shelf) deposit but there is less variety. This is hardly surprising as the sample size is smaller (14 onshore specimens and 43 offshore specimens). These woods have been compared with both northern and southern



Figures 6-9: *Mesembrioxylon woburnense* BP/16/227. **6:** TS to show regular tracheids and one growth ring. Magn 37x. Scale bar represents 270µm. **7:** RLS. Bordered pits on the radial walls of the tracheids, separate and contiguous. Magn 250x. Scale bar = 40µm. **8:** TLS. Biseriate ray, squarish cells and variable height. Magn 250x. Scale bar =40µm. **9:** RLS. Cross-field pits, single, simple and oval to round. Magn 240x. Scale Bar = 42µm.



Figures 10-14: *Mesembrioxylon stokesi* BP/16/223. **10:** TS. Regular tracheids but patchy preservation. Magn 42x. Scale Bar = 240µm. **11:** RLS. Contiguous bordered pits on the radial walls of the tracheids. Magn 270x. Scale bar = 37µm. **12:** TLS. Very high uniseriate rays. Magn 42x. Scale bar = 240µm. **13:** RLS. Cross-field pits bordered. Magn 800x. Scale bar = 12µm. **14:** RLS. Cross-field pits simple – the most common form. Magn 500x. Scale bar = 20µm.

hemisphere fossil woods and indicate a Lower Cretaceous age (see also Bamford & Corbett 1994).

The two families represented in the fossil record are the Podocarpaceae and Cheirolepidiaceae (offshore deposit, Bamford & Corbett 1994). Podocarpaceae is a well established southern hemisphere family with some 80 extant species. The fossils cannot be compared with any of the extant species although they share many of the family features. Modern podocarps are mostly restricted to wetter regions or higher altitudes. The Cheirolepidiaceae are extinct but extended from the Upper Triassic to the Lower Tertiary (Alvin 1982, Watson 1988). They occupied a variety of habitats but mostly had the ability to survive periods of drought (Francis 1983). Fossil podocarps frequently occupied low-lying plains (Dupéron-Laudoueniex & Pons 1985). The evidence from the growth rings of the fossil woods indicates that the palaeoclimate was a seasonal one with periods of drought. The low-lying coastal plains experienced changing sea levels (Kensley & Pether 1986) and the trees were occasionally flooded and preserved *in situ*. Some specimens may have been transported a short distance during the Cretaceous erosional phase (Ward & Corbett 1991).

Fossil woods have been collected from as far north as the Orange River mouth to just south of Kleinzee, a distance of approximately 150km (Figure 14). The homogeneity of the wood types suggests that the trees were contemporaneous, in geological terms, and this implies an extensive "forested" area. It is not possible to determine if the "forest" was a closed canopy one or more open woodland. Looking at modern vegetation there are variations within any particular region and one part may have been drier and more sparsely vegetated than another. It is not possible to extract such detail from the samples collected offshore. Nonetheless it is significant that there was an extensive wooded area along the west coast during Lower Cretaceous times.

Although the wood is of Cretaceous age, the sedimentary deposits are Pleistocene (Hendey & Volman 1986, Kensley & Pether 1986), thus providing clear evidence that the material in the palaeoshoreline at Oubeep has been derived from an older deposit. Surface drilling on the boundary of the farm Dreyerspan to the north of Kleinzee, and immediately south of Oubeep has delineated a palaeochannel feature. The pollen from a palaeo-channel on the farm Dreyerspan (Figure 1) has been dated as pre-Barremian (Soekor Report 1990). It therefore appears likely that the onshore fossil wood material has been derived through erosion of the Early Cretaceous palaeochannel feature by shoreface incision during transgression(s) across the area (pers. comm. Molyneux 1993). It is possible that the clasts of fossil wood have been reworked a number of times into successively younger palaeoshoreline deposits, as indicated by the extent to which the clasts have been rounded, polished and chattermarked.

CONCLUSION

The fossil woods from the onshore and offshore sediments of Namaqualand are very similar and are of Lower Cretaceous age. They indicate a moister climate than is experienced today because large trees were able to grow in the low-lying coastal plains. The palaeoclimate, however, was seasonal with periods of water shortages. In both cases the woods have been reworked and incorporated into considerably younger palaeoshoreline sequences.

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