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FOREST RESOURCES, CHIEFDOMS AND MORTUARY PRACTICES IN THE NEOTROPICS: PRELIMINARY ARCHAEOBOTANICAL ANALYSIS FROM EL CAÑO (COCLÉ PROVINCE, PANAMÁ) FUNERARY COMPLEX

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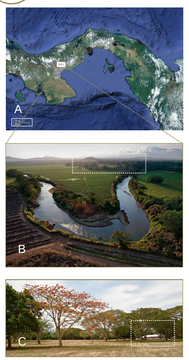
1 Introduction



The site of **El Caño** is located in the floodplain of the **Pacific slope of Panama** at 13 km from the mouth of the Rio Grande (Fig. 1A, 1B, 1C). This is an area with tropical seasonal weather –*awi*-, with two different seasons, one dry and one rainy. The site is periodically flooded during the rainy season.

The tropical dry forest, formed by xeric and mesoxeric species, is dominant. The most common are: cedar (*Cederela odorata*), cedar hawthorn (*Bombacopsis quinatum*), mahogany (*Switenia macrophylla* var. *Humilis*), carob (*Humenaea courbaril*), oak (*Tabebuia rosea*) and corotu (*Enterolobium*). In the mangrove estuaries and coastal inlets the species present are: black mangrove (*Avicennia germinans*), buttonwood (*Conocarpus erectus*), white mangrove (*Laguncularia racemosa*), neotropical mangrove (*Pelliciera rhizophorae*), red mangrove (*Rhizophora mangle*).

Fig. 1. **A**. Location of El Caño on the Pacific slope of Panama; **B**. Floodplain of Rio Grande at El Caño; **C**. Excavation area.

2 Archaeological context

Previous excavations, from 1928 until 1992, uncovered 97 sculptures (Mayo *et al.* 2010), alignments of basalt columns, a causeway and on surface 5 earthen mounds. Recent excavations confirm that the site was used as a **necropolis for high-ranking individuals** between **700-1000 AD** (Mayo & Mayo 2012, *in press*) (Fig. 2 A to E).

Archaeobotanical studies in the Neotropics have focused mainly on the analysis of phytoliths (Piperno 1985; Piperno *et al*. 2000), pollen (Bush *et al*. 1992) or carpological remains (Dickau 2005). However, charcoal analyses are still unusual in tropical region (Thompson 1994). Charcoal studies conducted at the site of El Caño allow us to observe the applicability of this type of analysis in tropical areas. These data complement those obtained from the excavations at other sites and from the sources and ethnographic documentation about the management of forest resources between chiefdoms societies in the Neotropics.

Fig. 2. A and B. Group of gold artifacts associated with main individuals; C to E. Process of excavation of the tombs.

3 Material and methods

The analyzed material comes from the **field work season** of **2008**. The method of collection was manual (Fig. 3 C and D) and by dry sieving using 2 and 1 mm. meshes of 7 sediment samples (160.05 liters) during the excavation. **215 fragments** of **charcoal** from **16 samples** were analyzed:

•71.2% of fragments came from the Stratigraphic Group 5 a concentration of pit-like structures or post holes (Stratigraphic Units 032, 035, 036, 039, 050, 065, 067, 068) (Fig. 3E). The SU050 was dated to 640-720 cal AD and 740-770 cal AD (Beta-244670) (Mayo 2008).

•19.5% of fragments were dispersed in deposits (SU006, SU10), and correspond to the most recent deposits. The SU006 was interpreted as an occupation level with fragments of pottery, stone (projectile points and edges), fragments of a figure of *tumbaga*, a turtle shell and several pieces of gold were recovered. The SU010 is a deposit of sediment in which a large amount of pottery, a projectile point, a shell, a bone fragment and a bead of gold bracelet or necklace.

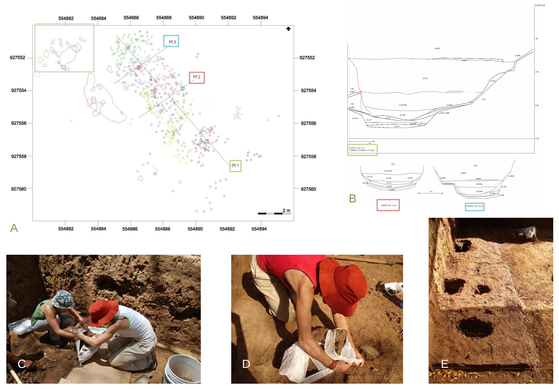


Fig. 3. **A** and **B**. Plan and profiles of the excavation area; **C** and **D**. Largest pieces of charcoal in the process process of collection; **E**. Group of pit –like structures or post holes of the stratigraphic group 5.

The charcoal samples were observed in a reflection light microscope with objectives 20x, 40x, 200x and 400x. The **taxonomic identification** was carried out manually, fracturing the charcoal according to the three anatomical planes of wood: transversal, longitudinal tangential and radial longitudinal. An anatomical description was made from the sheets defined by A. C. Barefoot and F.W. Hankins (1982) and from the criteria for identification of angiosperms established by IAWA (Wheeler *et al*. 1989). Once defined, the anatomical features were compared with our wood reference collection, with wood anatomy atlases (Carpio 2003; Leon 2002; Espinoza & Leon 2001, Espinoza & Melandri 2000) and with a descriptive database (InsideWood.2004-onwards; Richter & Dallwitz 2002). We have also recorded **dendrological features** of the charcoals, changes in the wood prior to combustion (entomofauna and fungi) and those produced during the combustion (cracks and vitrification of the tissues).

4 Results

During charcoal analysis **11 taxa** were differentiated (Fig. 4 A and B). However, some of them could not be identified because they did not correspond to any actual wood samples collected in the vicinity of the site. By comparing them with published descriptions of tropical species **7 taxa were identified** : Fabaceae-Mimosoideae type 1 and type 2, *Manilkara* spp., *Rhizophora* spp., *Schefflera* tp. D1 and *Pelliciera rhizophorae*. We also identified several fragments of monocot. Finally one of the fragments corresponds to a type of indeterminable plant tissue. The identification process was complicated because of the alterations produced by combustion: partial or complete vitrification of tissues or the presence of radial and tangential cracks are frequent.

Morphotype	Taxa	Nb.	%
Taxon A	*Rhizophora* spp.	84	39,07
Taxon B	*Manilkara* spp.	43	20
Taxon C	Fabaceae-Mimosoideae 1	11	5,12
Taxon D	Fabaceae-Mimosoideae 2	1	0,47
Taxon E		9	4,19
Taxon F		53	24,65
Taxon G	*Schefflera* tp. D1	2	0,93
Taxon H		1	0,47
Taxon I		3	1,40
Taxon J	*Pelliciera rizophorae*	2	0,93
Taxon K	Monocot	5	2,33
Unidentifiable 1		1	0,47
TOTAL TAXA		11	-
TOTAL FRAGMENTS		215	100

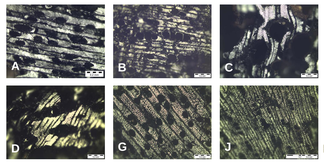


Fig. 4. **A**. Results of the charcoal analyses with morphotypes and taxa proposed. **B**. Photographs of the transversal section of the morphotypes A (*Rhizophora* spp.), B (*Manilkara* spp.), C (Fabaceae-Mimosoideae 1), D (Fabaceae-Mimosoideae 2), G (*Schefflera* tp. D1), J (*Pelliciera rhizophorae*), K (monocot).

The distribution of taxa is heterogeneous between the samples:

✓Dispersed charcoals. 4 taxa were identified: B (*Manilkara* spp.), C (Fabaceae-Mimosoideae 1), D (Fabaceae-Mimosoideae 2) and E. Also a fragment of a plant tissue that could not be determined.

✓Stratigraphic Group 5 (Fig. 5A). 8 taxa were identified: A (*Rhizophora* spp.), B (*Manilkara* spp.), F, G (tp *Schefflera*. D1), H, I, J (*Pelliciera rhizophorae*), K (monocot). Highest variability was documented in SU034, 068 and 035. In the rest of the samples only one taxon was identified, in 6 cases *Rhizophora* spp. and *Manilkara* spp. in the other. There is a **clear dominance** of ***Rhizophora* spp**. First in the **number of fragments** (54.9%) and second in the **recurrence of appearance** (77.78%). The other taxa appeared more sporadically.

The micro-spatial distribution of *Rhizophora* spp. was **concentrated in several postholes** located in close proximity (Fig. 5B). The dimensions of these fragments, the monospecificity of the sample, and the presence of angular corners in all of the fragments suggest the samples represent the burning of posts *in situ* or are the result of the burning of wood in the interior of these excavated structures. The sample in which *Manilkara* spp. was identified is also related to the Stratigraphic Group 5, but away from the largest concentration of structures. The different taxonomic composition and the location could indicate a different process of formation of the sample.

A

Stratigraphic Group 5 (7th – 8th centuries AD)										
Morphotype	Taxa	Stratigraphic units								
		032	034	035	036	039	050	065	067	068
Taxon A	*Rhizophora* spp.		3		6	20	20	20	10	5
Taxon B	*Manilkara* spp.	3								
Taxon F				53						
Taxon G	*Schefflera* tp. D1		2							
Taxon H				1						
Taxon I			2	1						
Taxon J	*Pelliciera rhizophorae*		2							
Taxon K	Monocot									5
TOTAL TAXA		1	4	3	1	1	1	1	1	2
TOTAL FRAGMENTS		3	9	55	6	20	20	20	10	10

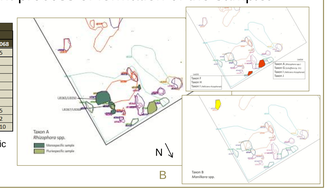


Fig. 5. **A**. Results of the charcoal analyses of the Stratigraphic Group 5. **B**. Micro-spatial distribution of the different taxa.

5 Discussion and conclusion

During the 7th – 8th centuries AD, when El Caño was a funerary complex, **firewood and timber collection** took place in the **mangroves** (Fig. 6A) and **other forest formations** (*Manilkara* spp., *Schefflera* tp. D1, Fabaceae-Mimosoideae). In El Caño the mangrove is represented by *Rhizophora* spp. and *Pelliciera rhizophorae*, the latter currently having a limited distribution along the Pacific coast from southern Costa Rica to Panama (Ellison 2004). The closest area to the site of El Caño with this type of vegetation are the mangroves of Rio Grande (Flores *et al*. 2009, Ellison 2004), which today are located 17-18 km downstream; although the possibility that the extent of the mangroves was greater at the time of the occupation of El Caño cannot be excluded (Fig. 6B). The **extension** of **catchment territories** is also attested by the presence of mangrove mollusks at other hinterland sites, such as the site of Cerro Juan Díaz (Cooke & Ranere 1994; Jiménez & Cooke 2001), and at Natá near El Caño, where large quantities of cocaleca shells, cambumbia shells, mangroves snails, oysters, etc. has been recovered (Torres 1992). The mangrove wood has traditionally been used as fuel, to produce coal, timber (piles, poles of houses, posts, canoes, paddles) and instruments for fishing (Garcia & Polanía 2007). Its wood is particularly appreciated for buildings because its hardness and resistance to wood decay.

Fig. 6. **A**. Mangrove. **B**. Mangroves of Rio Grande.

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