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Pollen analysis of Holocene sediments from the Poço das Antas National Biological Reserve, Silva Jardim, Rio de Janeiro, Brazil

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ABSTRACT

The Poço das Antas National Biological Reserve is located in Rio de Janeiro State, southeast Brazil. This paper presents information on past environmental characteristics of the area through pollen analysis. Two sedimentary columns were collected and five samples were selected for radiocarbon dating. The following ages of the columns from bottom to top were detected: column 1 – 1.20-1.16 m: 6080 ± 40 years BP, 0.775-0.735 m: 4090 ± 40 years BP, 0.385-0.345 m: 1880 ± 80 years BP; column 2 – 1.22-1.18 m: 3520 ± 40 years BP, 0.23-0.19 m: 1810 ± 40 years BP. Three samples from column 1 and two samples from column 2 were selected for pollen analysis: 1.20 m, 0.77 m and 0.37 m of column 1 and 1.22 m and 0.21 m of column 2. Chemical treatment followed standard methodology. The palynological analysis shows that around 6080 years BP the study area was dominated by a rain forest and from around 4090 years BP the vegetation changed to a fragmented forest, restricted to low hills and surrounded by an open area of grassland and pioneer plants, swamps and peat areas. The pollen assemblage of the samples 3520, 1880 and 1810 years BP suggest the permanence of this kind of vegetation between 4000 years BP and the actual.

Key words: Palynology, paleo-environment, Holocene, Brazil.

INTRODUCTION

The Poço das Antas National Biological Reserve (REBIO) was established in 1974 to preserve the natural habitat of the golden lion tamarin (*Leontopithecus rosalia rosalia*), an endangered species, native to this area. Located between 22°30′ and 22°35′S and 42°15′ and 42°19′W (Fig. 1) on a broad plain of Tertiary and Quaternary sediments, the REBIO occupies an area of 5000 ha in Silva Jardim municipality, Rio de Janeiro State, Southeast Brazil (IBDF/FBCN 1981).

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The rivers that cut through the Reserve or originate inside it drain into the São João River (IBDF/FBCN 1981). In the 1970s, the "Departamento Nacional de Obras e Saneamento" (DNOS) channeled part of the São João River and its affluents, opened new channels and constructed a dam near Juturnaíba lagoon, increasing the region´s irrigation capacity for farming activities, and also improving water quality (FEEMA 1991, IBAMA 1999). Due to dam construction, the swampy area was subjected to desiccation (IBDF/FBCN 1981), resulting in annual fires in the REBIO.

The vegetation of the REBIO is ombrophilous and seasonal (Lima 2000). Correia J.M.F., unpublished data, based on data obtained from the Rio de Janeiro Botanical Garden´s Mata Atlântica Programe, defined six vegetation units in the REBIO: submontane forest, alluvial forest, pioneer formation with fluvial influence, submontane "capoeira", alluvial "capoeira" and manmade grassland.

Besides an extensive continuous forest, hills isolated within the eastern border in swampy and peaty areas are also covered by forest (IBDF/FBCN 1981). Fernandez et al. (1998) and Castro and Fernandez (2004) described the forest fragments in the REBIO as "Barbados Islands", surrounded by an open area of peaty soil dominated by grasses, ferns, and pioneer trees, maintained in initial successional stages by frequent fires.

This research provides information on the age and past vegetation of the REBIO through pollen analysis of five ^{14}C-dated samples, collected in the open area on muddy soils surrounding the forest fragments.

MATERIALS AND METHODS

Two sedimentary columns (column 1 and column 2) were collected in the peaty area between forest fragments of the REBIO (Fig. 1). Column 1 (22°34′57,117″S; 42°15′03,166″W) was located in the middle of the open vegetation. Column 2 (22°34′58,807″S; 42°15′24,058″W) was located near of the base of one of the hills. Hand-excavated holes in the ground facilitated the exposure of sediment profiles. Aluminum boxes, 40 cm long and 2 cm wide, were used to obtain soil samples. The holes were less than 1.30m deep, since the ground water welled up at this depth. The holes were refilled with the removed sediments and the remaining vegetation cover.

Material for dating was collected at the following levels starting from the bottom sediments: 1.20-1.16 m, 0.775-0.735 m and 0.385-0.345 m of column 1, and 1.22-1.18 m and 0.23-0.19 m of column 2. Ages were established through radiocarbon methodology by Beta Analytic Inc., USA.

The sedimentological description of the columns was carried out in the Laboratory of Palynology, Botany Department, Institute of Biology, Federal University of Rio de Janeiro, in collaboration with geologist Dr. Marco André Malmann Medeiros.

Three samples from column 1 and two samples from column 2 were selected for palynologycal analysis: 0.37 m, 0.77 m and 1.20 m of column 1, and 0.21 m and 1.22 m of column 2. Chemical treatment followed Ybert et al. (1992). All samples were treated with 10% HCl, 40% HF for a minimum of 12 hours, 40% KOH, C and Zn_2Cl with density 2. Exotic spores (*Lycopodium clavatum*) were added to the samples to calculate palynomorph concentration. Five microscope slides of each sample were prepared. The calculation of pollen grain percentages was based on total pollen that includes aquatic and hygrophyte taxa, herbs, shrubs and trees, but not algae and spores. Therefore, care was taken to stop counting only after obtaining a minimum of 300 pollen grains per sample, excluding aquatic and hygrophyte taxa and Poaceae. Pollen identification relied on the reference slide collection of the Laboratory of Palynology, as well as specialized literature.

TILIA software was used for statistical treatment of the palynological data. Palynomorphs were grouped in two different ways for plotting the pollen data through TILIAGRAPH software, based on the habit of the identified plants and on the floristic-unit classification (Correia J.M.F., unpublished data) for the REBIO.

RESULTS AND DISCUSSION

The analyzed sediments were mainly composed of mud. Samples 0.37 and 1.20 m, from column 1, were composed of brown mud with plant fragments, while sample 0.77 was composed of black mud with plant fragments. Sample 0.21 m, from column 2, revealed brown to grey mud with plant fragments and sample 1.22 a grey micaceous mud.

Radiocarbon analysis reveled the following ages: column 1, sample 1.20-1.16 m, corresponding to the base of this column, 6080 ± 40 years BP, sample 0.775-0.735 m, 4090 ± 40 years BP, and sample 0.385-0.345 m, 1880 ± 80 years BP; column 2, sample 1.22-1.18 m, corresponding to the base of this column, 3520 ± 40 years BP and sample 0.23-0.19 m, 1810 ± 40 years BP (Table I).

Pollen grain identification comprised 133 pollen types (Table II). In sample 1.20 m, base of column 1, tree pollen types of *Cecropia* (Moraceae), *Ficus* (Moraceae), Moraceae, Myrtaceae, *Piper* (Piperaceae) and *Trema* (Ulmaceae) prevailed, while non-arboreal pollen types

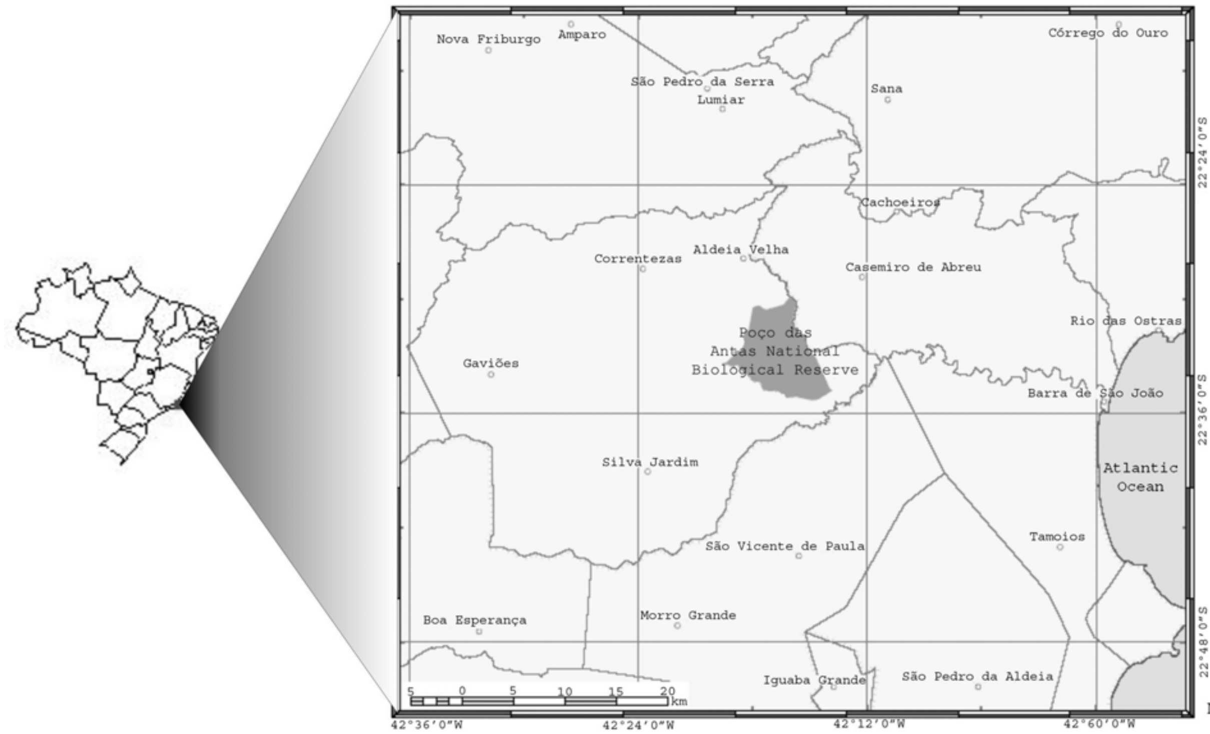

Fig. 1 – Map of the study area. (MMA/IBAMA 2007).

TABLE I
Radiocarbon dates of Quaternary sediments at five levels of two columns from the Poço das Antas National Biological Reserve, Silva Jardim Municipality, Rio de Janeiro State.

	Column 01			Column 02	
Reference code from Beta Analytic Inc.	Beta – 184063	Beta – 228012	Beta – 182054	Beta – 191406	Beta – 182055
Conventional radiocarbon age	1880 ± 80 BP	4090 ± 40 BP	6080 ± 40 BP	1810 ± 40 BP	3520 ± 40 BP
Calibrated radiocarbon age	Cal BP 1990 to 1610	Cal BP 4810 to 4440	Cal BP 7010 to 6800	Cal BP 1840 to 1620	Cal BP 3900 to 3690
Depth of the samples	0.385-0.34 m	0.775-0.735 m	1.20-1.16 m	0.23-0.19 m	1.22-1.18 m
Material	brown mud with plant fragments	black mud with plant fragments	brown mud with plant fragments	brown to grey mud with plant fragments	grey micaceous mud

were mainly represented by Cyperaceae and Poaceae in the other samples.

The pollen sum of each sample and pollen grain concentration/g of sediment are presented in Table III.

Total palynomorph concentration in the samples of column 1 was manifestly greater than that of column 2 samples. This may be attributed to the difference between sedimentation rates. Though the columns are practically the same depth, column 1 was nearly double the age of column 2, and therefore the sedimentation rate of column 2 was almost double that of column 1. The intense sediment accumulation rate in column 2 could be causing a reduction in total palynomorph concentration in these samples.

Sample 1.20 m (column 1) had high concentration (8.4×10^5 palynomorphs/g) and percentage (75.5%) of

TABLE II

Identified palinomorphs of the analyzed samples, showing habit and preferred vegetation type. The group of arboreal pollen types includes trees, shrubs and lianas. The following references were used to construct this table: 1 – Souza and Lorenzi 2005, 2 – Guedes-Bruni 1998, 3 – Carvalho F.A., unpublished data, 4 – Neves G.M.S., unpublished data, 5 – Joly 1966, 6 – Lorenzi 2000, 7 – Lorenzi 1998, 8 – Lorenzi 1992, 9 – Kissmann 1997, 10 – Kissmann and Groth 1999, 11 – Kissmann and Groth 2000, 12 – Reis C.A., unpublished data, 13 – Pio Corrêa 1984a, 14 – Pio Corrêa 1984b, 15 – Pio Corrêa 1984c, 16 – Pio Corrêa 1984d, 17 – Pio Corrêa 1984e, 18 – Pio Corrêa 1984f, 19 – Marchant et al. 2002, 20 – Bove et al. 2003, 21 – Luz C.F.P., unpublished data, 22 – Teixeira and Machado 2004, 23 – Pott et al. 2000, 24 – Rodrigues and Carvalho 2001, 25 – Lorenzi and Souza 1995, 26 – Coelho 2000, 27 – IBGE 2004, 28 – Von Martius et al. 1858, 29 – Garcia 1994, 30 – Luz 2003, 31 – Klein et al. 1988.

Pollen Types	Habit			Vegetation				References
	Non arboreal	Arboreal**	Variable habit	Ombrofilous forest	Grassland, "capoeira" and pioneer plants	Higrophytes and aquatics	Generalists	
Acalypha (Euphorbiaceae)	X				X			6, 13, 18, 19, 21
Acanthaceae	X						X	1, 5, 19
Adenocalymma (Bignoniaceae)		X		X				4, 14
Agavaceae	X				X			1, 5, 19
Alchornea (Euphorbiaceae)		X		X				2, 3, 4, 7, 13, 19, 21
Allophylus (Sapindaceae)		X		X				7, 15, 18, 19
Amaioua (Rubiaceae)		X		X				2, 8, 18
Amaranthaceae	X				X			1, 5, 19
Amaranthus/Chenopodiaceae	X				X			1, 5, 19
Ambrosia (Asteraceae)	X				X			6, 10, 13, 19
Anthurium (Araceae)	X						X	1, 13, 19
Aparisthmium (Euphorbiaceae)		X		X				31
Apiaceae	X				X			1, 5, 19
Apocynaceae			X				X	1, 2, 4, 5, 19, 21
Araceae	X			X				1, 5, 19, 21
Arecaceae		X		X				1, 2, 4, 5, 19, 21
Arrabidaea (Bignoniaceae)		X		X				1, 13, 19
Asteraceae	X				X			1, 4, 5, 19
Astronium (Anacardiaceae)		X		X				1, 2, 7, 13, 19, 21
Bacopa (Scrophulariaceae)	X					X		13
Bactris (Arecaceae)		X		X				1, 13, 19
Bauhinia (Caesalpiniaceae)		X		X				2, 6, 7, 14, 19, 21
Bignoniaceae		X		X				1, 2, 4, 5, 19
Bombacaceae		X		X				5, 7, 8
Boraginaceae			X				X	1, 5, 19
Borreria (Rubiaceae)	X				X			1, 6, 17, 19, 21
Brassicaceae	X				X			1, 5, 19
Bromeliaceae	X						X	1, 5, 19
Byrsonima (Malpighiaceae)		X			X			6, 8, 13, 19, 21
Cabralea (Meliaceae)		X		X				2, 4, 7, 13
Caesalpiniaceae			X				X	2, 4, 5
Calyptranthes (Myrtaceae)		X		X				3, 8, 13
Casearia (Flacourtiaceae)		X		X				2, 4, 7, 8, 13, 19, 21
Cassia (Caesalpiniaceae)			X				X	6, 13, 19, 21
Cayaponia (Cucurbitaceae)	X				X			6, 13, 19
Cecropia (Moraceae)		X			X			2, 4, 6, 7, 16, 19, 21
Cedrela (Meliaceae)		X		X				7, 8, 14, 19
Celtis (Ulmaceae)		X		X				6, 14, 19, 21
Centrolobium (Fabaceae)		X		X				8, 13
Chamaesyce (Euphorbiaceae)	X				X			6, 16
Chorisia (Bombacaceae)		X		X				7, 13, 19, 21
Clusia (Clusaceae)		X					X	13, 17, 19, 21

TABLE II (continuation)

Pollen Types	Habit			Vegetation				References
	Non arboreal	Arboreal**	Variable habit	Ombrofilous forest	Grassland, "capoeira" and pioneer plants	Higrophytes and aquatics	Generalists	
Coccoloba (Polygonaceae)		X		X				13, 14, 17, 19, 21
Combretaceae/Melastomataceae			X				X	1, 2, 3, 4, 5, 19
Cordia (Boraginaceae)		X		X				2, 3, 4, 7, 13, 19, 21
Crotalaria (Fabaceae)	X				X			6, 10, 13
Croton (Euphorbiaceae)			X				X	4, 6, 7, 13, 19
Cyperaceae	X					X		1, 5, 19
Daphopsis (Thymeliaceae)		X		X				16, 19
Desmodium (Fabaceae)	X				X			5, 6, 10, 14, 19, 20, 21
Dioscoriaceae	X				X			1, 5, 21
Eupatorium (Asteraceae)	X			X				6, 10, 13, 21
Euphorbiaceae			X				X	1, 2, 4, 5, 19
Erythrina (Fabaceae)		X		X				7, 13, 19
Erythroxylaceae		X		X				1, 2, 4, 5, 19
Euterpe (Arecaceae)		X		X				1, 2, 3, 4, 7, 16, 19
Fabaceae			X				X	2, 4, 5
Ficus (Moraceae)		X		X				2, 4, 7, 8, 14, 19, 21
Flacourtiaceae		X		X				1, 2, 4, 5
Forsteronia (Apocynaceae)		X		X				16, 19
Garcinia (Clusiaceae)		X		X				8
Gomphrena (Amaranthaceae)	X				X			6, 10, 13, 19, 21
Guarea (Meliaceae)		X		X				2, 4, 7, 8, 13, 19, 21
Heliotropium (Boraginaceae)	X				X			6, 13
Hyptis (Lamiaceae)	X				X			6, 10, 13, 19
Ichthiotere (Asteraceae)	X				X			21
Ilex (Aquifoliaceae)		X		X				7, 14, 17, 19, 21
Inga (Mimosaceae)		X		X				2, 3, 4, 7, 8, 13, 19
Jacaranda (Bignoniaceae)		X		X				2, 4, 7, 14, 19
Jatropha (Euphorbiaceae)		X			X			6, 14
Lacistemaceae		X		X				1, 2, 4
Laplacea (Theaceae)		X		X				16, 27
Lecythidaceae		X		X				1, 2, 4, 5, 19
Lithraea (Anacardiaceae)		X		X				1, 7, 13, 19, 21
Loganiaceae			X				X	1, 5
Loranthaceae	X			X				1, 5
Luehea (Tiliaceae)		X		X				13, 19
Ludwigia (Onagraceae)	X					X		6, 10, 19, 21
Machaerium (Fabaceae)		X		X				2, 7, 8, 13, 19
Meliaceae		X		X				1, 2, 4, 5, 19
Menispermaceae		X		X				1, 5, 19
Merremia (Convolvulaceae)	X				X			6, 10, 16
Mimosa (Mimosaceae)			X				X	6, 7, 8, 13, 19
Mimosa scabrela (Mimosaceae)		X			X			8
Mimosaceae			X				X	2, 4, 5
Monocotiledonea			X				X	
Moraceae			X	X				1, 2, 4, 5, 19
Myrtaceae		X		X				1, 2, 3, 4, 5, 19, 21
Myrsine (Myrsinaceae)		X		X				2, 4, 7, 8, 13, 21

TABLE II (continuation)

Pollen Types	Habit			Vegetation				References
	Non arboreal	Arboreal**	Variable habit	Ombrofilous forest	Grassland, "capoeira" and pioneer plants	Higrophytes and aquatics	Generalists	
Ochnaceae		X		X				1, 4, 5, 19, 21
Olacaceae		X		X				1, 2, 4
Onagraceae	X					X		1, 5
Pachira aquatica (Bombacaceae)		X		X				7, 14
Parinari (Chrysobalanaceae)		X		X				2, 4
Passiflora (Passifloraceae)	X			X				6, 11, 17, 19, 21
Palicourea (Rubiaceae)		X		X				1, 6, 11, 16, 19, 21
Paullinia (Sapindaceae)		X		X				1, 13, 19
Philodendron (Araceae)	X			X				1, 13, 25, 26
Phoradendron (Viscaceae)	X			X				6, 16, 21
Physalis (Solanaceae)	X				X			6, 11, 13
Phytolaccaceae	X						X	1, 5, 21
Piper (Piperaceae)		X		X				1, 6, 13, 19, 21
Platymyscium (Fabaceae)		X		X				2, 3, 7, 17, 21
Poaceae	X				X			1, 5, 19, 21
Polygala (Polygalaceae)	X				X			6, 11, 13, 19, 21
Polygonum (Polygonaceae)	X					X		6, 11, 14, 19
Pouteria (Sapotaceae)		X		X				2, 4, 7, 8, 14, 19, 21
Psychotria (Rubiaceae)		X		X				1, 2, 4, 11, 14, 19, 21
Rhamnaceae		X		X				1, 5, 21
Rinorea (Violaceae)		X		X				2, 16
Rubiaceae			X				X	1, 2, 4, 5, 19
Sabicea (Rubiaceae)		X		X				18, 22, 23, 24
Sapindaceae		X		X				1, 2, 4, 5, 19, 21
Sapium (Euphorbiaceae)		X			X			2, 6, 8, 16, 19
Scrophulariaceae	X						X	1, 5, 19, 21
Schinus (Anacardiaceae)		X		X				1, 4, 7, 13
Schwannia (Malpighiaceae)		X		X				28
Solanum (Solanaceae)			X				X	4, 6, 8, 11, 13, 21
Starchytarpheta (Verbanaceae)	X				X			6, 11
Stemodia (Scrophulariaceae)	X				X			6, 17
Sterculiaceae		X		X				2, 5, 19, 21
Stigmaphyllum (Malpighiaceae)	X				X			6, 13, 17
Struthanthus (Loranthaceae)	X			X				11, 14
Symplocos (Symplocaceae)		X		X				2, 4, 14, 19, 21
Tabebuia (Bignoniaceae)		X		X				2, 3, 4, 7, 13, 19, 21
Tachygali (Caesalpiniaceae)		X		X				8, 15
Tapirira (Anacardiaceae)		X		X				1, 2, 3, 4, 6, 7, 15, 19
Trema (Ulmaceae)		X			X			6, 7, 14, 19, 21
Trichilia (Meliaceae)		X		X				2, 4, 7, 8, 13, 19, 21
Typha (Typhaceae)	X					X		6, 9, 19, 21
Vernonia (Asteraceae)			X		X			2, 6, 7, 10, 13, 19, 21
Vigna (Fabaceae)	X				X			6, 15
Vitex (Verbenaceae)		X		X				2, 4, 15, 19

tree pollen types, while non-arboreal and variable-habit pollen types had low concentration (1.3 and 1.5 $\times$ 10^5 palynomorphs/g), and both contributed only 24.5% of total pollen. The vegetation graph shows that rain forest prevailed at this time, with 75.7% of total pollen and 8.4 $\times$ 10^5 palynomorphs/g. Grassland, "capoeira" and pioneer types had 1.9 $\times$ 10^5 palynomorphs/g, and 17.0% of total pollen, while hygrophyte and aquatic pollen types and the generalist group contributed with only 7.3% of total pollen and had low concentrations (0.2 $\times$ 10^5 palynomorphs/g and 0.7 $\times$ 10^5 palynomorphs/g respectively) (Figs. 2 and 3).

Sample 0.77 (column 1) was dominated by non-arboreal types (15.7 $\times$ 10^5 palynomorphs/g and 71.8%

TABLE II (continuation)

Pollen Types	Habit			Vegetation				References
	Non arboreal	Arboreal**	Variable habit	Ombrofilous forest	Grassland, "capoeira" and pioneer plants	Higrophytes and aquatics	Generalists	
Pteridophyts								
Adianthaceae							X	12
Adiantum (Adianthaceae)							X	12
Alsophila (Cyatheaceae)				X				5, 17, 18
Anemia (Schizaeaceae)							X	12
Blechnum (Polypodiaceae)							X	12
Dennstaedia (Polypodiaceae)				X				15
Monolete							X	21
Nephelea (Cyatheaceae)				X				19
Polypodium (Polypodiaceae)					X			6, 12
Salvinia (Salviniaceae)						X		5, 6, 9, 12
Selaginella (Lycopodiaceae)				X				12
Trichomanes (Gleicheniaceae)				X				12
Trilete							X	21
Algae								
Algae						X		30
Spyrogira						X		30
Insertae sedis								
Pseudoschizea						X		29

TABLE III
Pollen grain sum and pollen grain concentration/g of sediment from five sediment samples in the Poço das Antas National Biological Reserve, Silva Jardim Municipality, Rio de Janeiro State.

	Samples depth (m)	Pollen grain	Absolute pollen grain concentration/g of sediment
Column 01	0.37	874	24×10^5
	0.77	1171	23×10^5
	1.20	1021	19×10^5
Column 02	0.21	2112	3×10^6
	1.22	1072	4×10^6

of the pollen sum), followed by tree pollen types (5.3×10^5 palynomorphs/g and 24.3% of the pollen sum). Variable-habit pollen types had low concentration (0.8×10^5 palynomorphs/g) and percentage (3.8%). Grassland, "capoeira" and pioneer types prevailed, with high concentration (15.4×10^5 palynomorphs/g) and percentage (70.5%), over hygrophyte and aquatic (4.3×10^5 palynomorphs/g and 19.6%), rain forest (1.5×10^5 palynomorphs/g and 6.7%) and generalist (0.7×10^5 palynomorphs/g and 3.2%) pollen types (Figs. 2 and 3).

In sample 0.37 m (column 1) non-arboreal ($11, 0 \times 10^5$ palynomorphs/g and 71.2%) prevailed over tree (3.7×10^5 palynomorphs/g and 24.0%) and variable-habit (0.8×10^5 palynomorphs/g and 4.8%) pollen types. The vegetation graph shows a relative equilibrium between concentration and percentage values of rain forest elements (4.7×10^5 palynomorphs/g and 30.4%) and grassland, "capoeira" and pioneer pollen types (4.5×10^5 palynomorphs/g and 29.1%). Hygrophyte and aquatic pollen types (5.5×10^5 palynomorphs/g and 35.1%) were

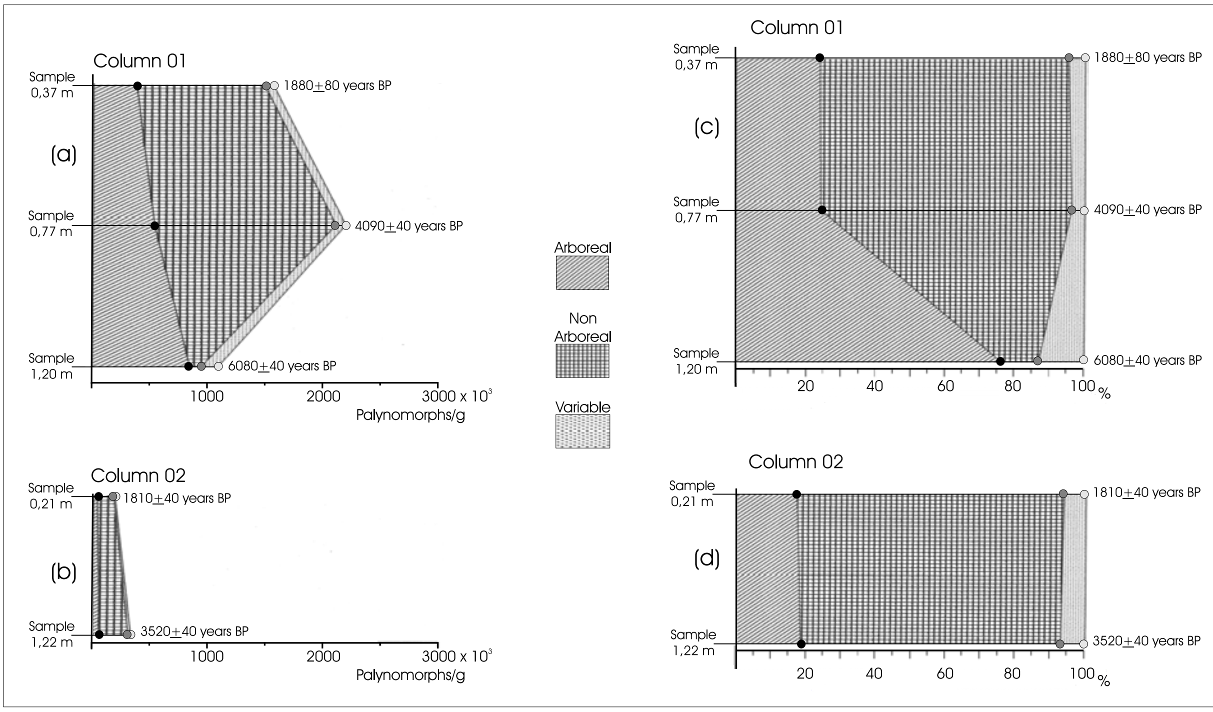

Fig. 2 – Comparison of arboreal, non-arboreal and variable-habit pollen grain content. (a) Concentration graphic of column 1, samples 1.20m and 0.37m; (b) concentration graph of column 2, samples 1.22m and 0.21m; (c) percentage graph of column 1, samples 1.20m and 0.37m; (d) percentage graph of column 2, samples 1.22m and 0.21m.

dominant and generalists were less representative (0.8×10^5 palynomorphs/g and 5.4%) (Figs. 2 and 3).

Sample 1.22 (column 2) showed high percentages and concentrations of non-arboreal pollen types (2.5×10^5 palynomorphs/g and 74.3%). Tree pollen types had only 0.6×10^5 palynomorphs/g, or 18.6% of total pollen, while the variable-habit pollen types constituted the less representative group (0.2×10^5 palynomorphs/g and 7.2%). Hygrophyte and aquatic pollen types prevailed in the environment (1.9×10^5 palynomorphs/g and 57.5%), followed by rain forest (0.7×10^5 palynomorphs/g and 19.6%) and grassland, "capoeira" and pioneer pollen types (0.6×10^5 palynomorphs/g and 17.7%). The generalist group had low concentration and percentage (0.2×10^5 palynomorphs/g and 5.2%) (Figs. 2 and 3).

In sample 0.21 m (column 2) the non-arboreal pollen types (1.4×10^5 palynomorphs/g and 76.3%) prevailed over the tree (0.3×10^5 palynomorphs/g and 17.3%) and variable-habit pollen types (0.1×10^5 palynomorphs/g and 6.3%). The vegetation graph revealed that hygrophyte and aquatic pollen types were dominant ($1, 1 \times 10^5$ palynomorphs/g and 60.5%), followed by rain forest (0.3×10^5 palynomorphs/g and 18.5%) and grassland, "capoeira" and pioneer pollen types (0.3×10^5 palynomorphs/g and 13.8%). Again, the generalists were poorly represented (01×10^5 palynomorphs/g and 7.2%) (Figs. 2 and 3).

The palynological analysis showed a strong dominance of tree pollen types from the rain forest around 6080 years BP in the study area, which today is composed mainly of grassland and pioneer plants, besides forest elements, according to Fernandez et al. (1998). The forest receded around 4090 years BP, firstly grassland and "capoeira" areas became abundant and around 3520 years BP hygrophyte vegetation increased, as in the 1880- and 1810-years- BP samples, and like the vegetation described for the study area today (IBDF/FBCN 1981, Fernandez et al. 1998).

Palynological research in Quaternary sediments in Rio de Janeiro State provided results similar to the data of the present study. Coelho et al. (2002) identified vegetation from a humid environment, between 6300 and

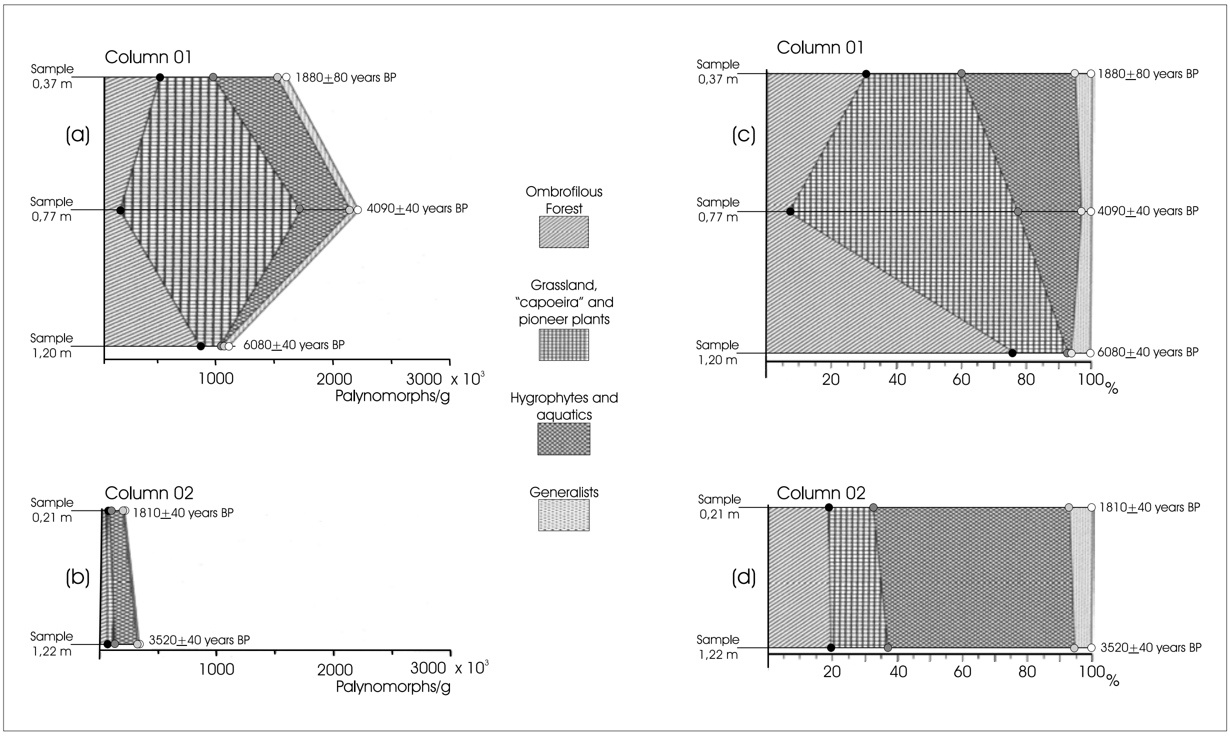

Fig. 3 – Comparison of ombrofilous forest, grassland, "capoeira" and pioneer plants, generalists, hygrophytes and aquatic pollen content. (a) Concentration graph of column 1, samples 1.20m and 0.37m; (b) concentration graph of column 2, samples 1.22m and 0.21m; (c) percentage graph of column 1, samples 1.20m and 0.37m; (d) percentage graph of column 2, samples 1.22m and 0.21m.

4650 years BP in the Guaratiba mangrove area, where tree pollen types from the Atlantic forest prevailed; between 4650 and 1350 years BP, a reduction of wet conditions was observed, associated with progressive forest reduction. Luz et al. (1999), studying sediments from Lagoa de Cima, in northern Rio de Janeiro State, observed a warm, humid phase around 6000 years BP; the swampy areas around the lake were well developed as was a pioneer forest, followed by a drier phase characterized by dry grassland vegetation in the vicinity of the lake. The period around 4000 years BP was the driest phase with high temperatures and the rain forest was confined to hillsides and valleys. Both studies indicate a reduction of rain forest area in periods similar to those observed in the present study.

In conclusion, palynological analysis indicates that the study area, today composed of forest fragments surrounded by grassland and "capoeira" vegetation, was dominated by rain forest around 6080 years BP. The dated samples of 4090, 3520, 1880 and 1810 years BP point to the installation of vegetation similar to that described recently for this fragmented area.

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RESUMO

A Reserva Biológica de Poço das Antas localiza-se no Estado do Rio de Janeiro, na região sudeste do Brasil. O presente estudo teve por objetivo fornecer informações a respeito de características ambientais pretéritas da área por meio de análises palinológicas. Foram coletadas duas colunas de sedimentos e cinco amostras foram selecionadas para datação pelo método de radiocarbono, revelando as seguintes idades, da base ao topo dos testemunhos: coluna 1 – 1,20-1,16 m: 6080 ± 40 anos AP, 0,775-0,735 m: 4090 ± 40 anos AP e 0,38-0,34 m: 1880 ± 80 anos AP; coluna 2 – 1,22-1,18 m: 3520 ± 40 anos AP e 0,23-0,19 m, 1810 ± 40 anos AP. Foram retiradas três amostras da coluna 1 e duas da coluna 2 para análise palinológica: 1,20 m, 0,77 e 0,37 m da coluna 1 e 1,22 m e 0,21 m da coluna 2. O tratamento químico foi baseado em metodologia padrão de preparação de amostras palinológicas. A análise palinológica indica que em torno de 6080 anos AP a área de estudo era dominada pela Floresta Ombrófila e que, por volta de 4090 anos AP, a vegetação tinha mudado para uma floresta fragmentada, restrita às baixas colinas circundadas por áreas de campo aberto, pantanosas e turfosas. A permanência desse tipo de vegetação entre 4000 anos AP e o atual é sugerida pelas amostras datadas de 3520,1880 e 1810 anos AP.

Palavras-chave: Palinologia, paleoambiente, Holoceno, Brasil.

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