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Late Pleistocene/early Holocene tropical forest occupations at San Isidro and Peña Roja, Colombia

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Evidence of early occupations by hunter–gatherers in diverse tropical forests is increasing the world over (e.g. Gorman 1971; Pavlides & Gosden 1994), even in America (Roosevelt et al. *1996). This paper reports them in northern South America. Several lines of evidence suggest that many kinds of forests, some or all without modern analogues, existed in the American tropics during glacial times and remained there, with changing composition, until the present. According to evidence presented here, human beings adapted to those forests in northern South America since, at least, the end of the Pleistocene.*

Northern South America is not a homogeneous geographical area. The Ecuadorian Andes form a continuous, although diverse, mountain chain (with high inner valleys, *jalcas* and *páramos*), flanked in both sides by lowlands covered with rain forests. In southwestern Colombia the Andes split into three branches of different geological origin, forming interandean valleys much wider than the narrow valleys of the Central Andes and even Ecuador. Between the three *cordilleras* there are two low river valleys, the Magdalena and the Cauca. On both sides, as in Ecuador, there are lowland areas covered with tropical rain forests: the narrow Pacific strip and the Amazon Basin. To the north of the latter extend large plains covered with grasses, forested along the rivers. The rest of the area is made up of rolling savannas along the Colombia Caribbean and the arid strip of the Atlantic coast of Venezuela. These geographical variants on the Equator produce dramatic climatic changes along the altitudinal gradient. And the differences of insolation and solar exposure, of rainfall, and of soils, make a mosaic of markedly different and narrow tiers, except in the Amazon and the Eastern Plains where the ecosystems are substantially wider.

The available archaeological evidence indicates that humans occupied most of these varied ecosystems of northern South America by late Pleistocene/early Holocene times with a diverse stylistic and technological repertoire. In fact, hunter–gatherers were exploiting open areas (FIGURE 1) in the arid coast of Venezuela (e.g. Ochsenius & Gruhn 1979; Jaimes 1994); in the Orinoco river basin (Barse 1990); and in the semi-arid Magdalena valley (López 1995). Evidence for human occupation of diverse tropical forests is better and well-organized in some regional sequences, and yet more abundant in high mountain forests, such as the Sabana de Bogotá (e.g. Correal 1986), and the upper and middle Calima valley (Cardale 1992). Although there is sparse evidence indicating that the tropical lowlands may have been occupied since the late Pleistocene (Correal 1977; Reichel-Dolmatoff 1987: 47), good information of occupations dating to 9000 BP has been obtained only recently from a terrace of the Caquetá river in the Colombian Amazon (Cavelier *et al.* 1995). There a pre-ceramic occupation occurs in a tropical rain forest with unifacial tools and the exploitation of vegetal resources with grinding artefacts. This evidence is presented in this paper, along with new evidence of late Pleistocene hunter–gatherer adaptations to a tropical mountain forest in the valley of Popayán, in southwestern Colombia, where bifacial, unifacial

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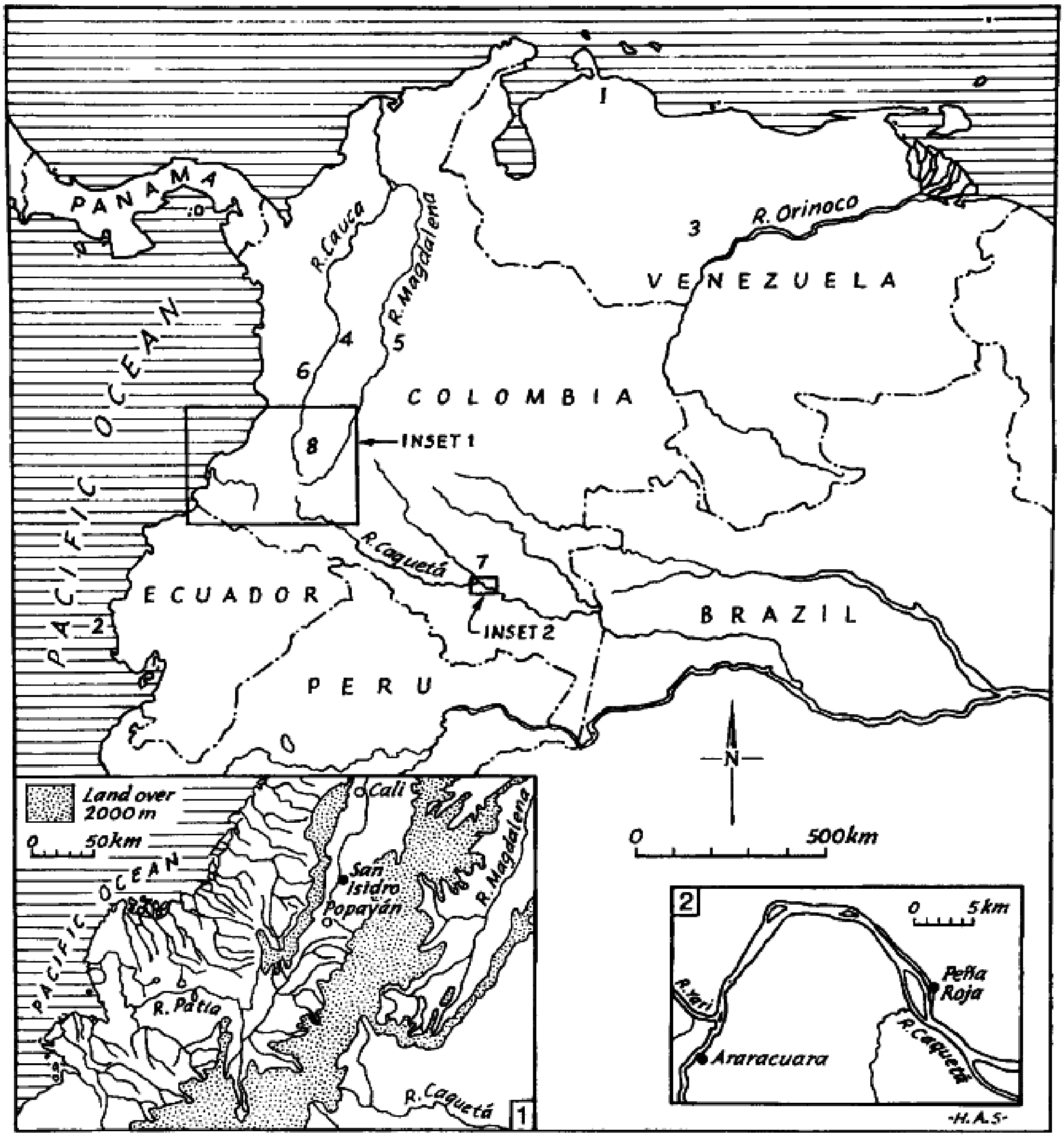

FIGURE 1. *Location of regions of northern South America mentioned in the text, including San Isidro and Peña Roja in Colombia.*

1. *coastal Venezuela:* 2. *Santa Elena:* 3. *Orinoco:* 4. *Magdalena:* 5. *Sabana de Bogotá:* 6. *upper Calima:* 7 *middle Caquetá:* 8. *valley of Popayán.*

and grinding tools have been uncovered along with abundant charred vegetal material.

San Isidro, in the valley of Popayán

San Isidro is located in an interandean valley, about 50 km northwest of the modern city of Popayán, in southwestern Colombia (FIGURE 1). The archaeological site lies in the open on the flat summit of a small hill, 1690 m above sea level. Although most of the area around the site was cleared long ago, remnants of original vegetation correspond to subandean forest (*sensu* Cuatrecasas 1958). Modern annual rainfall is 1800 mm; it must have been substantially higher

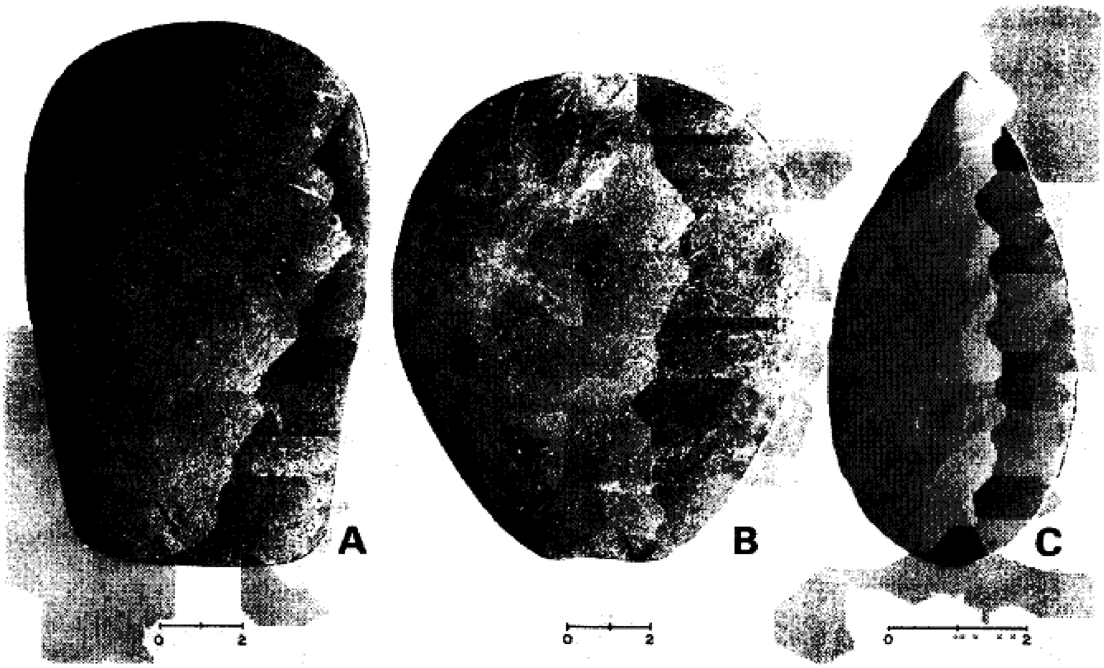

FIGURE 2. *Lithic tools from San Isidro.* A: *polished adze;* B: *edge-ground cobble;* C: *bifacial projectile point.*

in the past under forest cover. A single pre-ceramic component at the site covers approximately 60 sq. m; 20 sq. m, some 30% percent of the areal extension of the deposit, were excavated in 1993 using 1x1-m units and controlled by 5-cm levels. Soil was screened with a 5-mm mesh; 6 litres of sediments from each level were saved for flotation.

The archaeological deposit has a thickness of 40 cm (from 20 to 60 cm below the surface), with cultural material sparsely scattered between 5 and 85 cm below surface. The largest concentration is in a thickness of some 5 cm at an average 40 cm below surface; this suggests that the site was formed by a relatively short occupational event. Other than this vertical displacement of a minor amount of cultural material, there are no evidences of stratigraphic disturbance. This shallow pre-ceramic deposit is not unusual for the valley of Popayán, a dissected plateau with a very slow rate of soil formation in the uplands away from the rivers, like the one where San Isidro is located.

The soil has a weak organic development that lacks internal stratigraphy other than a normal pedological differentiation; the stratigraphy is of a developing soil profile which masks cultural stratigraphy. The A horizon is composed of an uppermost, sandy-loam humic stratum without cultural material, which is located over stratum 2 of the same texture; the few potsherds found in this stratum are not enough to identify a ceramic occupation of the site. The AB horizon is composed of strata 3 and 4 of sandy texture. The pre-ceramic occupation of the site is entirely restricted to stratum 3, lower portion sterile, which is easily distinguishable from the A horizon both in excavation and in section. Finally, the B horizon is composed of strata 5–8, all with a clay texture; this horizon was only exposed in the excavation of a deep test pit in unit ON5O. The rest of the units were excavated only to an average depth of 1 m.

Soil analysis and field observations indicate that the pre-ceramic occupation occurred in soils formed by erosion and biochemical activity of pyroclastic materials, with minimal sedimentary input (except, perhaps, falling ashes of holocene volcanic events). The weight of the upper levels has compacted the lower ones; the former are softer and less compact. From the bottom upwards the profile is progressively less compact and darker due to a higher content of

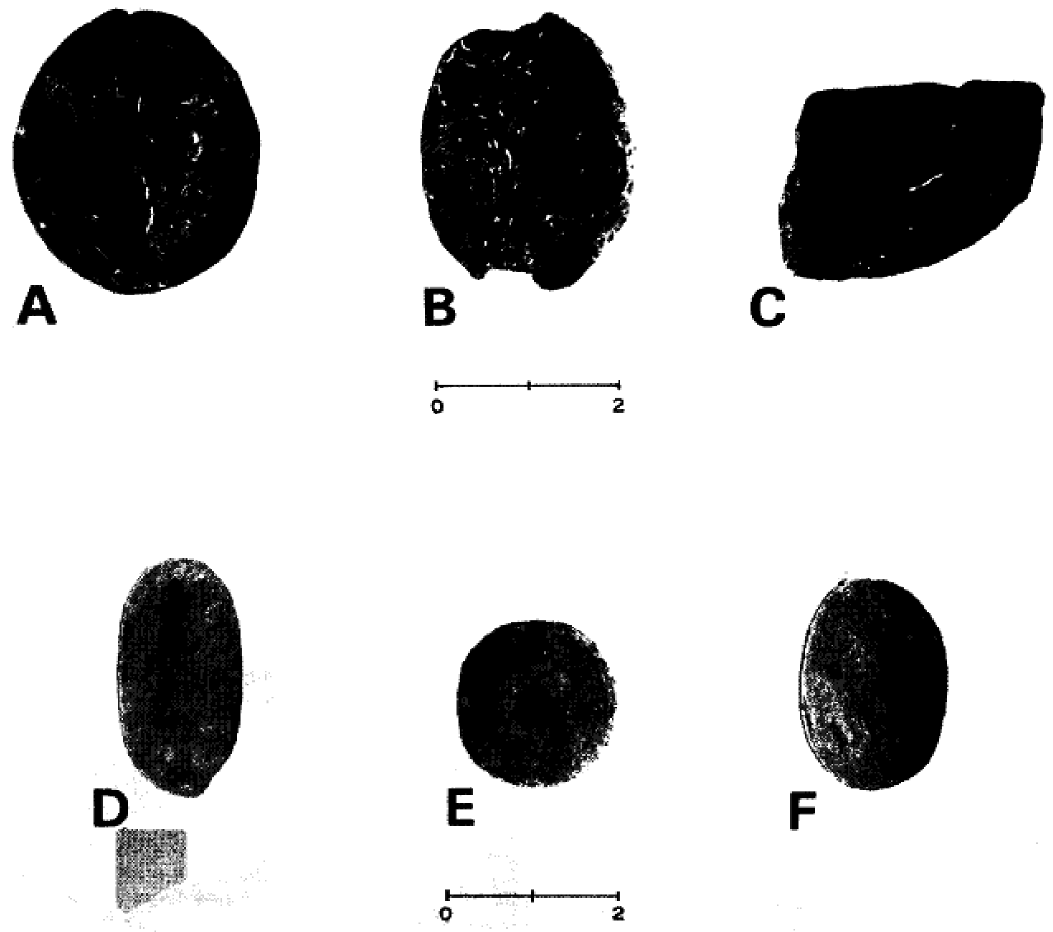

FIGURE 3. *Macro-botanical remains from San Isidro* (A–C) *and Peña Roja* (D–G). A: Persea; B: Virola; C: Caryocar; D: Oenocarpus bataua; E: Oenocarpus *sp.*; F: Oenocarpus bataua.

humus. With a high clay content in the AB horizon, waterlogging was common; this explains the abundance of dark ferro-manganese nodules in the lower part of the AB horizon.

The organic content of the stratum containing the pre-ceramic occupation is small, as reflected in low readings of organic matter (10%) and phosphorus (1·9%). This may be due to organic decomposition or indicate that occupation by mobile hunter–gatherers contributed very little organic content; the site lacks a midden, such that human occupation is only evident through cultural material in an otherwise normal soil profile.

Two conventional ^{14}C determinations on single wood charcoal samples from the middle of the archaeological deposit, clearly and unambiguously associated with the cultural material, are 9530±100 b.p. (B-65877) and 10,050±100 b.p. (B-65878); an additional AMS determination on a charred seed is 10,030±60 b.p. (B-93275). Excavation indicates the site was a knapping station where hunter–gatherers made lithic artefacts and everyday activities. The groups exploited a wide variety of forest resources, especially palm fruits. Information on hunting rests entirely on lithic tools.

More than 58,000 lithic items were found, most of chert; only 514 (less than 1%) are artefacts (FIGURE 2); more than 99% is knapping debris, 84% less than 1 cm in the longest dimension. Most of the tools are *ad hoc* artefacts; 3·5% are cobble stones modified by use, primarily on the edges; 4 are edge-ground cobbles, traditionally associated with grinding (Ranere 1978: 78–9); 1 specimen is a polished adze with no trace of use; 22% of the artefacts are bifaces in different stages of manufacture, from slightly knapped flakes (still retaining percussion platforms and bulbar sections) to finished projectile points.

Low-power use-wear analysis of the lithic assemblage (Gnecco 1994) shows tools were used for game processing, both for butchering and for hide preparation, for working boughs or bones of small diameter, for sawing either animal or vegetal matter, and for grooving. The rest of the tools were used in flint-knapping (hammerstones and abraders) and grinding vegetables. Phytoliths and starch grains of economically useful plants have been recovered from one grinding artefact (Dolores Piperno pers. comm.), while wood, apparently of the genus *Podocarpus*, has been recovered from three small unifacial tools (Nieuwenhuis 1996).

A considerable amount of vegetable material was recovered from the archaeological deposit (FIGURE 3A–C), preserved in the acid soil matrix by its carbonization. More than 3000 specimens are fragments from cortical or husks covers from the fruits of an undetermined palm species; 10 seed fragments are palm fruits, perhaps of the genus *Acrocomia*, typical of the tropical lowlands, which has several edible species. It is likely that the covers also belong to this genus. Three seed fragments belong to *Persea*, a genus with 82 species, some edible. Five almost complete seeds belong to the genus *Virola*, some of whose 40 species are still used by lowland aboriginal groups of Colombia as hallucinogens. Two fragments of the cortical cover of a fruit are of the lowland genus *Caryocar*, 15 species whose nut is edible, and a single nut was also identified to this genus.

All the genera identified include edible species, except *Virola* (which has hallucinogenic properties). None of the species that may have been eaten need processing, although the nuts of *Acrocomia* and *Caryocar* fruits must be broken from their cortical cover. It is worth noting that this evidence complements that previously found in late Pleistocene and early Holocene sites in Brazil, where palm fruits and other lowland, economically useful species were also exploited by hunter–gatherers (*cf.* Prous 1991; Magalhaes 1994; Roosevelt *et al.* 1996).

If current environmental conditions apply to the past of San Isidro, the forest formation in the valley of Popayán was of subandean type, similar to tropical rain forest, but with fewer and less abundant species. Its biodiversity is large, and it includes many useful botanical species, including 8 genera of palms, and 50 of mammals, birds and fish (Cuatrecasas 1958: 245–7; Carrizosa & Hernández 1990: 29–30). Yet analysis of pollen and macro-botanical remains indicates that the forest formation in the area at the Pleistocene–Holocene boundary has no modern analogues (Gnecco 1995); it is a mix of low- and high-altitude species, allopatric now and sympatric then. The hunter–gatherers of San Isidro inhabited a forest more like the modern rain forest than the modern subandean forest; its animal biomass must have been as low as in tropical forests today.

Peña Roja site, on the Caquetá river

The archaeological site of Peña Roja is located on a riverine terrace of the Caquetá river 50 km downstream from Araracuara, in the Colombian section of the Amazon basin (FIGURE 1). It has an altitude of 170 m above sea-level, where its temperature oscillates between 24° and 28° Celsius. Rainfall averages 3500 mm. The current vegetation around the site is a tropical rain forest (*sensu* Cuatrecasas 1958).

Archaeological investigations in 1991 and 1993 found a pre-ceramic component beneath a ceramic one. An auger survey in the middle of the terrace revealed 350 sq. m of the pre-ceramic component, which dates to about 9000 years before present according to the following ^{14}C determinations: GX-17395: 9125±250 b.p.; B-52963: 9160±90 b.p.; B-52964: 9250±140 b.p. A 4x2-m test pit was excavated in 1993, with a total of 36 artificial levels of 4 cm. Macro remains larger than 0·5 cm were recovered by dry screening, smaller lithic and charred remains through flotation. Soil analyses were done for each level. Analysis of 10 samples for pollen revealed too little to warrant counting.

The ceramic component is restricted to strata 2 and 3. Stratum 4 (levels 10 through 12) mix

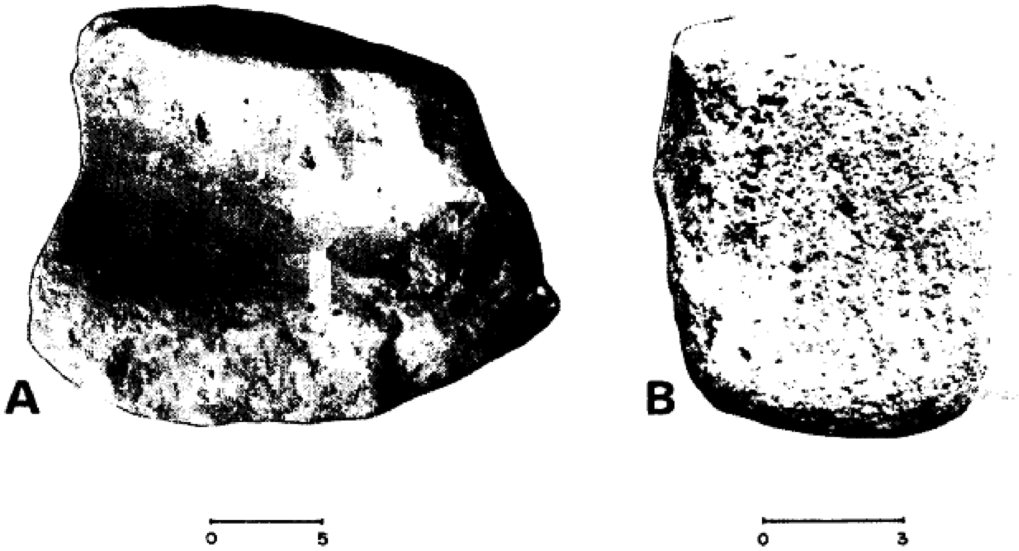

FIGURE 4. *Lithic tools from Peña Roja.* A: *milling stone;* B: *flat mortar.*

ceramic and pre-ceramic materials. From level 13 downward, in strata 5, 6, 7 and 8, the archaeological deposit includes only pre-ceramic material; some alteration in this component resulted from the activity of animals and roots. A stratigraphical discontinuity between ceramic and pre-ceramic levels was evident through pedological analyses: at stratum 4 (22–54 cm) the amount of lime suddenly increases, while that of clay decreases. In stratum 5 (54–68 cm) the values of clay and lime are normal for sandy soils. Organic matter, also decreasing in stratum 4, increases once more during the ceramic period. The discontinuity is also evident in levels of aluminium, with low values during the pre-ceramic period. Only the ceramic strata present structure, indicating agricultural activity in the anthropic soil and the absence of agriculture below. Phosphorus values above 350 ppm, very high for Amazon soils, reveal three moments of intense occupation: one in the superior strata, corresponding to the ceramic component, and two separate events in the pre-ceramic component (54–122 and 122–164 cm).

Artefacts, as well as carbonized vegetable remains, mainly seeds, were found in all levels. Lithic artefacts were of local raw material: chert, clastic sedimentary rocks, igneous and metamorphic rocks, a diversity in raw material available at the middle Caquetá formations (Urrego 1991: 45). A high concentration of lithics occurs from level 14 downward, with an important concentration — 15% of the total — on level 22. The lithic assemblage from Peña Roja consists mainly of artefacts made on small chert cobbles (50–70 g); bifacial artefacts and fine retouch are conspicuosly absent. *Ad hoc* artefacts — mainly sharp flakes with use wear along an acute edge — comprise the majority of tools: concave scrapers on thick flakes, flakes with notches, perforators, wide base wedges; some artefacts are multiple tools. Among the more interesting are a fractured milling stone (FIGURE 4A), flat mortars (FIGURE 4B), and several grinding stones.

Following previous studies of lithic function (Ranere 1980; Flannery 1986; Alonso & Mansur 1990) a separation may be suggested between tools used in game processing and tools used for processing wood and edible vegetable material. Unretouched flakes and perforators appear to have been used for processing game and fish; concave scrapers, notches, and wedges were likely used to work wood. Grinding stones, flat mortars, and the fractured milling stone were probably used to process all kinds of nuts.

Charred macro-botanical remains include several plant species (FIGURE 3D–F), palms representing 68% of the total; 8 palm species, belonging to 4 genera, were identified: *Astrocaryum* with three species, *A. javari*, *A. aculeatum* and *A. sciophilum*; *Oenocarpus* with 3 species, *O. bataua*, *O. bacaba* and *O. mapora*; *Mauritia* with 1 species, *M. flexuosa*; and *Maximiliana* in its 1 species, *M. maripa* (Cavelier *et al.* 1995: 34). *A. javari* shows the greatest abundance in pre-ceramic levels 22 and 23; in the ceramic levels the abundance of this species falls. The high frequency of *A. javari* is highly significant; there is no ethnographic record of its human consumption, only of its use as fishing bait. *A. aculeatum* reaches a maximum concentration in pre-ceramic level 23, falling considerably in all other pre-ceramic levels and appearing in minimal amounts on upper ceramic levels; *A. sciophilum* follows the same trend, with a maximum quantity in level 23, a smaller frequency on level 14, and no evidence in the ceramic levels. *Oenocarpus*, as well as *Astrocaryum*, reveals patterns which might indicate early hunter–gatherer diet. *O. bataua* presents two trends: in the pre-ceramic component, the highest amount is in levels 22 and 23; much less appears in level 14; from levels 13 upward its presence decreases dramatically. *O. mapora* appears from level 14 to 24, highest frequency in level 23. *Mauritia flexuosa* only appears in the pre-ceramic component, maximum abundance in level 22. *Maximiliana maripa* is present in both ceramic and pre-ceramic components.

Palynological data (*cf.* Van der Hammen 1974; Van der Hammen *et al.* 1991) show the climatic sequence and vegetation from mid-Pleniglacial (65,000 BP) onwards in the middle Caquetá, where Peña Roja is located (see also Colinvaux *et al.* 1996). During the Tardi glacial two different climatic events took place: the Guantivá interstadial, 12,600–11,000 BP, hotter and more humid than at present; then the colder and drier El Abra stadial. In the Island of Mariñame, in the middle Caquetá, a more humid climate occurs towards the beginning of the Holocene, around 10,150 BP (Urrego 1991); 9000–8000 BP, the climate became drier and the vegetation on the island a Cecropia pioneer forest; more humid period followed 6500–4000 BP. All in all, there is strong palynological evidence for a tropical rain forest existing in the middle Caquetá by the time of human occupation of Peña Roja.

Discussion

The ecofactual evidence from San Isidro and Peña Roja shows hunter–gatherers relied heavily on plants; it can be posited that a successful and lasting hunting–gathering way of life in tropical forests must be generalized and flexible, relying more on gathering than on hunting, given a low animal biomass and the heterogeneous distribution of vegetal resources (e.g. Gilmore 1950; Beckerman 1993; Politis & Rodríguez 1994).

Evidence from both sites suggests human impact and modification of the ecosystem as early as 10,000 BP. Pollen data from San Isidro, with families such as *Leguminosae* and *Gramineae* and the one pioneer species *Plantago* among mainly primary forest species, suggests forest clearing naturally or by human agency; one artefact from San Isidro is a polished adze. The overwhelming amount of palm remains in both sites may represent dietary preferences or resource availability, or a humanly induced concentration of palm trees and their seasonal exploitation. The artificial concentration of favoured species would have requiered tending and planting, including forest clearing, much in the way contemporaneous amazonian groups do, from hunter–gatherers (Politis 1996) to agriculturalists (Posey 1984). And the three *Persea* seeds from San Isidro (longest, 6 cm) may be from a cultivar, as they are larger than average for a wild population (see Smith 1966; 1969). One edge-ground cobble from San Isidro was used for grinding arrowroot, *Maranta arundinacea* (Piperno pers. comm.). Piperno (1995: 139–41; see Piperno *et al.* 1991: 238) has suggested that arrowroot was domesticated in prehispanic Panamá by the 9th millenium BP, based on evidence for habitat displacement of this species; this may also be the case in San Isidro.

The human preference for palms defines new adaptive strategies in the humid forests of tropical America (see Balick 1984; 1988; Clement 1993) and demonstrates their complexity. Non-agricultural adaptations to tropical forests can only be tentatively modelled from ethnographic data, while ecological models must not ignore the human capacity to use alternative resources. San Isidro and Peña Roja, in documenting early hunter–gatherers' exploitation of diverse tropical forests, also suggest that human beings were modifying and impacting on the ecosystem from very early times.

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