

## Monumentality in Western Amazonian formative societies: geometric ditched enclosures in the Brazilian state of Acre

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### Abstract

In Amazonia, monumentality has traditionally been considered characteristic of the late pre-colonial densely populated complex societies. Recent archaeological fieldwork concerning the geometric earthworks in the Brazilian state of Acre has shown that the southwestern Amazonian interfluvial zone was a significant setting for long-term large landscape modifications. We describe the geometric ditched enclosure sites of Acre as early monumental public spaces reserved for ceremonial purposes, analogous to the central Andean ceremonial-civic centers of the Formative period. The geometric earthwork sites contain contiguous ditches and embankment structures of varying forms enclosing areas typically 3-10 hectares in size. Documented cultural features are sparse within the enclosed areas. Making use of satellite imagery, aerial photographs, and pedestrian surveys, 360 earthwork enclosures have been recorded in southwestern Amazonia. Our radiocarbon dates suggest that construction and use of geometric earthworks began at the latest around 1000 BC, and prevailed in the region until 1400 AD. The relatively small number of ceramics recovered from the geometric ditched enclosure sites appear to be local sub-styles of the same tradition, sharing certain attributes with contemporary ceramic traditions of the upper Amazonian region. This, and consistency in ceremonial earthwork architecture, indicate close cultural interaction between communities that built and used the earthwork sites, and imply probable relationships also with the central Andean area.

### Introduction

In archaeological science, monumentality is often understood as a feature of politically centralized, stratified, and densely populated complex societies,<sup>1,2</sup> a spatial production of authority demonstrating widespread cultural complexity.<sup>3,4</sup> Similarly, large-scale agricultural fields, coupled with irrigation systems are also

seen as implying centralized planning and labor-force control in highly hierarchical sociopolitical organizations.<sup>5,6</sup> In many contexts, however, in which constructing public architecture involves coordinated efforts and considerable labor investment, the collective effort of many small communities might have produced similar constructions within non-hierarchical systems.<sup>5,7</sup> Communal labor is a product of both people and time alike; over a long period of time, fewer people might have built the type of public architecture that would otherwise have required a sizeable population to invest in manual labor for a much shorter period of time. Indeed, examples of community labor and monumental public architecture have been extensively documented in the British Isles and central Europe where the causewayed enclosures were constructed during the early Neolithic period and used predominantly for ritual purposes.<sup>8-10</sup> In South America, the central Andean sites of monumental ceremonial architecture have long been the subject of archaeological studies, and many of these public works were constructed during the Formative/Initial period.<sup>11-14</sup> The Andean societies of the Initial period have been described as small in scale and weakly stratified with highly developed religious institutions.<sup>15</sup> In Amazonia, while the Formative period (ca. 1000 BC-AD 500) was characterized by the advance of forest farming associated with large-scale migrations, principally of the Arawak and Tupi-Guarani groups,<sup>16</sup> monumentality has been considered a feature of the complex societies that flourished at the eve of European contact.<sup>17-20</sup> However, recent radiocarbon dates obtained from geometric earthwork sites located in southwestern Amazonia provide a different story.

Pre-Columbian earthwork complexes in the western Amazon were acknowledged at the beginning of the twentieth century<sup>21</sup> and again in the early 1960s,<sup>22,23</sup> but only lately have they become a focus of interest and debate among scholars working in the area.<sup>5,24-32</sup> Making use of satellite imagery, aerial photographs, and pedestrian surveys, 360 earthwork enclosures have been recorded in Brazilian state regions, including eastern Acre, southern Amazonas and western Rondônia, and in the Bolivian northeastern lowlands. The geometric earthwork sites contain contiguous ditches and embankment structures of varying forms and sizes; typically circles, squares, rectangles, ellipses, octagons, and U-shapes enclosing areas ranging between 0.1 and 10 hectares. Roads, delineated by low banks, frequently connect the separate enclosures and link them to a network of streams carved in the upland soils. In Acre, the enclosure sites indicate a significant effort in constructing the earthworks, which contrasts sharply with the low ceramic density (in general domestic wares),

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lack of well-developed anthropogenic soils (see Appendix 1), and few cultural features documented within the enclosed areas.<sup>31</sup> Wide-ranging anthropogenic ADE (Amazonian Dark Earth) deposits found at many prehistoric Amazonian sedentary occupation sites<sup>33</sup> were not verified within the geometric ditched enclosures.

In this article, we present recent archaeological data acquired at nine archaeological sites: JK, Fazenda Colorada, Jacó Sá, Severino Calazans, Fazenda Atlântica, Balneário Quinauá, Ramal do Capatará, Prohevea, and Fazenda São Paulo (Figure 1). We hypothesize that these geometric earthworks had a central role in ceremonial and/or ritual gatherings of Formative-stage communities from 1000 BC onwards, or even a few centuries earlier. To build, maintain, and use these monumental sites required a social unit larger than a few families, as planning and sustaining a labor force demanded more than a loosely organized group. However, there is as yet no evidence of either dense residential

areas displaying a centralized settlement site hierarchy, or clear social ranking systems in the archaeological record of the ancient earthwork building society in Acre. The population densities and even the social organization of this society were thus somehow distinct from the complex late prehistoric cultures of the central and lower Amazon. We attempt to show that the society controlling the geometric ditched enclosures was united by a firm dedication to religious and/or political ideology that was represented by the monumental earthwork architecture.

## Early public architecture in the central Andes and western Amazon

Along with agriculture-based sedentary village life, establishing specialized public architecture, generally as ceremonial centers, was a type-attribute for American Formative cultures.<sup>34</sup> A ceremonial center is an environment built to serve a local population that is maintained and seasonally used by that population and, during the periods when it is not utilized, is either empty or has few residents looking after the public institution.<sup>35,36</sup> As stated by Adams, *early monumental architecture is not only often more massive than later examples but also more painstakingly executed in ways that may suggest a qualitatively different degree of commitment and intensity affecting the work force as well as the ruling elite.*<sup>37</sup>

In the central Andes, many early prehistoric sites include public, conceivably sacred sectors that contain monumental structures.<sup>38-41</sup> An enclosed or demarcated space with a prepared floor is a fundamental architectural component of early ceremonial-civic places.<sup>42</sup> The emergence of ceremonial architecture among cultures transitioning from dispersed egalitarian groups to more organized and settled societies with developing agriculture, higher population density, specialized laborers, and spiritual and political leaders, indicates that religious ideology was converted into a tool of power and prestige.<sup>14</sup> Ceremonial architecture formed the material basis in the early societies that became organized through ideological devotion.<sup>43</sup> Trigger concludes that *the need to express power through the medium of monumental architecture may be greater during the formative stages of early civilizations or at times when the degree of centralized power is increasing.*<sup>44</sup>

Recent studies have confirmed ideological interactions and exchange networks between early societies occupying different ecological zones in the central Andes and tropical lowlands.<sup>45</sup> The most discussed example is the

Chavín de Huántar ceremonial-civic complex, dated to 900-200 BC which contains elaborate religious monuments, including rectangular plazas and circular sunken patios used in communal ceremonies and more restricted rituals.<sup>46</sup> Interestingly, some stone friezes adorning the plazas and stone sculptures at the site are decorated with creatures originating from the eastern tropical lowlands, suggesting long-distance contacts between the Andean region and Amazonia.<sup>46,47</sup> Furthermore, the location of the Santa Ana-La Florida ceremonial site on the eastern slopes of the Ecuadorian Andes is strategic not only regarding access to diverse natural resources, but also for transmitting information and ideologies between populations in different ecosystems.<sup>48</sup> Occupation of the site with sparse domestic refuse was dated to 3010-200 BC, and its ceremonial architecture contains an exterior section marked by circular stone structures and an inner area with smaller rectangular-shaped spaces.<sup>48</sup>

In western Amazon, the documented sites featuring public architecture may be fewer in numbers than in the central Andes, but are no less impressive in their labor investment or structural design complexity. Various monumental earthwork complexes with road networks and rectangular platforms delineating square-shaped plazas have been documented in the Ecuadorian Upano Valley in the Andean piedmont.<sup>49-51</sup> The Upano mound sites were built for habitation, commencing around 700 BC, but some plazas and platforms also had ceremonial functions.<sup>51</sup> In the Bolivian Llanos de Mojos, the vast systems of raised fields, causeways, canals, ditches of many types, and

artificial wetlands linked to adjacent mound and forest island settlement sites were actively used by 400 BC; however, conscious alterations in the lowland savanna probably began centuries earlier.<sup>5</sup> Along with ritual and political purposes, the diverse earthworks had many functions, including agricultural and water management systems, means of transportation, dwellings, and cemeteries.<sup>5</sup> The Tumichucua earthwork complex, at the south-east margin of an oxbow lake of the River Beni in the northern Bolivian lowlands, covers an area of 125 hectares and contains distinctive ditches. The most significant of these ditches is circular, approximately 775 m in diameter, connected to a smaller semicircular ditch adjacent to the oxbow lake.<sup>52</sup> These ditches surrounded, and probably protected, a village site dating from 200 BC to AD 300.<sup>29</sup> Furthermore, Arnold and Prettol<sup>52</sup> mention a badly destroyed mound inside the circular ditch. It is still not clear what function the mound had.

Reconstructing the history of early ceremonial centers, such as those in the western Amazon, is challenging due to the low density of cultural remains and the absence of other architectural features besides earthworks. Temples, communal and residential houses, and other architectural compounds were made of perishable materials, and ceramics constitute the bulk of the material culture available for analysis at most sites. This is why pottery analysis is an approach that can detect possible cultural similarities and continuities between sites and access the range of activities performed at those places.

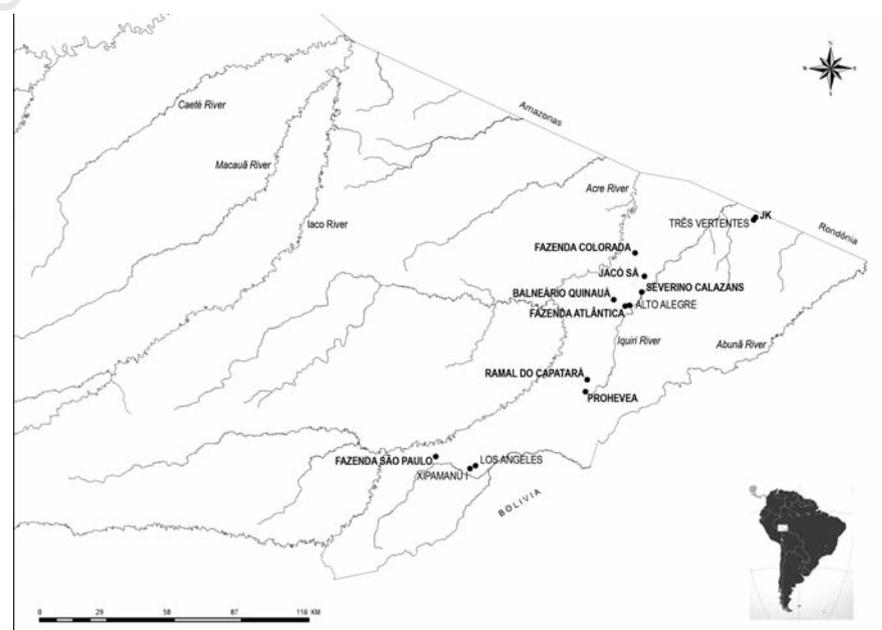


Figure 1. The geometric ditched enclosure sites in eastern Acre, Brazil, mentioned in the text.

## Formative period ceramics of western Amazon

The western Amazonian ceramic traditions that can be dated to the Formative period are still not well known. The Tutishcainyo and Shakimu Phases of the River Ucayali Basin are the earliest ceramic styles recognized in the region and were replaced around 200 BC by Hupa-Iya modeled-incised style pottery.<sup>53</sup> The characteristic vessel types of the Tutishcainyo Phase are large, open-mouthed vessels with a board labial flange and markedly concave sides (Figure 2A), smaller vessels with inward-sloping sides and sharp basal angles, and open bowls with short concave sides that were possibly cooking and serving dishes.<sup>53</sup> Decorated ware presents geometric incisions, fine-line hatching, punctuated rows, red paint and, in the Late Tutishcainyo Phase, nicking on rims and carinations also appear.<sup>53</sup> The Shakimu Phase, with a single date of 650 BC, introduces open bowls with level bases decorated with detailed excised designs, traits that are interpreted as the result of Chavín Horizon influence.<sup>53</sup>

In the eastern Ecuadorian lowlands, Yasuní Phase ceramics, associated with early settlement sites located on the banks of the Napo River, date to around 50 B. (50 BC).<sup>54</sup> Yasuní vessel forms typically include shallow rounded open-mouthed and carinated bowls with labial flanges (Figure 2B) and rounded or flattened bases.<sup>54</sup> The ware is generally tempered with sand, charcoal and caraipé (siliceous tree-bark (*Licania* sp.) ash) and decoration techniques include incision, punctuation, zoned hachure, rim nicking, simple plastic adornments and red slip.<sup>54</sup> Carinated bowls with labial flanges also appear in the central Amazonian Açutuba Phase of the Incised Rim Tradition. The earliest date for the long sequence of Açutuba ceramics is 1100 BC.<sup>55</sup>

Yasuní pottery resembles some early Formative Andean ceramic complexes, such as

Waira-jirca.<sup>54</sup> There are also numerous similarities in vessel shapes and decoration between Yasuní and Tutishcainyo pottery, which suggests that the Tutishcainyo Phase, without absolute dates, was somewhat later than presumed,<sup>54</sup> and that vivid interaction and exchange of ideas and material goods already occurred within and between the Formative-stage societies of the western Amazon and central Andes.

The earliest ceramic assemblages in the northern Bolivian Amazon were collected at the Tumichucua and Chacra Telería sites.<sup>29</sup> The Tumichucua ware is mainly grog tempered, though charcoal and sand tempers are also present. Rims are everted, direct, or inverted with rounded and thickened or tapered lips. Common decorative techniques are incision and fine-line incision, though rim-nicking and fingernail incisions occur to a lesser extent. A fragment of a small anthropomorphic vessel was also recovered at the site. Chacra Telería ceramics are caraipé, grog, and sand tempered. Rims are everted or direct with rounded and thickened lips, and the bases are flattened. The few defined vessel forms represent globular bodies. Frequently used decoration techniques are incision and fine-line incision. Additionally, some sherds have a dark brown slip that covers the entire form.

In Acre, based on his fieldwork during the PRONAPABA (Programa Nacional de Pesquisas Arqueológicas na Bacia Amazônica) project in 1977-1980, Ondemar Dias established two ceramic traditions for the region: Acuriá for the River Juruá valley, and Quinari for the Upper Purus Basin.<sup>24</sup> Data about the former tradition remain unpublished. The Quinari tradition contains four sub-phases of which the Quinari, Iquiri, and Xapuri Phases are associated with sites in the interfluvial upland between the Acre and Abunã rivers in eastern Acre, and the Iaco Phase with the Purus and Iaco river plateaus near the border of the state of Amazonas.<sup>24,56</sup> Ceramic assemblages that do not readily corre-

spond to the above-mentioned phases have also been recovered at several sites in the Upper Purus Basin.<sup>24,56-58</sup> The thermoluminescence dates obtained on the ceramics recovered at the Xipamanu I, Alto Alegre, and Los Angeles sites containing circular ditches range between 950 BC and AD 750.<sup>56,58</sup>

Typical components of pottery in the Quinari tradition phases include fusion of cylindrical and globular shapes in vessels with direct or everted rims and flattened bases, red slip as the primary surface finishing technique, painted (red or black) lines on a white engobe and incision as principal decorative elements, and caraipé as the predominant temper, though charcoal, hematite and grog tempers are also found.<sup>24</sup> According to Dias,<sup>24</sup> a hallmark of the Quinari tradition is an anthropomorphic vessel in the form of a globe resting on a cylinder, decorated with an appliqué human face (Figure 3). Platters, potstands and cylindrical containers appear as secondary vessel types in the Quinari tradition, and shallow open bowls and carinated and conical-based vessels are elements shared with other ceramic traditions.<sup>24</sup>



Figure 3. Globular anthropomorphic jar with a cylindrical neck and base from Areia Branca, municipality of Plácido de Castro, Acre, representing a human face constructed of appliqué nubbins for ears, eyes, nose, and possible chin labret. The mouth is formed by an oval-shaped appliqué strip. The eyebrows are executed by excision. The surface of the vessel was covered with a white slip and the face with a reddish brown slip. The total height of the caraipé-tempered vessel is 36 cm, the mouth is 9 cm in diameter, and the body wall thickness is 8 mm. Palácio Rio Branco (Acre) museum registration number: NA 01.84.01.

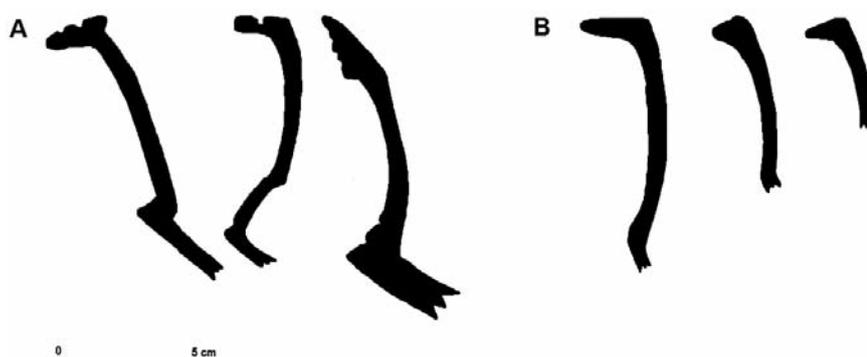


Figure 2. (A) Tutishcainyo rim sherds with labial flanges from the Central Ucayali Basin.<sup>55</sup> (B) Yasuní Phase flange rims recovered from sites located along the Napo River, Ecuadorian Amazon.<sup>56</sup> Re-drawn from<sup>55,56</sup>.

## Investigated sites

Earthwork sites with ditched enclosures discussed in this study are located at 159-219 masl on terra firme plateaus between the Acre and Abunã rivers, white-water tributaries of the Purus and Madeira rivers (Figure 1). The landscape of the region is characterized by numerous minor streams in the undulating topography formed by tertiary sediments of the non-flooding ground. Soils are clayey tropical latosols and acrisols.

The areas enclosed by the earthworks at the different sites cover around 3-10 hectares in size (Table 1). In addition to geometric ditches, the Fazenda Colorada, Jacó Sá, Severino Calazans, Fazenda Atlântica, and Balneário Quinauá sites feature areas enclosed by embankments. Road systems were not noted at the Severino Calazans and Ramal do Capatará sites. During the fieldwork periods in 2007-

2010, we mapped the earthworks and excavated 1 m<sup>2</sup> units in artificial 10 cm levels at each site to reveal the distribution, density, and characteristics of cultural deposits in different sections of the sites, and collected ceramic, soil, and radiocarbon (wood charcoal) samples. For a more comprehensive description of the fieldwork at Severino Calazans, Fazenda Colorada, and Jacó Sá, see Schaan *et al.*<sup>31</sup>

The JK site has two concentric square-shaped ditches with external and internal embankments (Figure 4A). The sides of the outer ditch are 190 m long. In the northern part of the site, the ditches are 2.5-3 m deep and 18 m wide. In the south, the ditches follow the margin of a stream; this watercourse actually forms part of the outer ditch in the southwest. On the west side, the outer ditch ends before reaching the edge of the stream and the embankment between the ditches has an opening toward the watercourse. A 14-m wide banked road running in a north-south direc-

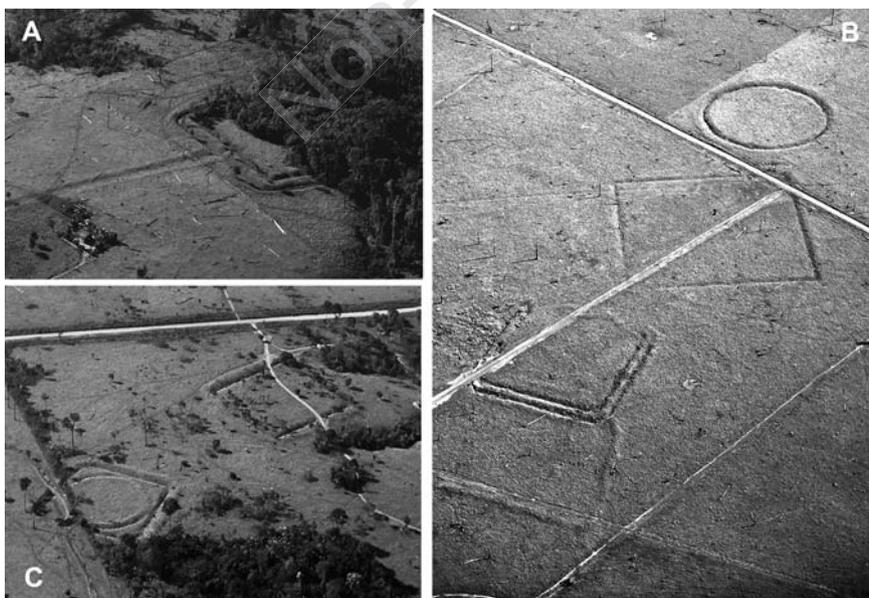
tion at the north side of the square forms the main entrance to the site. Another road was registered on the southwest side of the site continuing in the direction of Três Vertentes, an earthwork site comprising a square-shaped ditch and situated 1.5 km to the southwest.

At JK, seven units were placed inside the square and four units at the bases of the ditches. The units excavated within the area demarcated by the ditches suggested scarce archaeological deposits (Figure 5) (see Appendix 2), whereas the bases and slopes of the ditches yielded considerable quantities of ceramics. A focal cluster of cultural material was encountered in Unit 5, excavated at the base of the interior ditch in the main entrance. Abundant diagnostic sherds in a dark brown soil mixed with fragments of charcoal and burned clay were detected at a depth of 120-200 cm, including a deposit of deliberately placed vessels at 140-180 cm.

The Fazenda Colorada earthwork complex

**Table 1. Investigated geometric ditched enclosure sites.**

Site	Ditch form	Enclosed area, ditches	Enclosed area, embankments	m <sup>2</sup> excavated	N. sherds collected	N. sherds collected/m <sup>3</sup>	Diagnostic Sherds (%)
Fazenda Colorada	Circle, square, U-shape	7.64 ha	2.50 ha	17	908	66	4%
Fazenda Atlântica	Circle, square	7.48 ha	1.00 ha	12	2807	390	7%
Severino Calazans	Square	5.30 ha	1.00 ha	22	482	32	-
Jacó Sá	Circle, square	4.52 ha	0.48 ha	18	579	53	3%
Ramal do Capatará	Circle, ellipse	4.05 ha	-	40	1133	16	-
JK	Square	3.61 ha	-	12	2540	144	5%
Fazenda São Paulo	Circle, rectangle, ellipse	3.60 ha	not mapped	4	1398	548	7%
Balneário Quinauá	Circle, square	1.05 ha	1.63 ha	22	1813	114	4%
Prohevea	Circle, (square)	0.79 (2.89) ha	-	10	1093	201	2%



**Figure 4. Geometric ditched enclosures of Acre. (A) JK. (B) Fazenda Colorada. (C) Jacó Sá.**



**Figure 5. Generally, units excavated within the areas enclosed by the geometric ditches display scarce cultural deposits, such as Unit 2 at the JK site.**

contains a circular ditch, a squared ditch and a U-shaped double ditch (Figure 4B). A walled road transects the square and the circle, continuing toward the northeast. The U-shaped figure encloses several small mounds. A trapezoidal banked enclosure, including an interior embankment, is attached to the southern side of the double ditch and continues its course as a walled road to the southwest. Sherds, primarily utilitarian, were recovered on small mounds located inside the U-shaped enclosure, and from embankment structures and ditch bases. The few decorated sherds were located in the ditches. The cultural layer in the flat areas between and within the enclosures did not exceed 40 cm in thickness, but was approximately 120 cm on the mounds. At the time when the site was actively in use, the ditches were approximately 3 m deeper than today.

The Jacó Sá site includes a square-shaped ditch surrounded by an external embankment. A walled road running in an east-west direction begins at the western side of the square-shaped enclosure. Another ditch and embankment complex is to the north, creating a circle inscribed in a square (Figure 4C). A rectangular embankment is between the above-mentioned earthworks. Excavations at the site indicated scant cultural deposits on the embankment structures and at the base and on the slopes of the ditches. The thickness of the cultural layer was 20-70 cm on the embankments and 100 cm in the ditch. The number of sherds in the Jacó Sá collection is small compared to those at the other sites and does not contain decorated pottery.

The Severino Calazans site is a single square-shaped ditch partially destroyed by the BR-317 highway (Figure 6B). On its northern side, a square-shaped embankment is attached to the ditched enclosure. Inside the square-shaped ditch and some 140 m to the east, we recorded remains of rectangular embankments. The cultural layers at the site are partly mixed with modern intrusions and the recovered pottery is extremely fragmented and eroded. Most sherds derive from units placed on the internal embankment structures situated near the ditch inside the enclosure on the western side. A trench excavation placed crossing the ditch on the northern side of the site yielded only a handful of sherds.

The Fazenda Atlântica site (Figure 6C) features a square-shaped ditch with shallow semicircular ditches dug within the western and eastern corners. A roughly quadrangular embankment is in the middle of the square-shaped ditch. A small mound, attached to the internal embankment structure, is adjacent to the eastern semicircular ditch. The main entrance of the earthwork, defined by a 100-m wide road, is on the south-eastern part of the square. Minor roads begin on the northeast and southwest sides of the square-shaped

ditch, and another road leads to a circular ditch in the northwest. A low embankment surrounds the circular and the square-shaped ditches. Archaeological deposits were concentrated on the embankments while the flat surfaces enclosed by the ditches were practically empty of cultural layers and finds. Furthermore, this site included an interesting archaeological context: the 15×15 m mound of dark brown anthropic soil mixed with occasional charcoal fragments and a considerable quantity of diagnostic pottery. The 110-120 cm level of the unit excavated on the mound contained a feature with shattered carinated vessel, burned clay fragments, cemented calcium carbonate nodules, and a few unburned animal bones (S Saunaluoma, personal communication, 2011).

The Balneário Quinauá site contains a square-shaped ditch and a small circular ditch (Figure 6A). Both ditches have low external embankments. A road connects the two earthworks and continues on the opposite side of the square toward a stream to the north. This road and two small mounds on the external embankment mark the northern entrance to the square. On the eastern side of the square-shaped ditch are remains of a trapezoidal-shaped embankment and of a simple linear embankment in a north-south direction, situated 100 m from the ditch. A roughly square-shaped embankment is connected to the southeast section of the circular ditch and continues as a walled road to the southeast. Cultural deposits were concentrated in the ditches and embankments, while units excavated in areas inside and between the earthworks yielded scarce archaeological material. The radiocarbon dates suggested that the cultural layers on the northern side of the circular enclosure at the juncture of the road connect-

ing the ditch structures preceded earthwork construction at the location (S Saunaluoma, personal communication, 2011).

The Ramal do Capatará earthwork complex has two elliptical and three circular ditches (Figure 7B). The northernmost earthwork is an ellipse 65×73 m in size. Another ellipse 150×175 m in size is about 150 m to the southeast and a circle 100 m in diameter lies approximately 100 m to the southwest. The last-mentioned earthwork is partly damaged by a dirt road. A conjunction of two minor circles (70 and 35 m in diameter) is 80 m southwest of the solitary circle. Today, these ditches have an average depth of 2 m.

Excavation units were placed along lines traversing the outer embankments, ditches and center of the enclosures; five units and a 1.35×26 m trench at the major elliptical enclosure, five units at the smaller elliptical earthwork, and three units at the major circular enclosure. The deposits and ceramics associated with the earthworks were found at the bases of the ditches, which were around 1.80 m deeper than today, and on the external embankment structures, where sherd density was most prominent at a depth of 40-80 cm.

Dias first documented the Prohevea site in the late 1970s, when cattle grazing had already affected a circular ditch which was approximately 100 m in diameter, 10 m wide, and 1 m deep.<sup>24</sup> It is now impossible to distinguish the ditch in the field due to sugarcane cultivation, but the Google Earth satellite imagery acquired in 2003 still shows a semicircular structure at the location (Figure 7C). The same Google Earth imagery reveals a square-shaped enclosure, approximately 145×145 m in size, approximately 350 m northwest of the circle. Long linear roads running in north-south and east-west directions enter each side of the

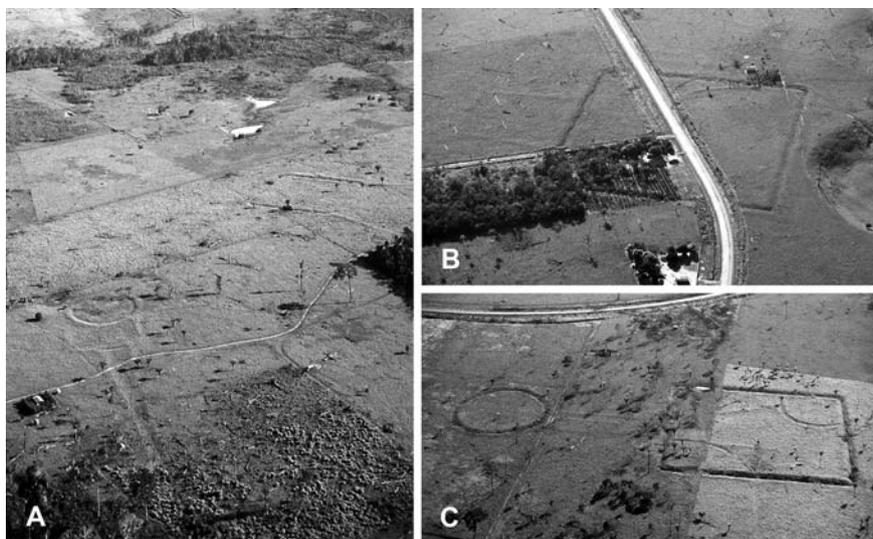


Figure 6. Geometric ditched enclosures of Acre. (A) Balneário Quinauá. (B) Severino Calazans. (C) Fazenda Atlântica.

square. The square-shaped enclosure and roads are by now most likely completely destroyed by the sugarcane plantations. The above-mentioned structures were possibly once incorporated into the same earthwork complex.

At Prohevea, nine units were placed at 20 m intervals along a line in the northwest-southeast direction traversing the circular ditch remains, and one unit was on elevated ground 40 m northeast of the circle. Due to present-day land use, prehistoric layers at the site are completely mixed with contemporary ones and ceramics were not found in their original contexts. Sherd density was less significant in the units excavated within the area formerly enclosed by the circular ditch. The thickness of the layers containing ceramics did not exceed 70 cm in depth and most pottery was recovered at a depth of 20-60 cm.

The Fazenda São Paulo site (Figure 7A) includes a rectangular ditch with approximately 100-m long sides and rounded corners attached to the southeastern part of an irregular elliptical ditch measuring 160×230 m. Remains of embankment structures are inside the ellipse and a road enters the rectangular enclosure on the southeast side. A smaller circular ditch 70 m in diameter is approximately 50 m to the north. The ditches at this site are still clearly marked, and are a maximum of 5 m deep. One unit was excavated at the base of the rectangular ditch and three units on its external embankment. The highest ceramic and diagnostic sherd densities were encountered 10-50 cm deep in the unit excavated on the external embankment next to the southeastern main site entrance. This unit revealed soil mixed with burned clay fragments and charcoal, and also a possible posthole feature. The other units on the top of the embankment on the western side contained a much smaller quantity of cultural material. The unit at the base of the ditch yielded a moderate quantity of sherds at a depth of 15-65 cm.

## Distribution and characteristics of the ceramics

Based on excavations carried out at the sites discussed in this study, these earthwork sites share common traits in cultural deposit distributions and archaeological material characteristics. In addition to ceramics, fragments of ferruginous laterite slabs used as grinding stones were found at all sites. At JK and Fazenda Atlântica, some simple polished stone axes were also recovered. The finds are concentrated mainly at the bases and on the slopes of the ditches as well as on the embankments, particularly on the small mounds attached to embankments. Our excavations on

flat areas within the earthen enclosures showed scant evidence of archaeological deposits, indicating that these parts of the sites were kept clean of cultural debris. This was also the case with the roads and banks delineating them.

The ceramic collections of the geometric enclosure sites share some attributes regardless of the distance between sites, physical setting of the earthworks in the landscape, or temporal variation. The principal ceramic characteristics correspond to the description of the Quinari tradition. Dias<sup>24</sup> previously categorized the pottery from the Prohevea site as belonging to the Quinari Phase. Undecorated utility ware, which represents most of the ceramics recovered at the sites, is fragmented and potsherd surfaces are eroded creating a coarse appearance. However, red and brown slips are perceptible on some sherds. Charcoal and caraipe are the most common tempering materials but hematite, grog and sand tempers were often used. The manufacture technique is coiling and air bubbles, and dark cores frequently occur in the ceramics we recovered. Body wall thickness varies between 3 and 28 mm, and the 5-10 mm thick sherds are the most numerous. Diagnostic sherds are scarce (Table 1). Rims are mostly direct or slightly everted with rounded or flattened lips. Some rims have been thickened on the interior. Bases are flattened or faintly rounded. The collected sherds suggest mostly globular and direct vessel body forms. Decoration consists mainly of incisions in parallel horizontal lines that are often executed on the rims. Curvilinear and stepped incisions also occur, but to a lesser extent.

Differences are evident in the finer ware encountered in particular contexts at the enclosure sites. In the Fazenda São Paulo assemblage, most worthy of note is pottery decorated with fingernail impressions (Figure 8A), finger-pressed motifs, and shallow

grooved lines together with angular punctuations recovered from the excavation on the external embankment near the main site entrance. At JK, the sector of the main entrance yielded most of the decorated better-quality ceramics. Of utmost interest is an elaborate square-shaped lid decorated with incised-excised motifs (Figure 8B) that differs remarkably from the otherwise homogenous ceramic material collected from the sites. The interlocking incised-excised design is frequent in the Shakimu pottery of Central Ucayali that also shares traits with Central Andean Wairajirca.<sup>59</sup> Moreover, this context also contains rims with a labial flange with parallel incised lines on the lip (Figure 9D and E), everted rims decorated in incised motifs (Figure 8C), a rim sherd of an open bowl painted red on the inside, rim sherds of a vessel decorated with parallel incised lines and a row of triangular punctuations on the labial flange, a fine-line incised rim, sherds with traces of white engobe and a sherd featuring black designs painted on white. At Fazenda Atlântica the small mound inside the square-shaped ditch yielded an abundance of diagnostic sherds. In addition to the carinated bowl (Figure 8D), the mound contained several sherds featuring incision in curved and stepped lines, rims with labial flanges (Figure 9A-C), rim sherds of an open-mouthed vessel decorated with parallel incised lines on the interior of the rim, an out-folded rim with fingernail impressions, a direct rim painted with a red band and black fine lines on white, and a flat spindle whorl fragment (S Saunaluoma, personal communication, 2011).

At central European causewayed enclosure sites, the ritual aspect is displayed in the purposeful placement of pottery, stone axes, and animal bones in specific locations in the enclosed areas or ditches, especially next to enclosure entrances.<sup>9,60</sup> The main entrance at the Fazenda São Paulo and JK sites, and the

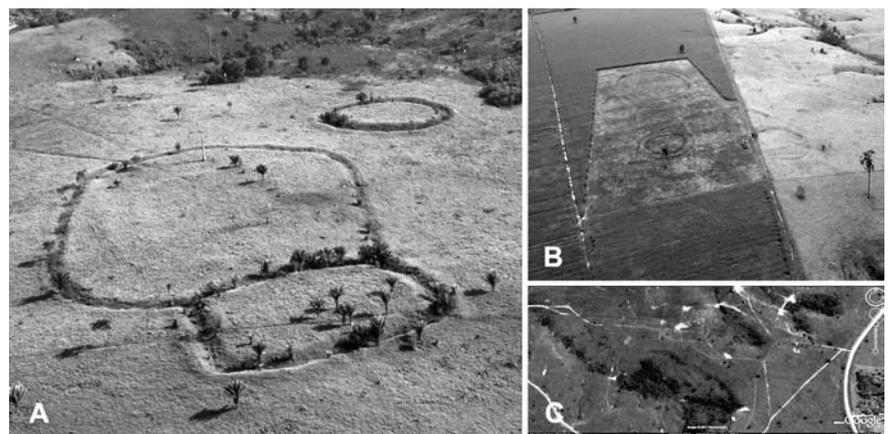


Figure 7. Geometric ditched enclosures in the state of Acre. (A) Fazenda São Paulo. (B) Ramal do Capatará. (C) Prohevea (Google Earth imagery © Google Inc., Europa Technologies; © 2010).

small artificial mound at the Fazenda Atlântica, are locations for the finer decorated ware, which imply that these contexts had a special function in the setting of the ceremonial center. The stylistic similarity featured in carinated vessels with down-slanting labial flanges present in ceramic collections from these sites implies strong cultural continuity which involves apparent connections toward central Ucayali and Ecuadorian Amazonia, as the resemblance to the Tutishcainyo and Yasuni Phase carinated bowls with flange rims is striking.

## Chronology

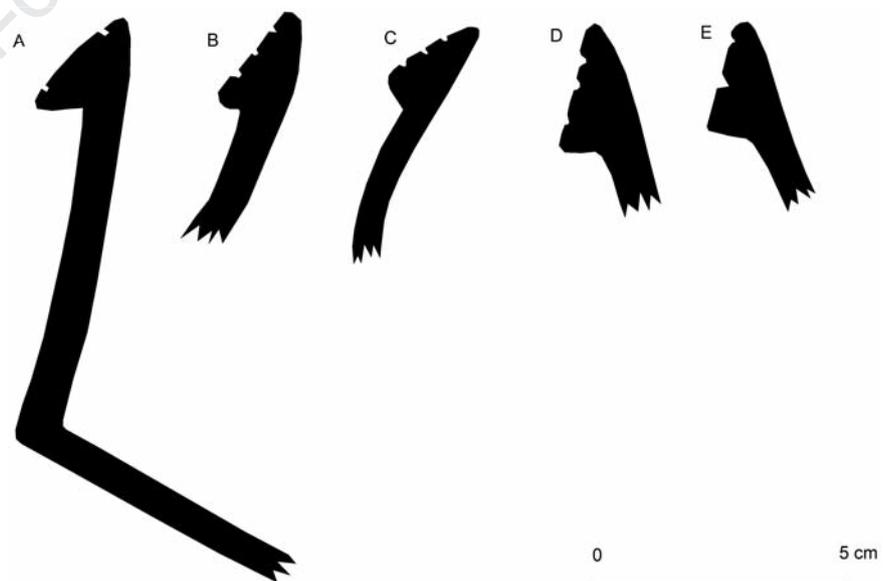
Dating the earthworks, especially the period of their initial construction, is complicated for various reasons, including scarcity of cultural material and clearly defined stratigraphical features at the sites. Furthermore, dealing with the possible presence of long-lived trees at the sites that may contribute wood charcoal centuries older than the society that used it (see Appendix 3) is equally demanding, as the ecological life history of most tropical trees remains unknown.<sup>61</sup> Our aim was to obtain 14C measurements from secure cultural contexts associated with the earthworks. The samples were collected from ceramic-bearing deposits in the ditches, embankments and small mound features present at some sites.

The date of 2570-2290 cal BC from the Severino Calazans site (Table 2) is probably too early to be associated with earthwork construction, but the date 1191-912 cal BC probably corresponds to the establishment of monumental architecture in the region.<sup>31</sup> This is confirmed by the radiocarbon date of 970-780 cal BC for the Los Angeles site<sup>24</sup> and the date of 1631-1430 cal BC for the last level containing ceramics at the base of the bigger elliptical ditch at Ramal do Capatará. The thermoluminescence date of  $2673 \pm 8.9\%$  years obtained at the Xipamanu I site<sup>56</sup> argues for an early prevalence of the geometric earthwork tradition in the state of Acre.

Though the exact initial construction ages of the individual sites remain undetermined, our radiocarbon data suggest that the most intensive period of geometric enclosure use occurred between 200 cal BC and cal AD 900 (Table 2). While most enclosure sites appear to have been actively used for approximately three to four centuries, Severino Calazans, Ramal do Capatará, and Fazenda Colorada were used for a longer period of time, possibly because of their larger size (Table 1). The 14C dates indicate gaps in the depositional record of these sites so their use was not necessarily continuous. However, no significant stylistic changes were noticed in the ceramic collec-



**Figure 8.** Pottery from geometric ditched enclosure sites. (A) A direct rim sherd with a flattened lip, decorated with a row of circular fingertip impressions (indicated by arrow) and two parallel incised lines. Body wall thickness 10 mm, rim diameter approx. 30 cm. Recovered next to the main entrance of the Fazenda São Paulo site. (B) A partly assembled 14×14 cm square-shaped lid with rounded corners and handle decorated with incised-excised concentric and interlocking designs from the 170-180 cm level of Unit 5 at the JK site. Wall thickness 5 mm. (C) An everted caraipé-tempered rim with a tapered lip and decoration in angular incised motifs on the outer surface and parallel incised lines inside the rim from the 160-170 cm level of Unit 5 at the JK site. Body wall thickness 5 mm, rim diameter approx. 14 cm. (D) A reconstructed carinated bowl with a down-slanting labial flange, decorated with linear, spiral and meander motifs incised on the collar and on the lip, and measuring 18 cm in rim diameter and 15 cm in height. Body wall thickness 7 mm. Recovered from the 110-120 cm level of the small artificial mound at the Fazenda Atlântica site.



**Figure 9.** Rim sherds with down-slanting labial flanges from the (A-C) Fazenda Atlântica and (D and E) JK sites.

tions, implying cultural continuity regardless of the possible separate occupation phases at these sites. At the Fazenda Atlântica, JK, Balneário Quinauá, and Jacó Sá sites, the 14C measurements suggest more consecutive use of the sections enclosed by distinctive earthworks. The individual earthworks at any given site were most likely built and meant to be used contemporaneously as a monumental entity, as at the Balneário Quinauá site, where the radiocarbon dates most decisively reveal contemporary use of its circular and square-shaped enclosures (S Saunaluoma, personal communication, 2011).

Nevertheless, the dates do not explain the variation in ditch forms at the earthwork sites. The enclosure shapes and general site layouts did not change or expand much during the centuries. At the JK site, Unit 5, placed at the base of the inner ditch in the main entrance, yielded the dates cal AD 134-345 and cal AD 260-533 associated with decorated pottery not found in the other parts of the site. Remarkably, the ceramics from this context are comparable to the pottery recovered from the mound structure at the Fazenda Atlântica site, which dated to cal AD 127-335 (S Saunaluoma, personal communication, 2011). This means that the two sites are chronologically and culturally connected, despite distinct site layouts.

## Discussion

Site use after building the earthworks seems to have been sporadic, and no domestic or residential layers are evident. The sparse cultural material is concentrated in the embankment and ditch structures. Some discarded sherds in the ditches seem to be in a secondary location, as a result of periodic site maintenance and cleaning the enclosed areas. Re-deposited utilitarian ceramic material also became a component of the embankments. Several semi-artificial mounds at Cahuachi, the most important Nasca culture (ca AD 1-700) ceremonial center in the Central Andes, contain day to day and ritual refuse which accumulated through ceremonial activities that actually formed and repeatedly modified the mound constructions.<sup>36</sup> This may have happened at the Amazonian geometric enclosure sites. During ceremonies involving eating and drinking, some vessels that were accidentally broken or smashed as offerings ended up in the embankment structures and in the ditches. The deliberately placed complete vessels and large sherds revealing the vessel forms deposited in the artificial mound at Fazenda Atlântica and in the ditch near the entrance at JK and Fazenda São Paulo suggest ritual contexts at these sites. The rituals probably

included social gatherings and communal feasting, reflected in the large amount of scattered utilitarian wares in the ceramic assemblages. Communal consumption probably occurred during the initial construction period of the public monuments and continued throughout the recurring use of the sites.

The ceremonial and ritual gatherings at the sites may have occurred during certain periods of the year marking special annual occasions. For example, among modern-day Maipuri living in the northwestern Amazon, ceremonies take place at the beginning of the rainy season, when large quantities of fish are easily available, and during the period when certain palm fruits are in abundance.<sup>62</sup> More socially related causes that are less predictable than natural seasons, including birth, puberty, change of leadership, and death, can also justify public commemoration and services. The periodic use of geometric enclosure sites is suggested by the low density of ceramics documented and the scarcity of cultural deposits in most of the enclosed areas.

Since the geometric enclosures were apparently not meant to be permanent habitation sites, a principal aim of future research will be to locate the village sites of the earthwork builders. Several archaeological sites without earthworks that yielded ceramics similar to the Quinari tradition have been recorded in the

**Table 2. Radiocarbon dates of the investigated sites.**

Site, provenience	Lab. number	$\delta^{13}\text{C}\text{‰PDB}$	$^{14}\text{C}$ Age B.P.	Cal. age (2 $\sigma$ )	Reference
Jacó Sá, external embankment -47 cm	Ua-37257	-27,8	1195±30	A.D. 782-984	31
Jacó Sá, square-shaped ditch 80-90 cm	Ua-37258	-27,6	1205±30	A.D. 780-977	31
Jacó Sá, ditch slope 10-20 cm	Ua-37259	-25,4	1485±35	A.D. 562-662	31
Balneário Quinauá, square-shaped ditch -230 cm	Ua-37263	-26,9	1565±35	A.D. 433-638	
Balneário Quinauá, external embankment -42 cm	Ua-37262	-26,9	1570±35	A.D. 432-623	
Balneário Quinauá, circular ditch 160-170 cm	Ua-37260	-13,1	1585±30	A.D. 431-602	
Balneário Quinauá, interior of circular ditch -50 cm	Ua-37261	-27,5	1760±35	A.D. 246-416	
JK, inner ditch -158 cm	Beta-294309	-26,6	1710±30	A.D. 260-533	
JK, inner ditch -170 cm	Beta-294310	-26,5	1830±30	A.D. 134-345	
Fazenda Colorada, small mound -25 cm	Hela-616	-26,6	750±35	A.D. 1229-1386	27
Fazenda Colorada, interior of U-shaped ditch -67 cm	Ua-37255	-28,8	1275±30	A.D. 688-891	31
Fazenda Colorada, interior of U-shaped ditch 70-80 cm	Ua-37236	-23,2	1340±35	A.D. 656-858	31
Fazenda Colorada, inner U-shaped ditch -218 cm	Ua-37567	-26,7	1775±35	A.D. 238-411	31
Fazenda Colorada, between U- and square-shaped ditches -90 cm	Ua-37256	-25,5	1820±30	A.D. 139-381	31
Fazenda Colorada, outer U-shaped ditch 150-160 cm	Ua-37235	-24,1	1865±65	A.D. 69-385	31
Fazenda Atlântica, mound -110 cm	Ua-37252	-25,6	1855±30	A.D. 127-335	
Fazenda Atlântica, internal embankment -40 cm	Ua-37251	-30,6	1905±35	A.D. 71-251	
Fazenda Atlântica, external embankment -55 cm	Ua-37253	-27,2	2110±35	177 B.C.-A.D. 48	
Ramal do Capatará, ditch 130-140cm	Beta-288232	-27,9	1850±40	A.D. 90-377	
Ramal do Capatará, ditch -170 cm	Beta-288233	-25,5	1990±30	39 B.C.- A.D. 134	
Ramal do Capatará, ditch -79 cm	Beta-288234	-25,9	3310±40	1631-1430 B.C.	
Severino Calazans, internal embankment 20-30 cm	Ua-37264	-24,2	2050±35	102 B.C.-A.D. 117	31
Severino Calazans, ditch 50-60 cm	Ua-37265	-27,8	2275±35	389-195 B.C.	31
Severino Calazans, interior of square-shaped ditch -45 cm	Ua-37238	-25,3	2915±35	1191-912 B.C.	31
Severino Calazans, internal embankment -50 cm	Ua-37237	-28,2	3990±40	2570-2290 B.C.	31

The dates were calibrated with the OxCal 4.1 program using ShCal04 curve for southern hemisphere.

region where the geometric enclosures occurred.<sup>24,63</sup> Earthwork sites such as Campo Esperança,<sup>63</sup> Coqueiral, Sol de Maio,<sup>64</sup> and Fazenda Iquiri II<sup>65</sup> contain small mounds in a circle about 100 m in diameter with abundant sherds scattered on the surface. There have been no detailed studies of the characteristics and chronology of these two types of archaeological sites so we still know little about their possible connection to the geometric ditched enclosures.

The JK site is in the northern part of the geometric earthwork region where the frequency of square-shaped enclosures is highest. Fazenda São Paulo is located in southern Acre, 170 km to the southwest of JK, near the Bolivian border, in a territory dominated by circular earthworks. In the central part of the geometric enclosures, region combinations of diverse ditch forms are most common, such as at the Fazenda Colorada, Jacó Sá, Fazenda Atlântica, and Balneário Quinauá sites. The formal homogeneity of the ritual architecture may reflect the dynamic process of constant and intense interaction between the groups inhabiting a given region that may have resulted in competitive displays and imitation in ritual settings,<sup>66,67</sup> in this case, the building of geometric ditched enclosures. Certain architectural elements also reveal messages of community unity.<sup>67</sup> The distinct enclosure outlines, mainly the division between circular and square shapes, may indicate differences in kinship or even ethnicity. The ceremonial aspects of community life are not just significant locally, as participation in ceremonial activities is fundamental for maintaining social connections with distant villages.<sup>68</sup>

The ceramics associated with the geometric enclosure sites share similar attributes and can thus be considered local sub-styles of the Quinari tradition. The anthropomorphic vessels typical of the Quinari tradition are absent in the assemblages we studied, which could imply a temporal or functional difference in these vessels, for instance their use as funerary jars. No human burials have yet been recorded within the ditched enclosures in Acre. However, late prehistoric funerary urns were encountered at the Lobão earthwork site, situated on the Iaco River plateau some 150 km to the northwest of the core location of the geometric enclosures and composed of several mounds that form two circular structures.<sup>24,56</sup>

The ceramic assemblages in this study indicate a functional difference with the majority being composed of utilitarian wares and the smaller portion including finer decorated pottery with features common to certain contemporaneous western Amazonian ceramic traditions. This last-mentioned fact is perceptible in the material recovered from ritual contexts at the Fazenda Atlântica and JK sites that yielded large fragments of vessels with labial

flanges and carinations, pottery decorated with elaborate incised-excised motifs, and fragments of painted open bowls. Carinated bowls with a labial flange are present in the Yasuní and Tutishcainyo pottery of the Upper Amazonian Formative period. Long-distance relationships, based principally on exchange, between the Formative cultures of the central Andean highlands and coastal lowlands have been extensively recognized.<sup>59,69,70</sup> The specific exotic elements visible in the ceramics may imply interaction between communities of distinctive regions and the exchange of ideas, values and information in addition to material goods. Social integration networks of this kind undoubtedly reached the southwestern Amazonian region as well.

The pottery found at the geometric enclosure sites of Acre resembles the upper Amazonian ceramics styles more than those associated with the earthwork sites of the Bolivian lowlands, many of which are also more recent and primarily used as settlement sites.<sup>29,71,72</sup> The earthwork tradition may have spread from Acre toward the Bolivian lowlands, though people may have only gained knowledge of the earthwork architecture and not the ideological system originally coupled with it. Some principles of symmetry and layout of the geometric enclosure sites are analogous elements in the central Andean Formative ceremonial sites.

The temporal factor appears to play a lesser role in the formal development of the geometric enclosure sites. The earliest sites are neither less complex nor significantly smaller than more recent ones. However, the most ancient sites, Severino Calazans and Ramal do Capatará, lack road systems. This could mean that the tradition was more local during the initial establishment period of the geometric enclosures. The need for communication routes increased and roads were added as basic elements of the geometric earthwork sites only when the tradition expanded as a regionalized phenomenon. More studies are needed to verify the exact initial period of the earthwork constructing tradition, why some sites seem to have been occupied longer than others, which sites were constructed and used roughly contemporaneously, and whether and why all sites had only a seasonal active use, as seems to be the general rule for ceremonial centers.

The cultural tradition of monumental earthwork construction in the southwestern Amazonian lowlands began around 1000 BC, maybe even centuries earlier. Since monumental architecture contributes significantly to making new social, political, and economic formations stronger,<sup>44</sup> the emergence and extension of geometric earthwork sites in eastern Acre suggest growing complexity among the region's Formative-stage societies.

In the context of the central Andean region, the earliest manifestations of public architecture display marked spaces with few access limits suggesting a loose social cohesion. When the hierarchical organization of the society later increased, the large open spaces were divided in more restricted areas with controlled right of entry.<sup>42</sup> Some Acrean earthwork sites (including Severino Calazans, Fazenda Atlântica, and Fazenda São Paulo) feature smaller divided areas; specifically, remains of embankment structures located inside the ditched enclosures. This does not necessarily imply that these sections were arranged for more privileged use and not for communal ceremonies. Moreover, the material culture record indicates hardly any signs of social stratification typical of late pre-Columbian societies. We suggest that the Acrean earthworking society was a society in transition, displaying increasing ideological and social complexity. More studies are needed to define the role of ideology and wide-ranging organizational systems prevalent during the construction and use of geometric enclosures.

A millennium after the initial appearance of the geometric earthwork tradition, the local communities were integrated by a regional ideological or sociopolitical system. By the tenth century AD, the ideological/social configuration that generated the geometric enclosures was already disintegrating. Even so, the Fazenda Colorada site remained in use until the fourteenth century AD. However, by that time, the regional tradition that manifested its ideological/political power in monumental earthwork architecture had probably come to its end.

Southwestern Amazonia's monumental architecture, containing geometric earthworks but relatively few cultural features and artifacts, presents a challenge to archaeologists, who usually rely on material culture to interpret past societies. A multidisciplinary research group, including soil scientists, paleobotanists, and paleoenvironmentalists is currently dedicated to studying the earthworks in Acre, and in the near future we hope to present more data on the relations between ancient earthworking communities and their monumental landscapes in this part of Amazonia.

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