Contributions to the Eocene palaeontology and stratigraphy of Beira Alta, Portugal

III — Eocene plant remains from Naia and Sobreda (Beira Alta, Portugal)

João PAIS

Centro de Estratigrafia e Paleobiologia da U.N.L., Faculdade de Ciências e Tecnologia,
Quinta da Torre, P- 2825, Monte de Caparica, Portugal

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RESUMO

Palavras-chave: Palinologia—paleoxilologia—Eocénico — Arcoses de Côja — Portugal.

Apresenta-se o resultado do estudo de fragmentos de troncos encontrados no membro inferior das Arcoses de Côja (Membro do Casalinho de Cima) em Naia e em Sobreda. É também identificado um tronco recolhido no membro de Monteira, situado acima do anterior, em Sobreda.

Apresenta-se ainda o estudo palinológico dos níveis lutíticos negros que envolviam o tronco de Naia.

São estabelecidas comparações com os troncos provenientes de Nave de Haver e tecem-se considerações acerca da paleoecologia e paleoclimatologia.

RÉSUMÉ

Mots-clés: Palynologie — Paléoxylologie — Eocène — Arkoses de Côja — Portugal.

On présente l'étude de fragments de bois recueillis dans le membre inférieur des Arkoses de Côja (Membre de Casalinho de Cima) à Naia et à Sobreda. Du dernier gisement provient un fragment de bois (récolté dans le Membre de Monteira, situé au dessus de celui de Casalinho de Cima), qui a également été identifié.

L'étude palinologique des niveaux de lutites sombres qui entouraient le bois de Naia est présentée.

Sont établies des comparaisons avec des bois en provenance de Nave de Haver et reconstituées des conditions paléoécologiques et paléoclimatiques.

ABSTRACT

Key-words: Palynology — Paleoxylology — Eocene — Côja Arkoses — Portugal.

The result of research conducted in trunk fragments from the Côja Arkoses Formation at Naia and Sobreda is reported.

It is also reported the palynological study of the lutaceous black level surrounding the Naia trunk.

Comparisons with trunks from Nave de Haver are established. Comments on palaeoecology and palaeoclimatology are presented.

INTRODUTION

The Hesperic Massif, in the Beira Alta Province, suffered erosion phenomena which gave rise to platforms, later covered by tertiary arkosic deposits, which are deposited in small troughs. There were exploited for tin mining, for building industries and, in some places, for industrial clays. The deposits are poor in fossils. Vertebrata are the only clues for dating the Naia and Côja arkoses in a level equivalent to the Upper Eocene (Ludian) of Montmartre (ANTUNES 1964, 1967, 1986, ANTUNES & DE BROIN 1977).

Plants remnants are known at Nave de Haver (fragments of trunks), at Naia (fragments of trunks and palinomorphs) and at Sobreda (fragments of trunks); the known material is scarce and in general poorly preserved. It is reported here the plant fossils lately collected at Naia and Sobreda.

NAIA

At Naia ("Fábrica de Cerâmica da Beira"), trunks of angiosperm were found in carbonaceous black clays included in Casalinho de Cima Member of the "Arcoses de Côja" Formation (Lower part) as defined by P. Proença Cunha (written comm. 1991). A lutaceous layer included in the Monteira Member situated above the previously mentioned deposits, contains vertebrate fossils of Ludian age (Upper Eocene) (ANTUNES 1964, 1967, 1986, 1992, ANTUNES & DE BROIN 1977). Samples of the clays in the imediate contact with this trunk were analysed for spores and pollens. They produced some badly preserved material.

Casalinho de Cima Member (lower part of the "Arcoses de Côja" Formation)

Trunks

PTERIDOPHYTA
+undet. arboreal fern - badly preserved fragment of trunk

ANTHOPHYTA
Meliaceae or Leguminosae
+ *Entandrophragmoxylon* sp. or *Leguminoxylon schoelleri* BOUREAU - coaly trunk with badly preserved structure

Spores and pollens

Samples were colected for palynological study close by the angiosperm trunk. The following forms have been recognized:

	nº of palynomorphs
BRYOPHYTA	
Sphagnaceae	
+ *Sphagnum* sp.	1
HEPATOPHYTA	
Ricciaceae	
+ *Riccia* sp.	7
Anthocerothaceae	
+ *Anthoceros* sp.	6
LYCOPHYTA	
Selaginellaceae	
+ *Lusatisporis* sp. (*Selaginella* sp.)	12
PTERIDOPHYTA	
Polypodiaceae	
+ *Polypodiaceoisporites* cf. *sculptus* KEDVES	4
+ *Polypodiaceoisporites* sp.	2

Gleicheniaceae	
+ *Toripunctisporis* sp.	2
Unknown affinity	
+ *Undulatisporites* sp.	6
CONIFEROPHYTA	
Abietaceae	
+ *Pinus* type *haploxylon* DOKT. & HREBN.	19
+ *Pinus* type *diploxylon* DOKT. & HREB.	2
Cupressaceae	
+ *Cupressacites* sp.	2
ANTHOPHYTA	
Fagaceae	
+ *Tricolpopollenites* cf. *librarensis* (TH.) TH. & PFLUG	3
+ *Scabratricolpites microhenrici* (POTONIÉ) TH.&PF.	2
Salicaceae	
+ *Scabratricolpites* sp.	1
Juglandaceae	
+ *Triatriopollenites platycaryoides* ROCHE	3
Hamamelidaceae, Labiatae ou Tamaricaceae	
+ *Retitricolpites rauscheri* ROCHE & SCHULER	1
Amaranthaceae/Chenopodiaceae	
+ *Chenopodipollis* sp.	1
+ Gramineae	3
Palmae	
+ *Arecipites* sp.	4
+ *Racemonocolpites* sp.	
TOTAL	82

SOBREDA

At Sobreda (between Nelas and Seia) precisely at the top of the deposits equivalent to the carbonaceous levels of Naia (black lutites enriched in organic matter of the Casalinho de Cima Member) a fragment of trunk was obtained. From the unit imediately above (Monteira Member) another trunk fragment was found. The following taxa were identified:

Monteira Member (upper part of the "Arcoses de Côja" Formation)

CONIFEROPHYTA
Cupressaceae
+ *Cupressinoxylon lusitanenis* VALLIN 1966
(*Tetraclinis* sp.?)

~~~~ Disconformity - Pirenaic phase ~~~~
(ANTUNES, 1967)

Casalinho de Cima Member (carbonaceous lutites):

ANTHOPHYTA
Leguminosae
+ *Leguminoxylon teixeirae* VALLIN.

The fragments collected at both Naia and Sobreda correspond, basically, to the same forms identified at Nave de Haver by VALLIN (1965a, 1965b) and by BOUREAU & VALLIN (1966).

DISCUSSION

Age and correlations

Leguminoxylon schoelleri is known in the Stampian of Gironde. Other forms have a very broad distribution during the Paleogene, and some of them are even known in the Lower Neogene. It is interesting specially that the trunks belong to the same plants identified in arkosic deposits at Nave de Haver, which were included by CORROCHANO & REIS (1986) in the Eocene - Oligocene, and ascribed to the Upper Eocene - Oligocene by REIS & CUNHA (1989a), but without any accurate chronological support other than litological correlation with the Eocene deposits from Salamanca and Côja. The Nave de Haver arkoses belong to the Ciudad Rodrigo basin.

In palinological and lithostratigraphical studies of deposits in this basin (GAVILÁN & HERNÁNDEZ 1988), in the vicinity of the Portuguese border (Pedrotoro), the Alamedilla Arkose Formation is ascribed to the Upper Oligocene - Lower Miocene, but again without accurate chronological support.

For the moment, the "Arcoses de Côja" Formation is supposed to be an equivalent of the Members I and II of the Bom Sucesso Formation described by REIS (1979) and redefined by REIS & CUNHA (1989b) in the portuguese Atlantic shoreline (Vale Furado). The Casalinho de Cima Member is regarded as an equivalent of Member I, and Monteira Member of the Member II.

The vertebrates present at Côja clearly indicate a Ludian, Montmartre level age (Upper Eocene) (ANTUNES, 1964, 1967, 1986) for lower part of Monteira Member. Hence the Casalinho de Cima Member may probably be ascribed to the Middle Eocene and, maybe to part of the Upper Eocene.

In this situation the Nave de Haver deposits are either older than the Alamedilla arkoses or, if contemporaneous, the plants which supplied the trunks would have survived longer and the Nave de Haver deposit would not be correlative of the black clays of Naia and Sobreda, the last hypothesis seems less probable.

Ecology and paleoclimatology

Ecologically and paleoclimatologically we stress the following points:

- presence of subtropical epiphyte forms - Gleicheniaceae;

• presence of forms from humid and shady environments - Bryophyta, Hepatophyta, *Selaginella*;

• presence of subtropical and tropical forms — Palmae, Leguminosae and/or Meliaceae;

• presence of temperate to subtropical forms — Fagaceae (*Quercus*), *Platycarya*.

The plants here identified show that the climate was rather humid and warm, probably subtropical to tropical. The development of the vegetation was quite important with plentiful forest covering with shady and humid biotopes.

As far as paleoecological indications obtained at Pedrotoro (Alamedilla Arkoses) are concerned we may recognize that the Naia and Sobreda deposits have far more humid and warm characteristics. This fact may be related to the more continental situation of the Alamedilla region, which should correspond to lower humidity levels, or to a possible climatic degradation.

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DOCUMENTAÇÃO FOTOGRÁFICA

PLATE 1

Fig. 1 — Clay exploitation at Naia ("Cerâmica da Beira"). Angiosperm trunk locality.
Fig. 2 — Angiosperm trunk.

PLATE 1

1

2

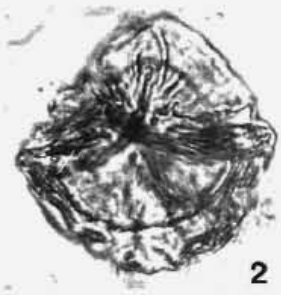
PLATE 2

Fig. 1 — *Anthoceros* sp., x1000.
Fig. 2 — *Lusatisporis* sp., x1000.
fig. 3 — *Torispunctisporis* sp., x1000.
Fig. 4 — *Undulatisporis* sp., x1000.
Fig. 5 — *Polypodiaceoisporites* sp., x1000.
Fig. 6 — *Arecipites* sp., x1000.
Fig. 7 — *Tricolpopollenites* cf. *librarensis* (THOMSON) THOMSON & PFLUG, x1000.
Fig. 8 — *Triatriopollenites platycaryoides* ROCHE x1000.
Fig. 9 — *Chenopodipollis* sp. X1000.
Fig. 10 — *Graminidites* sp., x1000.
Fig. 11 — *Entandrophragmoxylon* sp. or *Leguminoxylon schoelleri* BOUREAU:

a) transversal section, x100;
b) radial section, x100;
c) radial section, parenchime cells with cristals, x700.

PLATE 1


1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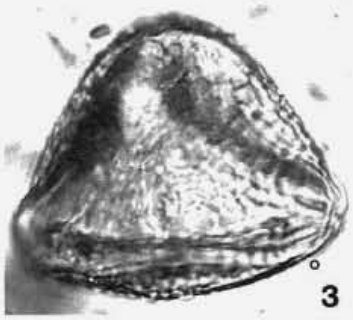
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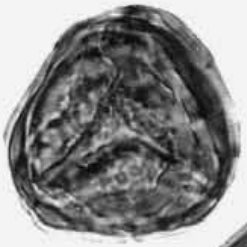
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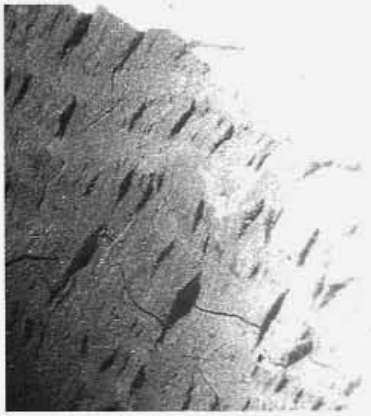
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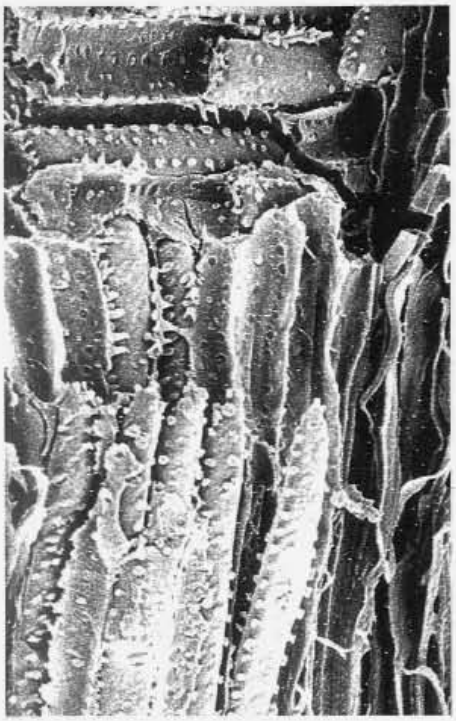
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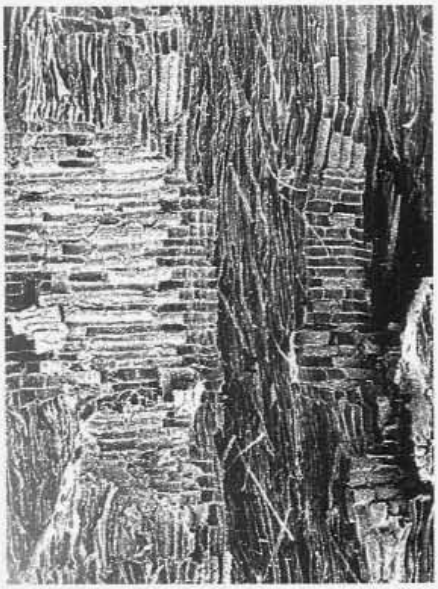
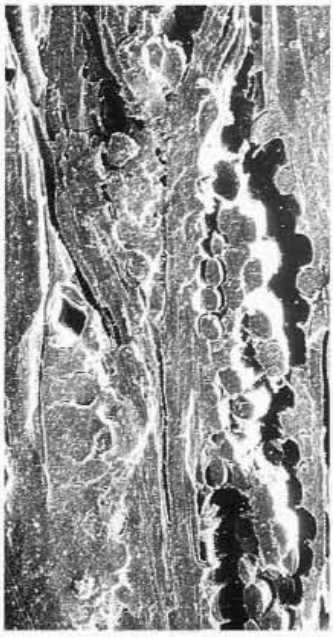

11b

PLATE 3

Fig. 11d — *Entandrophragmoxylon* sp. or *Leguminoxylon schoelleri* BOUREAU, ray cells in tangencial section, x320.

Fig. 12 — *Cupressinoxylon lusitanensis* VALLIN (*Tetraclinis* sp. ?):

a) transversal section, x260;
b) radial section, x240;
c) tangencial section, x140.



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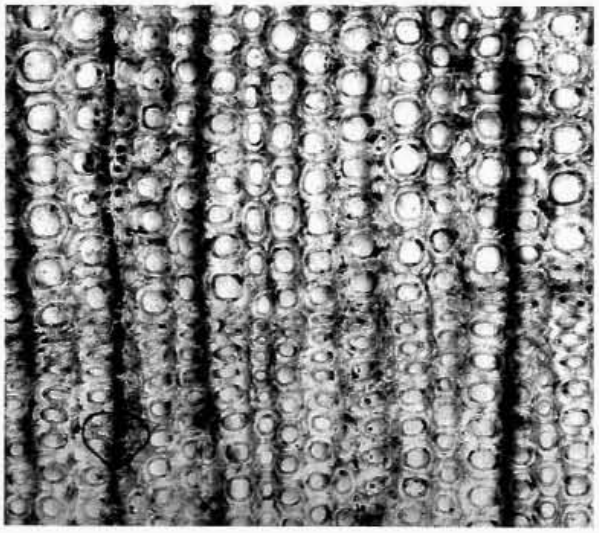

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12b

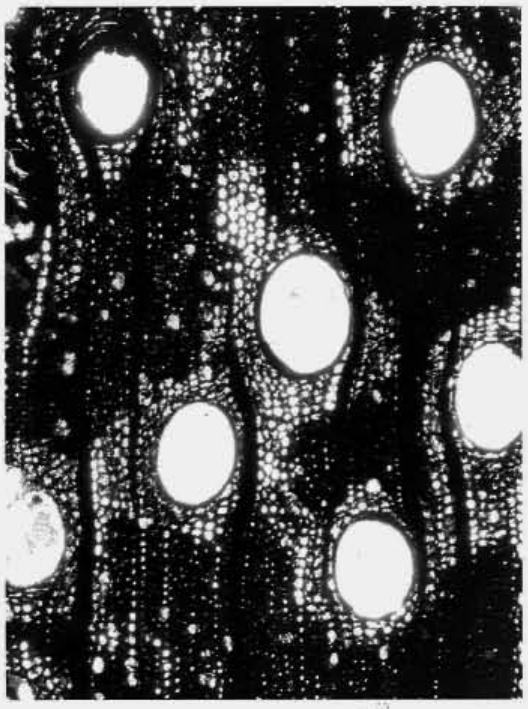
12c

PLATE 4

Fig. 13 — *Leguminoxylon teixeirae* VALLIN:

a) transversal section, x60;
b) radial section, x60;
c) tangencial section, x60;
d) ray cells in tangencial section, x500.

PLATE 4



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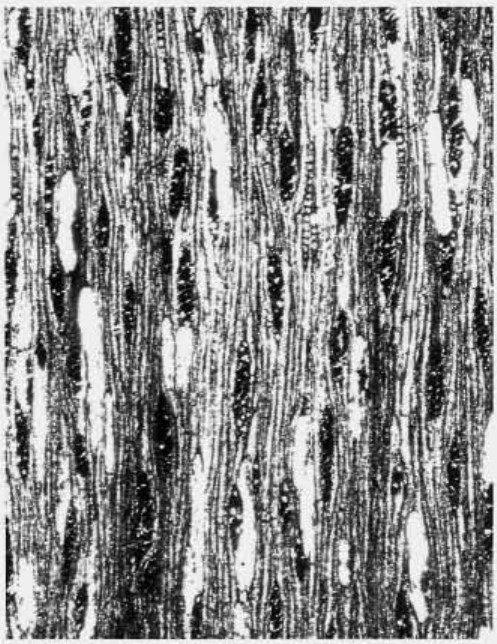

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