Early prehistoric sedentism and seasonal animal exploitation in the Caribbean lowlands of Colombia

Peter W. Stahl \textsuperscript{a,}\textsuperscript{*}, Augusto Oyuela-Caycedo \textsuperscript{b}

\textsuperscript{a} Department of Anthropology, Binghamton University, P.O. Box 6000, Binghamton, NY 13902-6000, USA
\textsuperscript{b} Department of Anthropology, University of Florida, 1112 Turlington Hall, Gainesville, FL 32611, USA

Received 20 October 2006; revision received 13 February 2007
Available online 23 April 2007

Abstract

San Jacinto 1 represents a special-purpose settlement that was used by late Archaic foraging groups who logistically moved from base camps to special-purpose camps in order to collect and process subsistence resources at the onset of the dry season in the Caribbean savannas of northern Colombia. Situated in an optimal location for permanent water and seasonal concentrations of dry season subsistence items, the site’s location was part of a logistic strategy in which specific task groups were moved to resources during a short season of availability. Preserved vertebrate and invertebrate faunas at San Jacinto conform to expectations about assemblage ubiquity, richness, and evenness or equitability within the early occupational strata at the site. Specific animals including turtles and fish were pursued, and may have been processed with \textsuperscript{C}3 plants and grasses in ubiquitous earth ovens. Certain local aquatic invertebrates were also procured along with the collection of specific extra-local gastropods.

Keywords: Archaic foraging; Logistic mobility; Sedentism; Seasonality; Zooarchaeology; Neotropical savannas; Colombia; Diversity indices

Our earliest evidence for fiber-tempered pottery in the western hemisphere is found at the site of San Jacinto 1 in the savannas of northern Colombia (Oyuela-Caycedo and Bonzani, 2005). We consider it likely that other pottery-bearing sites in this region may yield earlier dates because the end of the area’s preceramic sequence remains unknown (Raymond et al., 1998; Reichel-Dolmatoff, 1986); however, San Jacinto’s early pottery is important as it appears in association with evidence for seasonal subsistence rounds, social mobility, intensive plant processing, and the scheduled procurement of animal resources. Its high resolution contexts provide us with a unique opportunity to study early human subsistence in an inland savanna and to analyze the circumstances surrounding early sedentism and the origins of pottery and food production.

In particular, it is suggested that San Jacinto 1 was a special-purpose settlement for foraging groups that logistically moved from base camps to special-purpose camps as they collected and processed plants and animals at the onset of the dry period in a highly seasonal tropical savanna which was probably drier than today (Oyuela-Caycedo...
and Bonzani, 2005:2). Evidence suggests that San Jacinto 1’s inhabitants focused on the availability of starchy seeds and other resources concentrated along a small stream during the driest months of the year from November through January, and possibly into March. Previous analyses of the site have focused on plant and invertebrate exploitation within the context of seasonal mobility (Bonzani, 1995, 1997; Oyuela-Caycedo, 1993, 1996, 1998; Oyuela-Caycedo and Bonzani, 2005), and here we incorporate information from analyses of all associated archaeofaunas. We begin with a brief summary of some important theoretical implications for understanding the early onset of sedentism and its relationship to early pottery and food production in a highly seasonal savanna and active floodplain environment, and identify possible material correlates of logistic mobility. We then introduce San Jacinto 1 within its temporal and environmental setting. The remainder of the paper considers associated vertebrate and invertebrate archaeofaunal evidence at the site within the context of hypothetical expectations of early logistic mobility during the dry season in the northern Colombian savannas.

Theoretical expectations: sedentism, early pottery, food production, and seasonality

San Jacinto 1 is an important and high resolution archaeological context for investigating the relationship between sedentism, early pottery, the origin of food production, and group territoriality in a markedly seasonal environment. Here, we use a general concept of sedentism which considers reduced mobility and increased territorial control through the constant presence of one group in the same location (Oyuela-Caycedo and Bonzani, 2005:34). We are interested in why these Archaic inhabitants of the seasonal savannas in northern Colombia might have changed mobility strategies to become increasingly sedentary. We pay particular close attention to variations in mobility as cultural strategies which can be employed in fluctuating environments and that are closely related to temporal and spatial variations in resources (see Steward, 1938; Thomas, 1983; Bettinger, 1991; Kelly, 1995:116–120; Binford, 1978, 1980, 2001).

Mobility is one of several buffering mechanisms or cultural responses to variations in the timing, spatial structure, relative intensity, and predictability of subsistence resources (Halstead and O'Shea, 1989; O'Shea, 1981). In heuristic fashion, Binford (1978, 1980, 2001:256–257) distinguishes between subsistence foraging and collecting strategies that correlate with mobility strategies along a graded continuum at whose extremes lie residential and logistic mobility (see discussions in Bettinger, 1991:100–103; Ebert, 1992; Humphreys, 1987; Kelly, 1995; Oyuela-Caycedo and Bonzani, 2005:175; Preucel, 1990:12–13; Price and Brown, 1985; Thomas, 1983). Foraging strategies “map” consumers on to critical resources through frequent movement of residential bases from and to which foragers leave and return on a daily basis in order to exploit resources in the locations where they are encountered. Collecting strategies use logistically organized task groups to procure critical resources at temporary field camps or special-purpose locations which supply a larger group of consumers located at residential bases (Binford, 1980).

Under what conditions do populations become sedentary? Reduced mobility is a common denominator between the origins of pottery, an increase in sedentism, and the beginnings of food production in tropical America (Piperno and Pearsall, 1998; Raymond, 1998). A strategy of reduced mobility can occur during environmental changes, which leads to social intensification (“social storage” as defined in Binford, 2001:370–371) and/or economic intensification (Testart, 1982). Social and economic intensifications are strategies selected to average out resources in space and time by reducing the risk of unpredictability (Cashden, 1992; Kelly, 1995:144–152). Intensification of social activities would include means to maintain conflict resolution as numerous groups are usually attracted to the same resources found in patchy and seasonal environments. Social mechanisms for conflict resolution might include activities that involve the development of reciprocal exchange networks often labeled under the term of “feasting” (Hayden, 1990, 1995, 2001). Economic intensification could be expressed in activities related to the processing of food resources (Stahl, 1989), with expected increases in the diversity of artifacts used in processing (i.e., groundstone and/or pottery), and the recovery of subsistence remains suggesting a focus on only a few species at specific site locations. This economic intensification is also interpreted as an initial stage in the processes leading toward full time food production (Bar-Yosef and Belfer-Cohen, 1992; Bonzani, 1995:1–53, 1997; Flannery, 1986; MacNeish, 1992; Piperno and Pearsall, 1998), division of labor and hierarchy (Binford, 2001:424–433), and ideological changes...
(Cauvin, 2000a; Hastorf, 1994,1999), or what Hastorf (2006:99) refers to as creating identity and territoriality with plants and trees.

What conditions might favor a strategy in which consumers “map on” to critical resources and which might favor a logistically organized strategy? Based on ethnographic estimates of residential mobility for hunter-gatherer populations, Binford (1980:14; 2001:269–276) has suggested that the highest incidences of mobility are found in extremely productive equatorial environments and less productive arctic environments, while reduced mobility prevails in temperate and boreal zones. Labor is reorganized in logistical strategies where consumer or residential mobility is restricted, and where critical resources are incongruent. Logistic mobility is favored when critical resources are spatially incongruent as collectors move their residential camps closer to the resource with the greatest bulk demand while making use of special task groups that extract targeted resources in special-purpose locations for consumption in the base camp. Temporal incongruence can be solved through preservation and storage, which by exacerbating spatial incongruence through the accumulation of bulk in one place, can further increase the logistical component of the settlement system (Binford, 1980:15). Binford (1980:18; 2001:260) has also argued that the prevalence of storage is correlated with a decrease in the growing season, and that the expected role of logistic mobility is greater under conditions of increased seasonal variability.

When the availability of critical wild resources is relatively predictable yet highly seasonal, mobility strategies and territoriality are adjusted to the timing and location of the resource. Mobility decreases and sedentism increases to coincide with seasonal abundance. (Oyuela-Caycedo and Bonzani, 2005:150). We expect to see a strategy of logistic mobility in the strongly seasonal savanna environment as organized task groups spatially and temporarily focused their extractive efforts on specific critical resources in order to ensure availability in times of scarcity. It is important to consider the patterned variability in archaeological assemblage properties that might be expected between special-purpose sites located where resources are extracted, and residential locations to where extracted resources are relocated for consumption by the larger group. In markedly seasonal settings, variability in the content of assemblages between different sites is expected to increase as these assemblages are associated with particular procurement strategies undertaken at special-purpose extraction sites. Greater content redundancy is also expected in these assemblages, due to very high re-use of the same special-purpose location (Binford, 1978:482–497).

Oyuela-Caycedo and Bonzani (2005:48–49) presented a number of related hypothetical expectations associated with early logistic mobility in the highly seasonal savannas of northern Colombia. They explored material patterning in the preserved assemblage of San Jacinto 1, which was considered as a special-purpose extraction site occupied during the dry seasons. These included: increased assemblage redundancy and feature clustering as specific tasks were repeatedly undertaken at the same location in serial fashion during dry season occupations; intensification in food processing and the presence of large quantities of associated artifacts; and, the adoption of specialized pottery to assist in social and economic intensification. They further presented evidence of critical subsistence resources in the form of preserved botanical remains that were dominated by seasonally abundant plants which could be processed into storable subsistence items for potential consumption at an associated residential site. In this paper, we add to the case for early logistic mobility at San Jacinto 1 by exploring the likelihood that the site’s associated faunal assemblage is similarly dominated by seasonally available, concentrated, and easily captured species that might also have served as potentially storable resources.

**San Jacinto 1**

San Jacinto 1 is the older of two sites found near the modern town of the same name, in the Department of Bolívar approximately 85 km to the southeast of the city of Cartagena (Fig. 1). The site lies at 210 m asl on the edge of the Serranía de San Jacinto, a series of foothills that rise to an elevation of 700 m asl. The surrounding Sabanas de Bolívar experience mean annual temperatures of 27.5 °C and strong annual contrasts between a protracted dry season from December to April/May with another short dry period in July/August, and the wettest month in October with a shorter rainy period in May/June (Oyuela-Caycedo, 1993:24–36).

Cultural strata at the site had originally been exposed through stream cutting by the adjacent quebrada San Jacinto, revealing a profile of anthropic occupation layers under 4 m of overburden
Initial auger testing confirmed a total of 26 strata, with strata 9 through 20 yielding the Archaic materials. Excavation of a 5 m by 15 m area consisted of removing overburden (strata 1 through 8) followed by the detailed stratigraphic excavation of strata 9 through 26. The stratigraphy in strata 9 through 20 was clearly defined by darker anthropic soils separated by lighter colored sterile alluvium which had been deposited through the accretion of a point bar during the rainy seasons. Some 75 m² of an estimated 346 m² of site deposits were excavated, with 875.66 kg of flotation samples taken from floors and features.

Evidence for the earliest human activity at San Jacinto 1 was recovered in strata 9, 10, 12, 14, 16, 18, and 20 (Fig. 2). Thirteen uncalibrated radiocarbon dates bracket these occupation layers between 5940 ± 60 BP (Pitt, 0155) and 5190 ± 40 BP (Beta 183291). Wet season flooding was defined by separate layers of yellowish alluvium in Strata 11, 13, 15 17, and 19. From stratigraphic and geoarchaeological perspectives, migration of the stream channel affected the development of the living floors and produced cross-bedding stratigraphy as San Jacinto 1’s inhabitants had settled in a point bar environment which was abandoned during the rainy season.
from April to November when the possibility of flooding was highest (Oyuela-Caycedo and Bonzani, 2005:52). During the dry season, the site would have been an optimal location as a persistent source of permanent water and for the seasonal concentration of subsistence resources.

Archaeological excavations uncovered 174 features, of which 112 were defined as clay-lined earth ovens or fire pits (Fig. 3). As the most abundant features at the site, these ovens or pits reveal a high redundancy of cooking activities typical of Archaic food processing in the Americas during the transition from foraging to part-time cultivation (Wandsnider, 1997). Sixty-eight pits were defined as cooking ovens, characterized by shallow to deep pits with carbonized layers at their bottom levels, and medium amounts of fire-cracked rocks used in boiling, cooking, and steaming. Forty-four fire pits used for direct and open cooking were identified by small to medium pits with carbonized layers at their bottom levels, and low amounts of fire-cracked rock.

A total of 78,697 g of plant fiber-tempered pottery, mostly fragments of semi-globular and globular pots, was recovered from all the cultural strata. Pottery fragments were relatively rare and found in a restricted spatial distribution which never included contexts of abandonment, caches for later use, nor associations with cooking features or artifacts. Pottery was likely not used in cooking, but rather performed a social role for fermented drinks

Fig. 3. Aerial perspective of redundant cooking features revealed in excavations at San Jacinto 1.
and serving. Vessels may have been curated and transported in periodic seasonal moves to a base camp. In addition to over two tons of recovered fire-cracked rock, lithic artifacts included slab, block, and basin-shaped metates, manos, very small mortars likely used as nutcrackers, and hammerstones, some discarded examples of which were reused as fire-cracked rock. The abundant grinding and pounding implements were probably used for processing wild grasses or rhizomes. Lithic items were all manufactured from local sources and typical of an expedient technology expected for groups with reduced mobility and little need to travel far for raw materials (Oyuela-Caycedo and Bonzani, 2005:106).

The technology suggests that the main cooking activity was focused on producing a wet mush or dry flour from grass seeds or C3 plants. Macrobotanical remains recovered from all the anthropic strata include: carbonized seeds of Malvastrum sp., possibly used as cordage or for leaf wraps in cooking; Portulaca sp. consumed as a pot vegetable; Eupatorium sp. and Polygonum sp., both weedy semi-aquatic succulent herbs; Cyperaceae, (cf. Cyperus sp. and Eleocharis sp.) found in swampy disturbed flooded areas; Leguminosae seeds and fruits; and, carbonized culms, leaves or other monocot plant parts identified tentatively as Poaceae or grass. One seed identified as belonging to the family Sapotaceae was recovered from a posthole. Other botanical remains that were initially thought to be small seeds of grasses (Bonzani, 1995:152-154, 1997) have undergone further analysis and are identified as spores of fungi, some of which were probably a wood-rotting type (i.e., Polyporous spp.) that would have originated in dead branches collected from the ground and used for firewood (Lee Newsom, personal communication, 2003). Microbotanical evidence includes indeterminate grass and arrowroot (Maranta arundinacea) phytoliths that were identified in a sample collected from under a cached block metate (Dolores Piperno, personal communication, 1995). The recovered botanical remains indicate that the site was utilized at the beginning of the dry season in this area of the savannas when these plants are in the process of fruiting and seed dispersal (Bonzani, 1998).

**Faunal exploitation at San Jacinto 1**

We are interested in how inferences derived from the preserved archaeofaunal assemblage at San Jacinto 1 conform to hypothetical expectations of early logistic mobility for faunal procurement in a highly seasonal savanna environment. During the recurring dry season occupations of the site, we expect that early foragers focused on the repeated exploitation of a restricted set of specific animal resources. These resources became highly predictable subsistence items through increased seasonal availability, local abundance, concentration, and/or ease of capture during the dry season, when they could potentially have been processed into storable food.

We expect specific patterns in the San Jacinto 1 archaeofaunal assemblage if prehistoric foragers systematically and repeatedly exploited a restricted range of key animals during each dry season occupation. In terms of prey ubiquity, specific animals should be consistently present within each of the anthropic strata that comprise the early occupations of the site. In terms of assemblage richness, the number of different kinds of exploited animals should be relatively low within each of the early anthropic strata, as inhabitants of San Jacinto 1 repeatedly focused their primary effort on a few highly predictable subsistence items during the dry season. In terms of assemblage evenness or equitability, the faunal component of each prehistoric dry season occupation should be numerically dominated by these principal prey resources, alongside smaller amounts of less important taxa. In terms of food preservation, these principal dry season animal resources could be processed into potentially storable subsistence products.

**Assemblage accumulation and preservation**

A total of 1647 non-human vertebrate and 24,522 invertebrate specimens were recovered in association with the earliest occupations at San Jacinto 1. Table 1 lists the vertebrate archaeofaunal specimens, excluding a small concentration of non-subsistence-related human bones in stratum 9. The vertebrate assemblage is numerically dominated by poorly preserved specimens that could not be reliably identified to zoological class, and a significant amount of reptile fragments (Fig. 4). These latter specimens comprise over one half of the assemblage by weight (Fig. 5), and consist primarily of fragmented turtle shell.

Most of the vertebrate specimens in the sample were fragmented and highly degraded. This was particularly noticeable in the extensive mosaic cracking on broad surface areas of turtle carapace and...
plastron elements. Many specimens were encrusted with variable amounts of calcrete (or caliche), which is a material commonly formed through cementation, accumulation, and/or replacement in subsurface matrices that lie above the level of permanent ground water in warm environments with limited rainfall (Goudie, 1983:93–95). X-ray diffraction analysis identified the adhering material as a siliclastic detritus composed principally of calcite with minor contributions of quartzite and feldspar (David Jenkins, 2004, personal communication). Prior to examination, many vertebrate specimens were pretreated in alternating baths of dilute acetic acid and water (Stahl and Brinker, 1991). Large calcrete conglomerates which included minor amounts of hydroxyapatite along with the common weathering materials of hard rock were also completely disaggregated and examined microscopically.

Fig. 4. Relative frequencies of vertebrate archaeofauna recovered in association with the earliest occupation of San Jacinto 1.

Fig. 5. Relative weights of vertebrate archaeofauna recovered in association with the earliest occupation of San Jacinto 1.
appear to be consistent with turtle/tortoise assemblages that were deposited after human consumption (Sampson, 1998:992; 2000).

No evidence for carnivore alteration or human butchery was observed in the highly degraded assemblage, and only three indeterminate shell fragments had any noticeable indication of thermal alteration. Archaeologists have characterized patterned burning on the dorsal side of carapace elements, through turning the animal upside down and roasting it in its shell, as a distinguishing feature of human consumption (Flannery and Wheeler, 1986:287; Sampson, 1998:998; Speth and Tchernov, 2002:473). Werner (1990:149) describes this practice for the slaughter of tortoises by the Kayapó of Central Brazil as they ready ingredients for the preparation of meat pies in earth ovens, a culinary practice which we explore in greater detail below. The reptile’s plastron is broken open with axes in order to expose edible meat which consists mainly of organs, and leg and neck muscles. The heart is torn out, and the tortoise is thrown upside down on burning rocks which are used to heat the oven.

It is probable that the San Jacinto 1 assemblage was subject to some degree of alluvial sorting, as the occupied portion of the site was a point bar that formed through relatively low energy accretion of deposits during annual inundation at the height of the wet season. The bulk of the vertebrate specimens was recovered in association with anthropic sediments within each occupation stratum at the site ($N = 1569$, or 95.3% of the total vertebrate assemblage), whereas only a minor portion ($N = 78$, 4.7%) was recovered in association with the alluvial strata. Almost all identifiable turtle/tortoise specimens ($N = 472$, or 94.4% of all turtle/tortoise bones) were recovered in direct association with the anthropic occupation floors. Element representation suggests minimal hydrodynamic sorting of deposited specimens, as the predominant elements in each stratum include various flat shell bones with large surface areas that would be expected to sort early under low energy current (Shipman, 1981:30). However, Blob’s (1997) experimental studies, undertaken with anatomically different soft-shelled turtle elements, indicate that small or flat bones may resist transport as they become entrained in the low velocity viscous sublayer of the stream profile. His study predicts variably intermediate and late dispersal for different elements of the turtle shell. Each anthropic stratum at San Jacinto 1 contains preserved carapace and plastron specimens; otherwise, skeletal elements potentially susceptible to hydrodynamic transport are missing. The absence of free vertebrae, cranial/mandibular, and limb elements might be explained by fluvial winnowing; however, they might also be absent for some other reason, including increased fragmentation or selective removal during processing by humans (Sampson, 2000:786).

Table 2 lists the invertebrate archaeofaunas that were recovered in association with the late Archaic human occupations of San Jacinto 1. During site excavation, mollusk specimens were separated by type, after which representative samples were identified by Juan Parodiz (then of the Invertebrate Section, Carnegie Museum of Natural History). Due to errors in the field, variation between two species of *Pomacea* was not identified; therefore, the table presents combined figures for this genus. The invertebrate assemblage is numerically dominated by three taxa (Fig. 6).

<table>
<thead>
<tr>
<th>Taxon</th>
<th>Common name</th>
<th>NISP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bivalvia</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mycetopodidae</td>
<td>Freshwater mussels</td>
<td></td>
</tr>
<tr>
<td><em>Anodontites hyrioides</em></td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>Hyriidae</td>
<td>Freshwater mussels</td>
<td></td>
</tr>
<tr>
<td><em>Diplodon</em></td>
<td>1007</td>
<td></td>
</tr>
<tr>
<td><em>Ecuadorea hylaeus</em></td>
<td>1</td>
<td></td>
</tr>
<tr>
<td><em>Prisodon alatus</em></td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Gastropoda</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Prosobranchia</td>
<td>Operculated gill-bearing snails</td>
<td></td>
</tr>
<tr>
<td>Ampullaridae</td>
<td>Apple snails</td>
<td></td>
</tr>
<tr>
<td><em>Pomacea cornucopialeegans</em></td>
<td>14308</td>
<td></td>
</tr>
<tr>
<td>Poteriidae</td>
<td>Poteria snails</td>
<td></td>
</tr>
<tr>
<td><em>Neoeclytus</em></td>
<td>9144</td>
<td></td>
</tr>
<tr>
<td>Thiariidae</td>
<td>Marsh snails</td>
<td></td>
</tr>
<tr>
<td><em>Doryssa</em></td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Conidae</td>
<td>Marine cones</td>
<td></td>
</tr>
<tr>
<td><em>Conus</em></td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Pulmonata</td>
<td>Non-operculated lung-bearing snails</td>
<td></td>
</tr>
<tr>
<td>Indeterminate</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bulimulidae</td>
<td>Bulimulid land snails</td>
<td></td>
</tr>
<tr>
<td><em>Drymaeus cf. virgulatus</em></td>
<td>5</td>
<td></td>
</tr>
<tr>
<td><em>Orthalicus</em></td>
<td>25</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>24505</td>
<td></td>
</tr>
<tr>
<td>Decapoda</td>
<td>Freshwater crabs</td>
<td>17</td>
</tr>
<tr>
<td>Total</td>
<td>24522</td>
<td></td>
</tr>
</tbody>
</table>

NISP refers to the total number of identified specimens.
Again, only a minor portion \((N = 369, 1.5\%)\) of the mollusk specimens was recovered in direct association with the alluvial strata. The available evidence strongly suggests that the deposition of Pomacea and Neocyclotus can be attributed to cultural activity. All of the deposited specimens are of large adults. A similar exploitation of these two species, some 1000 years later, is recorded for the distant site of San Jacinto 2. Clusters of intentionally discarded adult snails, which seem to be the product of singular storage events in perishable containers, are redundant in strata 10, 12, and 14. Moreover, a spatial analysis of the two genera in stratum 9 indicates concentrations into separate clusters on the floor, with Neocyclotus being more spatially concentrated than Pomacea. In particular, Neocyclotus is an extra-local snail which is not found anywhere in the immediate vicinity of the site, but was imported by San Jacinto 1’s human occupants.

Dry season vertebrate exploitation

The preserved turtle and tortoise specimens at the site include at least four identified genera that currently inhabit the area (Table 1). Most are aquatic or semi-aquatic taxa that prefer quiet waters with soft bottoms, and that often congregate in pools or burrow in mud during the dry season. Trachemys scripta, in particular, is known to bask along river margins in large numbers and nest during the dry season when females deposit up to 35 large eggs (Ernst and Barbour, 1989; Savage, 2002). Turtles, and in particular their eggs, are singularly important dry season resources for contemporary savanna dwellers of central Brazil, whose seasonal forays are intended for gathering eggs on exposed beaches, along with intensive hunting and fishing (e.g., Coimbra et al., 2002:161, 167; Cormier, 2003:47; Maybury-Lewis, 1974:39; Murphy and Quain, 1955:27; Wagley, 1977:52; Werner, 1990:106). Also during the dry season, fishing with traps, poisons, or bow and arrow is greatly facilitated by receding water levels, decreased turbulence, and concentration of fish within intermittent ponds (e.g., Coimbra et al., 2002:166; Cormier, 2003:47; Werner, 1990:97).

Other vertebrate prey can persist near rivers and in gallery forests during dry periods, as seasonally decreasing food resources continue to be available in these areas. Iguanas can be plentiful, especially females who annually lay up to 70 eggs in sandy beaches and river terraces during the dry season in order to ensure that the emergence of hatchlings coincides with the onset of rains (Müller, 1972). The Miskito of eastern Nicaragua search inland beaches, lagoons, and swamps for Trachemys and Iguana during the dry season, when both taxa assume dietary importance (Nietschmann, 1973:91, 115). Today, in the lower basin of the Magdalena River and the Serrania of San Jacinto, Icoteas (Trachemys) meat and Iguana eggs and meat are collected and consumed mainly between March and April. In the seasonal savanna climate, caiman congregate in remnant water bodies during the dry season (Ojasti, 1996). The common large agouti is particularly susceptible to trapping during periods of fruit shortage (Smyth, 1978:3), and the larger paca concentrates in or near forest galleries where both food and protection are available throughout the dry season (Collett, 1981:555–556, 564). Other mammals like felids, peccary, deer (all presently extinct in the region), and raccoons also frequent water bodies and riverside galleries in savanna areas where they find food and cover, particularly at the height of the dry season.

Vertebrate ubiquity

Table 3 lists the frequency with which recovered vertebrate specimens are associated within each early occupation stratum at San Jacinto 1. The grouping of categories includes indeterminate specimens and corresponds roughly to zoological Order while accommodating some separation for ecological purposes. In addition to indeterminate specimens, two categories of identified vertebrates are found in recurrent association with each of the repeated human occupation floors at the site. Turtle/tortoise specimens are almost as ubiquitous as indeterminate fragments within each of the
occupational strata, and we strongly suspect that many of these indeterminate fragments likely include unidentifiable carapace or plastron fragments. Bony fish, particularly catfish, are also ubiquitous within the human occupation levels at San Jacinto 1. To a lesser extent, deer and large rodents are also recurrently associated with the repeated occupations, whereas most other vertebrate categories are only intermittently associated.

**Vertebrate richness**

We expect that the numbers of different kinds of vertebrate prey items found in association with each occupation stratum should be relatively low if the early human occupants of San Jacinto 1 were repeatedly pursuing a restricted set of resources during their dry season occupations of the site. Using the data in *Table 3*, we plot the values of common diversity measures for each occupation stratum. Each maintains a somewhat consistent relationship until the largest subsample (stratum 18) and smallest subsample (stratum 20) are encountered (Fig. 7). However, interpretation of these indices is not at all clear because richness values are strongly and significantly correlated to sample size differences between the different strata (Grayson, 1981). When corresponding numbers of vertebrate specimens within each occupation stratum are used as cumulative increments toward sampling to redundancy (e.g., Lepofsky and Lertzman, 2005; Lyman and Ames, 2004), asymptote is not reached until 700 to 800 specimens are recorded, which far exceeds the totals for any of the recovered stratum samples.

We next explored rarefaction (e.g., Gotelli and Colwell, 2001; Raup, 1975; Tipper, 1979) in order to compare vertebrate richness between the occupation strata. A rarefaction curve for vertebrate remains at San Jacinto 1 was generated, using Analytical Rarefaction Ver. 1.3, created by Steven Holland and available on the University of Georgia Stratigraphy Lab web page (http://www.uga.edu/strata/software/Software.html). The overall curve shape does not rise steeply, suggesting that the samples are numerically dominated by a few items (Gotelli and Colwell, 2001:382), which we examine in the following section. Fig. 8 illustrates the relationship between assemblage richness (Sample S) and estimated richness based on rarefaction (Estimated S) for each stratum at its respective sample size, along with upper and lower 95% confidence intervals. The richness figures suggest some variability between the occupation strata: strata 18 and 20 fall below the lower 95% confidence interval, strata 12 and 16 are comparable to estimated values, strata 14 and 9 fall below the estimate but within the lower confidence interval, and stratum 10 exceeds the

---

**Table 3**

Numerical distribution of non-human vertebrate archaeofaunas associated with the earliest anthropic strata at San Jacinto 1

<table>
<thead>
<tr>
<th>Identified faunas</th>
<th>Shark</th>
<th>Bony fish</th>
<th>Catfish</th>
<th>Frog/toad</th>
<th>Turtle/tortoise</th>
<th>Crocodile</th>
<th>Iguana</th>
<th>Snake</th>
<th>Reptile indet.</th>
<th>Bird</th>
<th>Edentate</th>
<th>Raccoon</th>
<th>Large cat</th>
<th>Peccary</th>
<th>Deer</th>
<th>Large rodent</th>
<th>Mammal indet.</th>
<th>Indeterminate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Taxon</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>9</td>
<td>10</td>
<td>12</td>
<td>14</td>
<td>16</td>
<td>18</td>
<td>20</td>
<td>Total</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stratum 9</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>3</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stratum 10</td>
<td>9</td>
<td>5</td>
<td>3</td>
<td>10</td>
<td>15</td>
<td>2</td>
<td>44</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stratum 12</td>
<td>3</td>
<td>5</td>
<td>1</td>
<td>11</td>
<td>5</td>
<td>1</td>
<td>26</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stratum 14</td>
<td>1</td>
<td>5</td>
<td>1</td>
<td>27</td>
<td>35</td>
<td>44</td>
<td>472</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stratum 16</td>
<td>55</td>
<td>108</td>
<td>103</td>
<td>27</td>
<td>135</td>
<td>44</td>
<td>472</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stratum 18</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>4</td>
<td>6</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stratum 20</td>
<td>5</td>
<td>7</td>
<td>2</td>
<td>1</td>
<td>4</td>
<td>1</td>
<td>15</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>280</td>
<td>395</td>
<td>181</td>
<td>57</td>
<td>317</td>
<td>324</td>
<td>1569</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

---


338
upper 95% confidence value. We compare these values with Kintigh’s (1984, 1989, 1992) widely used simulation which tests the null hypothesis that separate assemblages are random samples drawn from a parent population. Fig. 9 plots the relationship between richness (ordinate) and sample size (abscissa) along with mean values and 90% confidence intervals for each early occupation stratum. The results are somewhat comparable, as only the richness value in stratum 10 exceeds the upper 90% confidence interval and strata 12 and 16 are similar to estimated values; however, strata 9 and 14 clearly join strata 18 and 20 below the 90% confidence interval. It appears that the richness values for vertebrate faunas in many of the earliest occupation levels tend to be depressed, suggesting that a relatively narrow range of different faunas was accumulated and deposited at San Jacinto 1. We suspect this outcome may in part be due to late Archaic foragers repeatedly pursuing the same restricted set of prey items in each of the dry season occupations at the site.

**Vertebrate evenness**

This interpretation is supported by the gradual slope of the rarefaction curve, and a comparable examination of evenness values for vertebrate taxa in the occupation strata, each of which is strongly dominated by a restricted set of categories. Using Kintigh’s technique, Fig. 10 plots the relationship between evenness (ordinate) and sample size (abscissa) along with mean values and 90% confidence intervals for vertebrate categories associated with each of the early strata. The analysis clearly reveals the repeatedly uneven distribution of specimens within the represented categories. Each stratum is disproportionately dominated by certain vertebrate categories, principally turtles, fish, and indeterminate fragments (Table 3).
Dry season invertebrate exploitation

The preserved invertebrate specimens at the site are dominated by three identified genera (Table 2). *Diplodon* is a freshwater mussel that was deposited in appreciable quantities on the occupation floors, and which would have been locally available in the stream that runs past the site. The bulk of the invertebrate assemblage is comprised of two different genera of operculated snails. *Pomacea elegans* and *P. cornucopia* are today the only mollusks found in the river during the driest point of the season. *Pomacea* are amphibious snails that possess a mantle cavity with both lung and gill, enabling them to respire terrestrially or while submerged at the water surface where they lay their egg masses. *Neo-cyclotus*, on the other hand, is extra local. This genus is found in very humid subandean cloud forest environments with large amounts of palms, such as in the Cerro Maco which is located in the upper part of the Serranía de San Jacinto, less than 10 km distant. It is also important to mention the presence of two tree snails, *Drymaeus cf. virgulatus* (Férussac) and *Orthalicus cf. maracaibensis* (Pfeiffer, 1856), also reported as *undatus* (Bruguière). Ecological data for these genera from the Sierra Nevada de Santa Marta (Breure, 1984) and from the Cordillera de la Costa National Park “Henry Pittier” in Venezuela, confirm an association with dry xerophytic communities or arid thorn woodlands with annual precipitation below 500 mm. This corroborates interpretations based on column analyses and shell midden formation (Oyuela-Caycedo, 1996) that the environment was more arid than today, with a prolonged dry season.

Invertebrate ubiquity

Table 4 lists the frequency of invertebrate specimens associated with the early occupation strata at San Jacinto 1. Both *Pomacea* and *Neo-cyclotus* are found in recurrent association with each repeated human occupation at the site; otherwise,
only *Diplodon* appears in any appreciable quantity in most of the occupation strata.

**Invertebrate richness**

The data in Table 4 suggest that the early occupants of San Jacinto 1 were repeatedly pursuing a restricted set of invertebrate resources during their dry season occupations of the site. Using these figures, we plot the values of different diversity measures for each occupation stratum which maintain a highly consistent relationship until the largest subsample (stratum 18) and smallest subsample (stratum 20) are encountered (Fig. 11). Unlike the vertebrate samples, the richness values are not correlated to differences in subsample sizes between...
the different strata, certainly as the invertebrate sample has quickly reached asymptote by the third lowest subsample at roughly 2000 specimens. An exploration of the relationship of richness within each occupation stratum using rarefaction, again reveals a gently upcurving slope which

Table 4
Numerical distribution of identified invertebrate archaeofaunas in the lowest anthropic strata at San Jacinto 1

<table>
<thead>
<tr>
<th>Identified Faunas</th>
<th>Stratum</th>
<th>9</th>
<th>10</th>
<th>12</th>
<th>14</th>
<th>16</th>
<th>18</th>
<th>20</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anodontites</td>
<td></td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td>6</td>
</tr>
<tr>
<td>Diplodon</td>
<td></td>
<td>275</td>
<td>646</td>
<td>78</td>
<td>2</td>
<td>1</td>
<td></td>
<td></td>
<td>1002</td>
</tr>
<tr>
<td>Ecuadoria</td>
<td></td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Prisodon</td>
<td></td>
<td></td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Pomacea</td>
<td></td>
<td>1940</td>
<td>7044</td>
<td>2319</td>
<td>773</td>
<td>1733</td>
<td>266</td>
<td>2</td>
<td>14077</td>
</tr>
<tr>
<td>Neocyclotus</td>
<td></td>
<td>402</td>
<td>2185</td>
<td>1885</td>
<td>1270</td>
<td>2649</td>
<td>614</td>
<td>6</td>
<td>9011</td>
</tr>
<tr>
<td>Doryssa</td>
<td></td>
<td></td>
<td>1</td>
<td></td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>Drymaeus</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Orthalicus</td>
<td></td>
<td>14</td>
<td>6</td>
<td>4</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td>25</td>
</tr>
<tr>
<td>Pulmonates Indet.</td>
<td></td>
<td>3</td>
<td>6</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>4</td>
</tr>
<tr>
<td>Decapoda</td>
<td></td>
<td>1</td>
<td>14</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>16</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>2635</td>
<td>9887</td>
<td>4289</td>
<td>2048</td>
<td>4403</td>
<td>881</td>
<td>8</td>
<td>24151</td>
</tr>
</tbody>
</table>

Fig. 11. Diversity indices for invertebrate archaeofaunas arranged by stratum.
may suggest uneven distribution of plotted categories. Fig. 12 illustrates the relationship between assemblage richness (Sample S) and estimated richness based on rarefaction (Estimated S) for each stratum at its respective sample size, along with upper and lower 95% confidence intervals. The richness figures also suggest some variability within the site: strata 18 and 10 fall below the lower 95% confidence interval, strata 9, 12, 16, and 20 fall below estimated values yet lie within the lower 95% confidence interval, and only stratum 14 lies slightly above the estimated richness figure, but well within the upper 95% confidence value. Fig. 13 uses the Kintigh simulation to plot the relationship between richness (ordinate) and sample size (abscissa) along with mean values and 90% confidence intervals for invertebrate categories associated with each early occupation. With the exception of stratum 18, and perhaps 10, the relationship between richness and respective sample sizes is difficult to separate.

**Invertebrate evenness**

Using Kintigh’s simulation, evenness values for invertebrate taxa within the occupational strata clearly indicate that, with the exception of stratum 20, each is dominated by a restricted set of categories (Fig. 14). Stratum 20, the earliest of the occupational strata at San Jacinto 1 has a relatively small sample size (N = 8) with both *Pomacea* and *Neocyclotus* present. These two genera are disproportionately dominant in all the other strata (Table 4).

**Discussion**

San Jacinto 1 is the first high resolution Archaic archaeological site with fiber-tempered pottery in Latin America that illustrates the complexity of variation in site formation, features, and material culture associated with the complex circuit of mobility and territorial resource use in highly seasonal tropical environments. Contextual and associational
data suggest that Archaic foragers of northern Colombia were repeatedly occupying San Jacinto 1 in the fourth millennium before the Christian era and using it as a preferred logistic camp during which they assumed particular tasks and procured specific game at the height of the savanna dry season. The spatial distribution of features suggests that the site had been utilized annually on a seasonal basis at the beginning of the dry season, and all strata except stratum 9 correspond to expectations for special-purpose sites of logistically mobile populations (Oyuela-Caycedo, 1993:112–124, 1998). Feature density is high, use is redundant and there is a near random distribution of features. These results are expected with seasonal re-occupations of a site. In this case, the degree of redundancy follows the expectations of a pattern that is very likely the product of a logistically mobile group that
used the site as a seasonal special-purpose camp (O’Connell, 1987; Binford, 1978:495–497). Further, it is very likely that the site was occupied for a few days at a time during each season.

A restricted range of redundant and primarily small prey dominates the faunal profile of the occupation strata at San Jacinto 1. Lupo and Schmitt (2005) demonstrate how behavioral variation, along with other factors like length of site occupation and seasonal precipitation can obscure assemblage interpretation and lead to erroneous conclusions if the results of focused foraging choices are considered as representative of the entire prehistoric diet. San Jacinto 1 is an archaeological context with relatively unambiguous patterning that resulted from short term and redundant occupations. Only when considered together with contemporaneous sites that reflect a variety of different seasonal and task foci, might we begin to understand the entire diet of late Archaic Colombian savanna foragers (Lupo and Schmitt, 2005:350).

It is difficult to identify specific preservation technologies from the recovered sample of vertebrate remains. Certainly, the capture and subsequent penning of live turtles is feasible, as is the collection of turtle eggs on nearby beaches. Smoking, salting, sun-drying, or parboiling surplus turtle, fish, and sundry meats are also possibilities (e.g., Coimbra et al., 2002:167; Nietschmann, 1973:211–212). However, the relatively large amount of turtle shell debris, in frequent association with thermally altered soil and fire-cracked rock, reminds us of the well-documented accounts of meat pies produced in earth ovens by various Brazilian savanna dwellers, for whom turtle collection is an essential feature of seasonal life. In general, the earth oven consists of a pile of firewood topped by large rocks. After the fuel is ignited and while the pile is burning, the meat pies are prepared. Banana or Heliconia leaves are covered with a manioc paste, to which lumps of meat are added, often topped by another layer of paste, after which the leaves are folded over and tied to form a large wrapped pie. After the fuel has been burned, the oven’s contents are swept out, the pies are laid in the center, and the rocks are piled on top. A final, heavy pile of dirt is placed over the contents in order to insulate the oven. After cooking, the oven is dug up, and the pies are removed for distribution and consumption (cf. Nimuendajú, 1967:34–35; Maybury-Lewis, 1974:45; Werner, 1990:72). Vegetable foods cooked in the numerous earth ovens could have included tubers or a mash made of seed flour which was wrapped in the leaves of either grass or species of Marantaceae. The cooking process was completed by sealing the pit, either with a cover or with earth. Once the food was cooked, the oven had cooled, and the food was extracted, the pit was refilled with earth.

We suspect that the species of Pomacea were exploited for food in the adjacent San Jacinto stream when they were easier to locate during the dry season. Neocyclotus, on the other hand, would have been gathered in the humid forest of the Serranía de San Jacinto, perhaps by a task-specific group that journeyed there and back in the same day. Considering that the amount of meat that can be extracted from either snail is not high, it is conceivable that they were perhaps an occasional or secondary source of protein. Oyuela-Caycedo and Bonzani (2005) have suggested the use of their opercula in the manufacture of beads. Juan Parodiz (1993, personal communication) identified the calcified opercula of Neocyclotus snails which had not been recorded previously for Colombia or the neotropics. The operculum is a dorsal plate on the posterior portion of the snail’s foot that seals the aperture when the body retracts into the shell. It serves to protect the snail from predators as well as to maintain interior humidity during the dry season. The complex structure of the operculum is formed by calcareous layers (Hunt, 1976) and may, therefore, be a good marker of growth and seasonality of deposition. All specimens represent adults between four and six years of age, based on the uniform size of shells and opercula within the assemblage, and assuming that their dark markings correspond to halted growth periods during yearly dry season.

The most probable season of occupation for all strata was the dry season when flooding did not endanger or affect the activities of the occupants. The collection of mollusks of the genus Pomacea in streams close to the site is easiest in this season when they were most likely utilized as an occasional food source. The recovered botanical specimens also indicate site utilization at the beginning of the dry season from November through January. During this period, plants such as grasses and species of Malvaceae and Sapotaceae are in the process of fruiting and seed dispersal in this region of the savannas of Bolívar (Bonzani, 1998). The climate also appears to have been much drier than it currently is in this area, potentially extending the dry season by one or more months. The abundant availability of seeds from grasses and certain trees, and
potentially other plant food sources during only a few months of the year may help to explain the need to intensify activities around the collection and processing of these resources. These collection and processing activities occurred independent of whether or not the plants were cultivated or wild (Hastorf, 1994:139–154, 1999:35–58). Intensification of processing is clearly evident in the lithic artifacts that include 145 complete and fragmented metates and 101 manos, ethnographically known to be used to process seeds, often those of maize, into flour (Stahl, 1989).

Given the dry season occupations of San Jacinto 1 over hundreds of years, the inhabitants appear to have moved to the site seasonally to collect and process abundant recurrent resources which were potentially stored at a base camp to which they returned for the duration of the dry season. The strategy most likely used is one associated with the monitoring of resources and a spatial–temporal or circumscribed territoriality whereby resources were watched for and utilized in the landscape and throughout the year (Dillehay et al., 2003; Flannery, 1986; Oyuela-Caycedo, 1993:137–142, 1995, 1996; Raymond, 1998).

The collection of Neocyclotus also suggests a logistic mobility strategy in that these mollusks grow only in the humid tropical forest, the closest of which is located approximately 10 km from the site. The inhabitants of San Jacinto 1 would have had to send special task groups to collect the mollusks and return to the site. The lack of other exotic materials at the site, such as those used to make the lithic artifacts and fire-cracked rocks, also points to restricted territoriality of the groups occupying San Jacinto 1. This restricted territoriality can be considered as evidence of “demographic packing” in the region (Binford, 2001:363–399). However, different ecological settings were utilized which points to the likelihood that a centralized base camp was occupied at various times of the year from which task groups would have left to visit these other ecological settings in order to collect resources.

In this context, the function of pottery appears to be associated more with social behavior than with economic process (Oyuela-Caycedo, 1993:101–108). No evidence was found of burned surfaces on the pottery or of indirect cooking by rock boiling. The pottery was also not associated directly with the fire-pits or fire-cracked rocks (Oyuela-Caycedo, 1995). This lack of association with cooking activities, however, does not mean that pottery was not used for other purposes in food processing such as fermentation. In this case, pottery at San Jacinto 1 would have been used in the process of intensifying social interactions for reasons that may relate to increased contacts with other groups, in social storage in the form of gift exchanges (i.e., food or drink), and in the demand for labor (Bonzani and Oyuela-Caycedo, 2006:345). The need for increased labor was most likely tied to the seasonal nature of the utilized resources while the increase in contact between groups would have resulted from overlapping territories in which different groups were attracted to similar seasonal resources.

Social and ritualistic behaviors may have been occurring as a means to alleviate conflict or competition in areas where the territories of adjacent groups overlapped (Bonzani, 1992; Cashden, 1983; Peterson, 1972:49; Rowley-Conwy, 2001). Such activities can be seen as a means of social intensification or the beginnings of ritualized behavior (Aldenderfer, 1998:303–305; Cauvin, 2000a,b; Hastorf, 1994,1999), which allow different groups to co-interact together and avoid conflict. This activity, related to a spatial–temporal territoriality, could then have developed into extended social networks and alliances (MacDonald and Hewlett, 1999) with the necessity of symbolically marking the group through various means including highly stylized ceramic vessels. The development of new technologies, such as pottery, could have played an important role in this process. In this context, the origins of pottery are better understood as social obligations described very well by Mauss (1967) in terms of gift giving. The data do indicate that the early pottery at San Jacinto 1 was not associated with economic cooking functions but was probably involved in social functions such as serving vessels of fermented drinks or hallucinogens (Oyuela-Caycedo, 1993:101–108, 169–173, 1995; see also Pratt, 1999; Hastorf, 2006:102–104). The use of pottery and other resources at the site, that would have been a minor component of the inhabitants’ yearly diet, probably helped to relieve stress more on a social level and by social means than by economic ones.

References


Doctoral Dissertation, Department of Anthropology, University of Pittsburgh, Pittsburgh.


Territoriality among human foragers: ecological models and an application to four Bushmen groups. Current Anthropology 24, 47–66.


