IGNITING LIFE: DOMESTIC HEARTHS OF THE ASURINI OF XINGU*

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Abstract: *evidences of the use of fire are almost omnipresent in archaeological sites. However, few are the cases in which fire is the main study object of research. With this contradiction in mind, this paper presents part of the results of an archaeology of fire conducted amongst the Asurini of the Xingu River. The objective of the research was to document technical and symbolic aspects of fire use in the daily life of the Asurini, identifying and classifying types of combustion structure and the employment of fire in domestic activities. Temperature data collected in the field with an infrared thermometer was compared with analyses of FTIR spectroscopy conducted on hearth and oven sediments. Lastly, the research intended to demonstrate how the understanding of fire as material culture can amplify the possibilities of its investigation in the present, also serving as an interpretative source of fire in the archaeological record.*

Keywords: *Asurini of the Xingu River. Fire Studies. Domestic fire. Archaeology of Fire.*

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Hearths are important objects of analysis for various theoretical perspectives in archeology, being an evidence of human activity in ancient contexts (ALPERSONAFIL, 2012; GOWLETT, WRANGHAM, 2013) and an agglutinating element of human experience (GHEORGHIU; NASH, 2007).

From different points of view, hearths can be understood as elements that bring people together. When lit, they gather people attracted by their heat and light. When put out, they attract archaeologists as evidence of human activity passive to the most diverse forms of research and analysis.

In Amazonian archeology[1], the first studies in the region were already interested in identifying the presence of domestic hearths. Clay structures for the use of fire have been documented in studies by Nimuendajú (2014 [1923]), who described almost a century ago the presence of clay fire structures in several Amazonian archaeological contexts of the regions of the Tapajós River and the lower Tocantins River.

In what can be considered a crucial moment in the consolidation of Amazonian archaeology, between the 1960s and the 1980s, fire also underwent different interpretations, as in the work of Donald Lathrap and Betty Meggers.

Lathrap, for example, discussed clay structures for fires found in archaeological contexts of the Ucayali River, stating that these, in groups of three, would have served as supports for ceramic vessels in the period of Pacacocha occupation in the region and that, despite having fallen into disuse in the main course of this river, they were still used frequently in villages near the Pisqui River (LATHRAP, 1975 [1970]). The author also suggested a type of use of domestic fire little discussed in Amazonian archeology, interpreting impressions of intertwined reed found in clays in Tutishcainyo (Peru) as the existence in these contexts of houses "completely closed, which every night was full of smoke", which would be a solution to "the mosquitoes clouds typical of this area" (LATHRAP, 1975 [1970], p. 95).

Meggers (1987[1971]) also presented different interpretations on the role of fire in the Amazonian past, discussing in a comparative way the fire in the cultivation fields (also called swidden or *roças*) and the domestic fire of different indigenous peoples. Her observations on domestic fire approached, albeit briefly, social and gender relations in which fire was imbricated. Meggers described that Kamayurá men held their meetings around fires (MEGGERS, 1987 [1971], p. 84), how among the Jívaro, men lit fires and brought firewood (MEGGERS, 1987 [1971], p. 97) and how, among the Waiwai, women were responsible for taking care of the domestic fire (MEGGERS, 1987 [1971], p. 136).

In her observations on Kayapó populations, the author describes that while houses are made by men, it is women who build the shelter for the communal oven, one of the few constructions of a public character, which served as a meeting place for women (MEGGERS, 1987 [1971], p. 106). Meggers also stressed the importance of nocturnal fire as a source of lighting and heating for the house, going so far as to state that the domestic night fire would be an adaptive aspect of the 'Terra Firme Culture' (MEGGERS, 1987 [1971], p. 144). The author's work also points to the important symbolic and social role of fire, whether in funerary cremation rituals, such as among the Waiwai (MEGGERS, 1987 [1971], p. 139-140), or in war, such as among the Jívaro when the enemy's house and everything in it are burned (MEGGERS, 1987 [1971], p. 103).

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Inspired by these previous research and attempting to better understand fire and issues that range from choices strongly guided by physical performance (such as the selection of fuels) up to the cosmology of its use, a study was carried out among the Asurini of the Xingu[2] to obtain a set of primary data on different types of fire produced by this indigenous People.

FIRE DOCUMENTING AND ANALYSIS

In 2014, fieldwork was carried out as part of the project "Territory and Memory of the Asurini of the Xingu: collaborative archeology in T.I. Kuatinemu, Pará", in which it was possible to investigate part of the universe of the Asurini fire in the villages of *Itaaka* and *Kwatinema*.

Over the days, in addition to excavation work in different areas of the *Ivytyra-Pytera* archaeological site (GARCIA, 2017) and research on the cultivation of food plants (CASCON, 2017), we recorded and described different types of contexts related to fire; hearths, ovens and swidden fire (CAROMANO, 2018). In the present paper we will discuss specially domestic hearths.

For the survey of hearths and combustion structures, a series of characteristics were investigated, whenever possible. These characteristics referred to the shape, dimensions, function, duration of use, change in soil color, composition of the structure (presence of rocks or other forms of support for pots, types of firewood), arrangement of firewood (radial, parallel, transversal), fire temperature, possible taphonomic processes after its abandonment, ambient and soil temperature during its use, wind speed and orientation (MARCH *et al*., 2012).

A total of 55 combustion structures were recorded in the field stage, with 20 being in the village of *Itaaka* and 35 in *Kwatinema*. Five of the hearths had sediment and charcoal samples collected, and three were excavated for a better understanding of their structures.

Due to the small size of the village of *Itaaka*, it was possible to observe the 20 identified combustion structures in detail and, besides being mapped and photographed, they were measured and described.

To verify the temperature of the hearths and the wind speed in the burning events, a portable digital infrared laser thermometer and a thermoanemometer were used[3].

The temperatures of the active hearths were recorded to verify the calorific power of fuels used and the maximum temperature reached by each type of combustion structure. The infrared measurement was also used to determine the temperature of the food being prepared, and of the clay pots heated in the cooking hearths prior to their final hardening by firing, as well as during the burning of the ceramic itself.

For comparative purpose of temperature investigation methods, soil samples from the fire hearths were collected for analysis by Fournier-transform infrared spectroscopy (FTIR)[4]. FTIR is a technique used to obtain an infrared spectrum of absorption or emission of a solid, liquid or gas. It is commonly used in archaeology for identification of heating in different clay minerals, allowing to estimate the heating temperature of archaeological hearths and ceramics (SHOVAL, BECK, 2005; BERNA *et al*., 2007; FRIESEM *et al*., 2014; FRIESEM, 2018; MONNIER, 2018).

In addition to hearths, the observation of other uses of fire allowed the attesting of its importance for various activities of the Asurini, such as in the preparation of flour

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in ovens and cultivation fields (CAROMANO, 2018; CAROMANO, CASCON, MURRIETA, 2016). Alongside field observation, informal (non-structured) and semi-structured interviews were carried out on the use of fire in the villages of *Itaaka* and *Kwatinema*. The interviews with male and female individuals from different age groups, in both localities, allowed to obtain data related to the technology of fire involved in these activities.

In these interviews, it was inquired what were the 'good fuels' for use in burning pottery and cooking fires. In addition to performance issues, in several cases the interviewees also raised symbolic aspects of fire, such as the descriptions of the evocation of the demiurge *Aí* in the burning of the field and the founding myth about how fire was acquired by humans under the intermediary of *Uirá*.

In *Itaaka* we drew a sketch of the village, with the distribution of the houses, flour house, storage structures and also the distribution of hearths for food, ceramics and garbage burning. Eleven hearths were identified for cooking, five for burning ceramics, one for children's play, one oven for making flour, and three areas for garbage burning[5]. Two very diffuse hearths were recorded, but it was not possible to identify their use. A hearth for ceramic burning was excavated with collecting of ash, charcoal and rocks, and three other hearths (two for food and one for ceramics) were controlled sampled for further analysis.

In *Kwatinema*, the survey of combustion structures resulted in the identification and register of thirteen hearths for food, nine for ceramics, two areas for garbage burning, one central hearth of the *Tavyva*[6], one hearth for children to play, two hearths for heating the *jatobá* resin used for finishing ceramics, and another hearth whose function was not identified.

HEARTHS FOR FOOD

The cooking hearths observed in *Itaaka* and *Kwatinema* presented some variations in shape and composition, but in general they were elliptical, with a large accumulation of ash and charcoal in an area directly related to the fire and a larger area of ash and charcoal dispersion. Many of them were close to large roots of felled trees that apparently served as support, fuel and protection for the hearths. Small and large rock fragments were used as supports for the hearths and, in some cases, ferruginous rocks, and cracked or broken ceramic pots were also used as support for grills and pans.

The firewood used is collected in the cultivating fields and also in the vicinity of the houses, generally opting for dry branches that have fallen or been previously cut.

Although when asked directly about the preference for firewood, women usually answer that there is none, that "any one will do", during fieldwork certain choices of characteristics of the woods to be used as firewood were gradually revealed, according to specific objectives. Some woods produce heat for a longer time, or are good for starting ignition. During conversations with the women and men, it was possible to make a preliminary survey of types of wood good for firewood, with names in *Asurini*. This survey was compared with lists of species previously compiled by Fabíola Silva, with additional information collected in the field by Leandro Cascon and with literature on the subject (Table 1).

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Table1 - List of species used as firewood

Asurini Name	Gender or Species	Family	Source	Notes
Jayridi	*Lecythis lurida (Miers) S.A. Mori*	*Lecythidaceae*	Silva, 2000:69, 2008:229	Dense wood
Tata'iwa	*cf. Astronium sp.*	*Anacardiaceae*	Balée 1994:271,219 (Ka'a tai-íwa)	
Mukape'iwa	*Luehea sp.*	*Malvaceae*	Balée,1994:308	Moderate density
Anina iwawa'iwa Aninga kiwawina	*Lindackeria latifolia Benth.*	*Achariaceae*	Balée,1994:288	Good firewood
Aka'iwa Aka'iwa eté	*Theobroma cacao L.*	*Malvaceae*	Ribeiro, 1982:37 Balée, 1994:307	
Iwira pitik'iwa	*Trichilia lecointei Ducke*	*Meliaceae*	Balée & Moore, 1991:226	
Pina ina'iwa	*Pithecellobium cauliflorum Mart.*	*Fabaceae*	Balée, 1994:296, Balée & Moore, 1991:226	
Cumaru'iwa	*Dypterix odorata (Aubl.) Wild.*	*Fabaceae*		
Peramety'iwa	_	_	_	It was used in the past as firewood inside the houses, after giving birth.

The Asurini cooking hearths often feature a longer log considered for purposes of analysis as the 'main firewood'. This one is also thicker than the others, and is positioned in the center of the hearth (Figure 1). When the part in contact with the fire is completely consumed, the wood splits itself into two pieces, which are continuously rearranged towards the center of the hearth. The other logs are positioned transversely to the main log and can have different sizes and thicknesses.

Figure 1: Hearth for food preparation with main log positioned in the center of the structure
Photo: Caroline F. Caromano (2014).

The Asurini women possess seven basic types of ceramic containers for cooking, serving and transporting food and liquids, in addition to secondary types (SILVA, 2008, p. 222-223). Silva recorded the existence of nineteen types of ceramics for different functions, with four main types (*japepa'i, japepa'i/ja'eniwa, jape'e* and *jape'ei*) used in cooking (SILVA, 2008, p. 223). After the use of ceramic cooking pots, these are rarely left on the fire, being cleaned and stored on wooden structures which function as shelves in the kitchens. Nowadays, the use of metal pans is very common in food preparation, but there is not so much zeal for these pans after use and it is possible to find many of them on hearths that have already been extinguished.

In addition to the pots, the cooking hearth attracts a profusion of artifacts around it (CAROMANO, 2020), such as fans, stone supports or old pots and grill structures used in food preparation (SILVA, 2008, p. 221).

Cooking hearths are also used for the immediate disposal of some food remains, such as fish bones, turtle shells and plastrons, remains of jaws of hunted game, seeds and palm endocarps. The addition of new components to the fire hearth body is dynamic, depending on the food prepared or the activities taking place in its surroundings.

COOKING HEARTHS AND LIFE IN THE VILLAGE

Tara's cooking hearths

Tara is an elderly Asurini woman who lives in the village of *Itaaka*. Unlike the other women in the village, Tara had no children and is also not married. She spends most of her day taking care of the wild pigs in styes close to her house and her dogs and chickens, weaving baskets and cooking in two different and uncovered hearths, one in

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front of her house (hearth 15) and another very close, located next to a large root, in front of the pigsties (hearth 19). She also spends long hours in Arambé's kitchen, in the company of her sister and nephews.

At the back of Tara's house there is also a covered kitchen, with a large fire hearth that appears to have been heavily used, with a thick layer of ashes. However, during the time that we stayed in *Itaaka*, Tara's closed kitchen was never used.

Over the course of one morning, it was possible to accompany Tara cooking in hearth 19, in front of the pigsty area. The fire temperature varied between approximately 660°C and 860°C (Figure 2).

Figure 2: Tara cooks on Hearth 19. Fire temperature was measured with infrared thermometer
Photos: Caroline F. Caromano (2014).

At 10:15 am, Tara placed rice in a small aluminum pot. Although the hearth was located very close to the Xingu River, on that day the wind came from the West, it was weak, with a speed of 0.6 to 2.0 m/s, and the ambient temperature was 29°C. While Tara prepared the rice, she first tested the pot on top of the metal grill and then placed the pot directly on the firewood. After repositioning the wood on the hearth, she returned the pot to the grill. During cooking, Tara ripped bark off some wood not yet used to feed the fire and used a fan to control the flames. While waiting for the rice to cook, Tara occupied herself with breaking babassu fruits and removing their nuts, separating these in a paper bag to feed the pigs a bit later.

At 10:55 the rice was ready. The first spoonful was placed on the fan and offered to her dog. Afterwards, Tara ate some of the rice. At 11:00 she returned to her house, carrying the rest of the rice with her.

The following day, with the fire already out, ash samples were collected from the center of the hearth and from the dispersion area of ashes and charcoal. The FTIR-ATR analyses of the samples indicated temperatures between 700°C and 800°C for the center of the hearth, and between 600°C and 700°C in the ash and charcoal dispersion area (Figure 3). This is coincident with the temperatures registered by the infrared thermometer during cooking. The FTIR data is especially interesting for archaeological analyses, demonstrating the reliability of this method for verifying the burning temperatures of archaeological combustion structures.

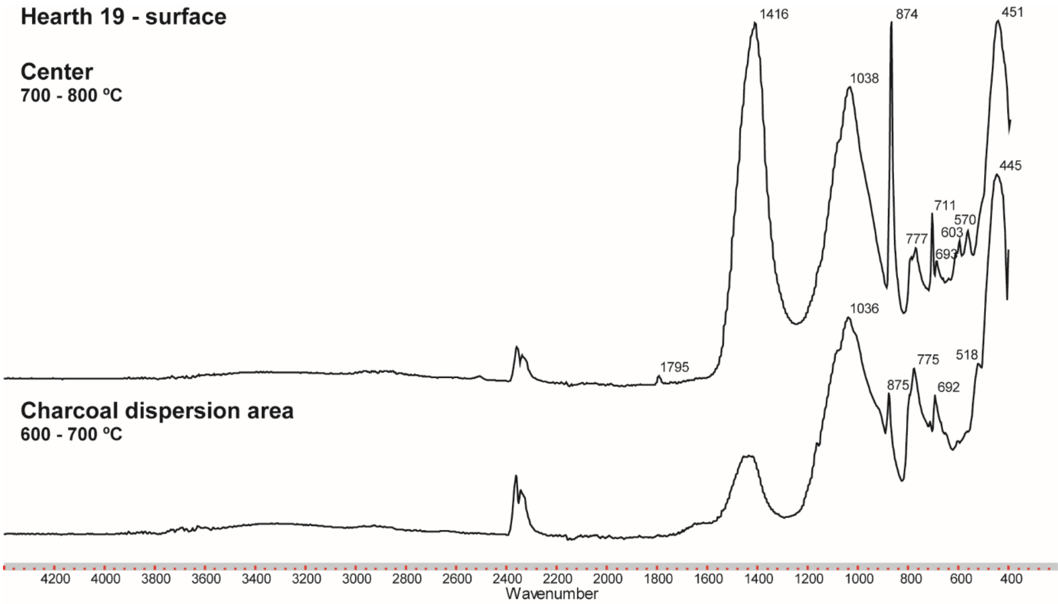

Figure 3: FTIR-ATR spectra for the center (top) and charcoal dispersion area (bottom) of hearth 19. Heating of clay minerals is visible in the absence of peaks in the OH region and the wide peak at 1038 – 1036 cm-1. Both samples contain calcite, from the hearth ashes, and quartz. Temperature estimation based on comparison with experimental heating of oxisols from Villagran *et al.* (2017).

Arambé's kitchen hearth

Arambé spends most of the day in the kitchen outside of her house weaving baskets, cooking on the hearth and making pottery. In the kitchen there is also a gas stove that, although connected to a gas cylinder, is rarely lit, being used as a kind of cupboard to support pots and utensils and to store in its oven food purchased in the city. Chickens and ducks spend the day wandering around the kitchen.

Arambé's hearth is made up of large rock fragments and cracked and broken pots, which are used as supports for the metal and ceramic pots and also for a metal grill, reused from an old gas stove.

Arambé's kitchen is in front of the port and practically in the middle of the village. It is an aggregating space and, throughout the day, children and adults sit in hammocks and on wooden benches around the hearth to eat, talk, breastfeed and lullaby the little ones. The constant trampling around the hearth contributes to further spread the ashes and charcoals.

The covered structure of the kitchen serves as a shelter for many of Arambé's objects, such as baskets and bowls. Corncobs are hung to dry over the hearth, following a pattern seen in all cooking hearths located in covered areas, be these kitchens or flour oven houses.

The hearth of Arambé's kitchen seems to be the ideal example of the central role of hearths for the Asurini: hearths need to be woken up, tended to and constantly fed. In gratitude, they transform foods, gather people, heat, distribute the odor of food mixed with firewood throughout the village and with its smoke can even drive away mosquitoes.

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Figure 4: Arambé in her kitchen, weaving and modeling a vessel
Photos: Caroline F. Caromano (2014).

The heating of ceramics in Arambé's cooking hearth

During the use of the hearth in Arambé's kitchen, it was observed, in two distinct moments, a type of mixed function of the cooking hearth: the heating or pre-firing of ceramic pots, carried out before the actual firing, as previously described by Silva (2000).

At 8:20 am, the wind was light, coming from the North, with speeds from 0.1m/s to 0.3m/s, and the temperature was mild, 25°C in the shade. Arambé placed three vessels, modeled the day before, next to the cooking hearth. With their openings facing the fire, the temperature of the pots ranged from 90°C to approximately 150°C. Two fishes were placed to roast on the grill over the fire and while she was cooking and heating the vessels, Arambé shaped ceramic rolls in order to make other pots.

Arambé left two *paabés* (babassu spathes) to dry in the sun, to be later used in the firing of the vessels. To better roast the fish, Arambé covered them with a ceramic roaster (*Jape'e*) that was no longer used (Figure 5). Various measurements of the fire temperature were made with the infrared thermometer, however, when trying to take direct measurements of the temperature of the ground with the thermopar probe, Arambé warned saying "be careful". It is uncertain if the warning was out of fear that the probe would ruin the heated vessels or to not get my hands burned. Either way, it was decided that the best move was to put the probe aside and continue using the remote thermometer, which seemed less invasive to Arambé. At all times, Arambé would arrange the heated pots on the hearth, either directly with her hands or using pieces of *paabé* or sticks, in order to ensure that all parts received heat. In order to control the fire to roast the fish, a fan was always in use.

The first pair of fishes was roasted and the three vessels remained on the ashes, being heated next to the flames. Meanwhile, Arambé made another one. After concluding that the three pots were already firmer, Arambé piled them up and left them drying in the hearth.

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Figure 5: In the top image, Arambé uses a stove grill to bake fish; in the bottom image a cracked *Jape'e* is used to smother the food
Photos: Caroline F. Caromano (2014).

At 9:42, her daughter brought three more fishes to roast. They were placed directly on the fire, over the pots. This was curious because it provides interesting data for archaeological interpretations. Chemical signatures of fish fat had just been left on the three small pots that hadn't been fired yet and that, given their shape and size, are unlikely to be used to prepare fish. The process of heating pre-fired pots can leave 'marks' on pottery, signatures of food remains that do not necessarily correspond to their use in the future.

Afterwards, Arambé fed the fire with more wood and as soon as she finished the new vessel she was smoothing, she went to her hammock to continue weaving.

The smoke resulting from the contact of the fish fat with the fire took over the kitchen environment, but this did not seem to bother Arambé.

Nearby, Tureí, the oldest Asurini woman in *Itaaka*, was also in her kitchen full of baskets, tending her hearth and observing the village and the river.

Arambé manipulated the elements of the hearth (grill, firewood, rocks) with her hands. The ashes she arranged with the help of barks, large seeds or sticks.

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Afterwards, Arambé returned to distributing the heating pots around the hearth, evaluating its surface in order to choose the part that should be in greater contact with the heat.

Turning then to the freshly smoothed and still damp vessel, Arambé ran her hands over the surface and decided to touch up the internal smoothing using a piece of gourd.

The temperatures of the ceramics in the pre-firing heating phase were recorded again. The flames of the hearth reached temperatures between 600°C and 650°C, and the ashes at the edges of the hearth approximately 250°C. The ceramic containers, heated for over 40 minutes, reached temperatures around 150°C. The recipients were heated in this fire for approximately five and a half hours until they were taken to the external hearth, exclusively used for firing ceramics.

The cooking hearths –patterns and innovations

The hearths for food preparation are directly related to the homes and kitchens and, for this reason, are recurrent, reused and have great potential to leave signatures of their long-term use. Their shapes, although possessing a general ellipsoid pattern (Table 2), can be altered according to the type of grills and other paraphernalia to be used, demonstrating the possibility of innovation in the forms and associated material with these structures.

Table 2: Synthesis of the elements that compose cooking hearths in the village of Itaaka

Hearth	Diameter center (cm)	Diameter ashes (cm)	Shape	Materials										
				Burned clay	Rock fragments	Charcoal	Fruits/ seeds	Ash	Animal	Broken pottery	Industrial	Construction Material	Ferruginous outcrop	Burnt root
1		170	Elliptic		X	X	X	X	X		X			
2	80	150	Poorly defined	X	X	X	X	X	X	X				
4		180	Elliptic		X	X		X						X
5	70	170	Elliptic, diffuse		X	X	X	X	X	X	X			
7		160	Round, diffuse	X	X	X		X	X					X
11	50	150	Elliptic, diffuse	X	X	X	X	X	X	X	X			
12	55	120	Elliptic		X	X		X						X
14		150	Very diffuse, delimited by ferruginous outcrop		X	X		X	X	X			X	
15	90	180	Elliptic		X	X		X	X	X	X			
17	140	240	Elliptic, diffuse		X	X	X	X	X		X			X
19	70	200	Elliptic, diffuse		X	X	X	X	X	X	X			X

Most of the hearths recorded in *Itaaka* and *Kwatinema* were structured on the surface, without excavation, but three structures differed greatly from this pattern.

Two of these structures were square-shaped hearths (Figure 6), one located near Matuia's house, in *Kwatinema*, and another in front of Parajuá's house, in *Itaaka*. Both hearths were made by Parajuá, son of Matuia, and dug approximately 30cm deep, covered with metal grills. When asked if that type of structure was common or a novelty, Parajuá explained that he made these hearths to roast turtles and fishes inspired by the several archaeological excavation areas, which he has been accompanying since 2010 (SILVA *et al*., 2011).

Figure 6: Hearth inspired by the archaeological excavation, made by Parajuá
Photo: Caroline F. Caromano (2014).

The third hearth, different from the others, was presented by a very young resident of *Kwatinema*. When noticing our interest in recording the hearths of the village, he invited us to see the hearth his father had built next to his house. The structure also had a square shape and was excavated on the ground. The sides of the hearth were surrounded by bricks and, over these, a grill was supported. The boy said that the hearth was made inspired by the meat grills that his father had seen in the city of Altamira.

These three hearths appeared to be good examples of the opening up to technological innovation in combustion structures for food preparation. The other cooking hearths observed also had non-traditional elements, such as metal grills from stoves and industrial ovens, adapted to serve as supports for pans, windbreaks or grills, such as an iron gate that was reused as a grill, or a school desk that was practically used as a stove (Figure 7).

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Figure 7: Hearths for food preparation with unusual materials, such as gates and school desks
Photos: Caroline F. Caromano (2014).

It is possible to consider, therefore, that fire understood as material culture allows elaborations on issues dear to archeology, such as stylistic and technological changes, innovations and permanencies.

HEARTHS FOR FIRING CERAMICS

The hearths for firing (sometimes also called *burning*) pottery of the Asurini are different from those used in food preparation, with a more transitory character, which had already been observed by Silva (2000). They have a circular shape and rigid composition, with the use of rock supports or reused building materials distributed in a circle (Table 3) serving as support for highly selected fuels[7] .

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Table 3: Synthesis of the elements that composes hearths for burning ceramics in the villages of Itaaka (I) and Kwatinema (K)

Hearth	Diameter center (cm)	Shape	Materials									
			Burned clay	Rock fragments	Charcoal	Fruits/ seeds	Ash	Animal	Broken pottery	Industrial	Construction Material	Ferruginous outcrop	Burnt root
3 (I)	49	Round		X	X		X						
6 (I)	50	Round, delimited by Ferruginous outcrop		X	X		X					X	
10 (I)	50	Round			X		X						
13 (I)	80	Round		X	X		X	X					
18 (I)	55	Round		X	X	X	X	X		X			
Cer. 1 (K)	75	Round		X	X		X						
Cer. 2 (K)	85	Round			X		X		X				
Cer. 3 (K)	90	Round			X		X		X		X	X	
Cer. 4 (K)	65	Round			X		X				X		
Cer. 5 (K)	60	Round			X		X						
Cer. 6 (K)	70	Round			X		X		X		X		
Cer. 7 (K)	95	Round, disperse	X		X								
Cer. 8 (K)	70	Round			X						X		
Cer. 9 (K)	70	Round, diffuse			X						X		

Firing affects the paste of the ceramic vessels, physically altering it through the transformation of the minerals that compose it (SKIBO, 2013; GARCIA, 2017). Firing in open hearths requires strict control of environmental variables, of the amount of pots to be fired and also the duration of the fire to prevent the pots from suffering fractures or having dark spots unevenly distributed on their surface (SILVA, 2000; RICE, 2005; SKIBO, 2013; GARCIA, 2017).

Unlike the firing in closed ovens, fire reaches the maximum temperature more quickly in open hearths and is preceded by a short period of cooling. In addition, fire is in direct contact with the pots, in an atmosphere of gases released by both the ceramic paste and the fuel (CHATFIELD, 2010). Therefore, it is necessary that the fuel is ideal and that its disposition in the hearth is well constructed, maintaining its structure for a sufficient time, being consumed by fire in a continuous manner, with ideal temperature and at an adequate speed.

In *Itaaka* five hearths were identified for the firing of ceramics, and in *Kwatinema* nine hearths for this same purpose were documented. For example, in *Itaaka* village, four meters from Arambé's kitchen and located on a slope in front of the football field and the Xingu River, there is a hearth for firing ceramics, structured with two large rock fragments fitted next to two outcrops of ferruginous rock. Unlike her kitchen hearth, this one has almost no burnt bones, with the exception of a few fish vertebrae. There was a thick layer of ashes and charcoal fragments, with no unburned wood fragments.

It was possible to accompany Arambé in the gathering of *paabé* fuel. The collecting of fallen babassu spathes is done by women in areas of concentration of common palm trees in both *Itaaka* and *Kwatinema*. Using a machete, the spathes were cut by Arambé into smaller pieces to facilitate their transport to the village. After collecting the amount of *paabé* that she considered sufficient, the pieces were placed in a cargo basket and carried on her back to her house, to be placed to dry (Figure 8). After drying in the sun, the *paabé* can be used as fuel for ceramics.

Figure 8: Arambé cutting the paabé collected on the way to the fields and carrying it to her kitchen Photos: Caroline F. Caromano (2014).

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The ceramic hearth of Arambé: two accounts of ceramic firing

At 12:50, Arambé began to set up the hearth to fire the vessels that had been heated in her kitchen's hearth for four and a half hours, as previously described. The wind was 0.5m/s and the temperature was 33ºC. To assemble the structure of the ceramic hearth, Arambé placed pieces of *paabé* over large rock fragments and ferruginous outcrops and then placed the pots with their opening pointing up, covering and surrounding them with a sort of *paabé* 'tent', in a conical shape. From the food hearth, Arambé took hot charcoals using a piece of *paabé* and then inserted them into the lower part of the structure for the ceramic firing.

The temperatures reached by the hearth were recorded throughout the entire firing process. From the beginning of the ignition, at 12:50h, until the end of the burning, with complete combustion of the *paabé* fuel, 25 minutes passed. At the start of ignition, within three minutes there was a temperature increase from approximately 100°C to approximately 730°C. This maximum temperature was stable for approximately five minutes. After reaching the peak, the temperature dropped to approximately 500°C for more than 10 minutes, until the entire structure of the body of the hearth was transformed into ashes.

After the ending of the burning and the extinguishing of the fire, direct measuring of the vessels with a probe registered temperatures of up to 310°C. At 13:30, Arambé removed the ceramics from the ashes with a stick. She placed them first in a metal pan and then on the floor to cool.

On the next day, only at 16:45 did Arambé start to organize the hearth to fire the vessels that had spent the day heating and darkening in the domestic hearth. For the base of the hearth, Arambé collected tree barks (*ivypé*) from the vicinity of her house, creating a firmer support structure for the two medium-sized pots she would fire. The conical structure that surrounds the hearth was made with *paabé*. Fifteen minutes later, using a piece of bark, she took a red-hot brand from the cooking hearth and inserted it into the hearth for ceramic firing. She covered the structure with a little more *paabé* and then, with a fan, fanned the fire. At 17:19, the complete burning of the *paabé* fuel and the ceramics had already ended.

In these two accounts, it is possible to notice how the firing of the ceramic itself is very fast, but the heating, which can be considered a type of indirect, slow and lower temperature firing, can take many hours, depending on the size and shape of the vessels to be fired and also the weather conditions for the burning, as in this second account in which the ceramics spent more than nine and a half hours heating up in the food hearth before the firing in the late afternoon.

Sediment samples from the hearth were collected at the center, at the periphery of the ashes, and at the periphery of the hearth. The sampling strategy aimed at verifying the temperatures reached by the hearth. Indeed, the FTIR spectrum for the center of the hearth is consistent with burning temperature between 600°C and 700°C, similar to those measured directly during firing of the ceramic pots.

The ashes and the periphery of the hearth exhibited lower temperatures than the center, between 400°C and 500°C, and 300°C and 500°C, respectively. This was an expected result, given the decrease in the temperature gradient of the combustion structure from the center to its margins (Figure 9).

In her research among the Asurini, Fabíola Silva (2000) measured the temperatures reached by ceramic fire hearths, using pyrometric cones, and obtained similar results to those here presented.

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Silva observed that the process of firing the vessels took between 30-50 minutes, but that in the first fifteen minutes the flames already reached their peak (SILVA, 2008, p.229). The average firing temperatures were between 635°C and 747°C, and the pyrometric cones indicated higher temperatures in the center of the fire hearths than at their edges (SILVA, 2000, p.70). Also according to her, in the case of firing two to three small pots, the firing temperature could be lower than 635°C and, when firing a set of medium or large vessels, this temperature would reach 800°C (SILVA, 2000, p. 70).

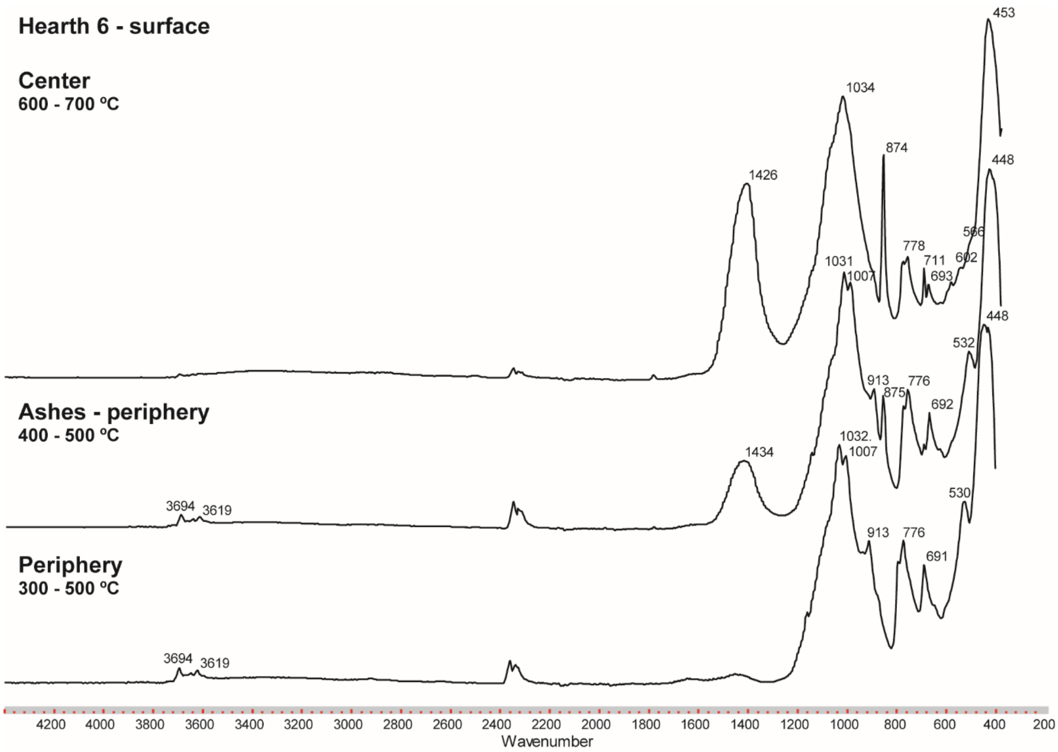

Figure 9: FTIR-ATR spectra for the center (top), periphery of the ashes (middle) and periphery (bottom) of Arambe's hearth for ceramic firing. Heating of clay minerals at high temperature is visible in the absence of peaks in the OH region, and the wide peak at 1034 cm^{-1} at the center of the hearth. The ashes and periphery reached lower temperatures, as indicated by the 3694 and 3619 cm^{-1} peaks in the OH region and the ~1031 and 1017 cm^{-1} peaks. Samples contain calcite, from the hearth ashes (except from the periphery sample, with minimal amounts of calcite), and quartz. Temperature estimation based on comparison with experimental heating of oxisols from Villagran et al. (2017).

Still regarding the collecting of temperature data from hearths for firing ceramics, another structure was identified near the trash area in *Itaaka* (Figure 10). Since this hearth was not in use, it was possible to partially excavate it in order to observe the depth of the layer of ashes and the effect of fire temperature on the soil color, as well as to collect samples for FTIR analyses.

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Figure 10: Fire hearth 18 in different stages of excavation and sample collection
Photos: Leandro M. Cascon and Caroline F. Caromano (2014).

The hearth appeared to still be structured, with six rocks in a semicircle used to support the plant fuel structure for the firing of ceramics. The hearth was photographed and drawn, and half of it was excavated in layers. Three rocks positioned in the excavated half were collected. They had soot marks on the sides facing the center of the hearth. The excavated sediment was separated according to position in the hearth and type of material: ashes from the central part, surrounding soil, dark soil with ashes and charcoals, seeds, charred or partially burned branches, burned bones, reddish sediment.

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Just below one of the rocks collected, an orange stain was identified on the soil that may have been the result of the heating of the rock in contact with the fire and, consequently, of the soil below it. The presence of the stain directly under the rock reinforced the initial hypothesis that it was *in situ*.

After the excavation of the ashes, a profile of 1cm to 2cm was evidenced. After the second layer was excavated, the ashes layer was 3 cm thick in the center of the hearth and 1.5 cm at the edges. Below the ash layer, after the third layer was excavated, a layer of darkened sediment was found, a little more reddish in the center of the hearth, approximately 1cm thick, and below this a layer of darkened sediment with 2.5cm thickness (Figure 11).

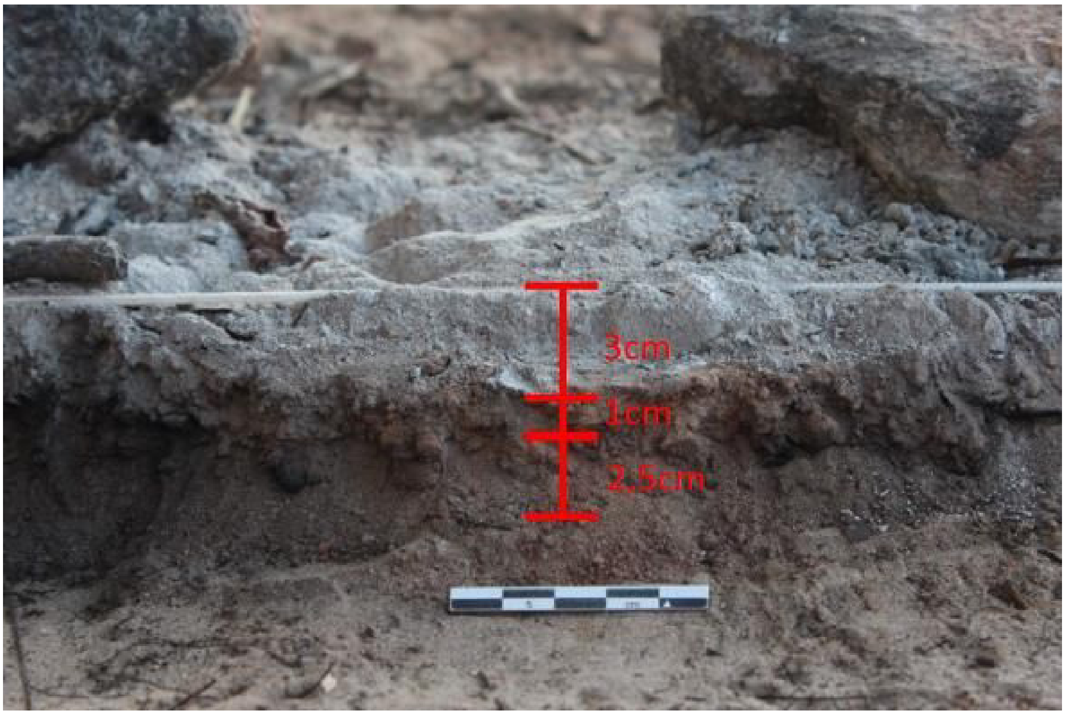

Figure 11: Detail of hearth 18 profile
Photo: Caroline F. Caromano (2014).

FTIR-ATR analysis of the superficial ashes layer from the hearth center revealed a burning temperature between 600°C and 800°C (Figure 12). Silva (2000, p. 70) had already recorded temperatures of around 800°C in larger hearths, for the firing of a set of medium-sized pots. This may have been the case with this hearth.

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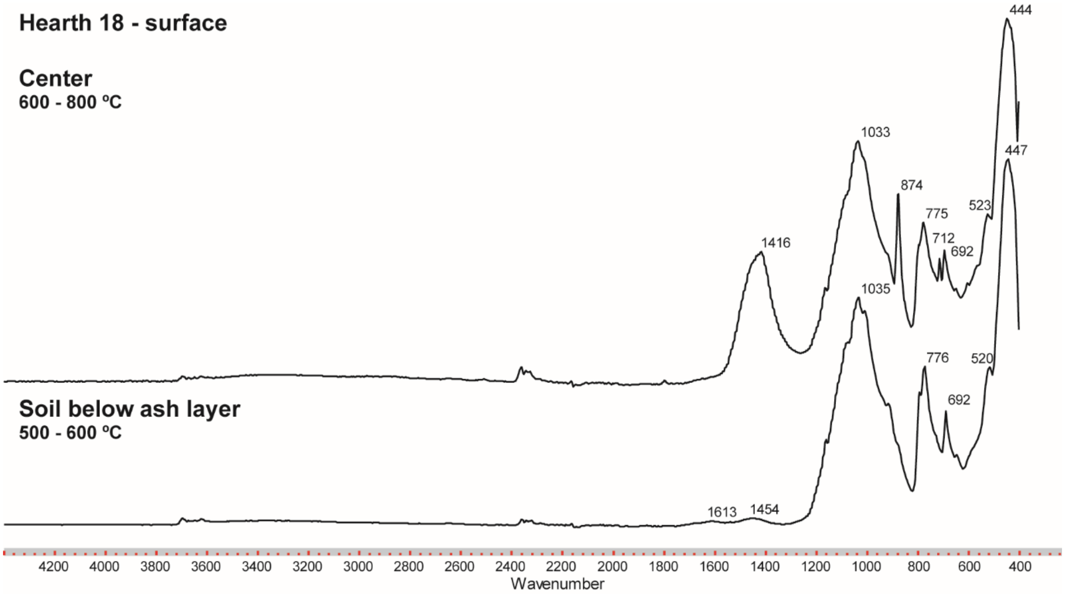

Figure 12: FTIR-ATR spectra for the center (top) and soil below the ash layer (bottom) of hearth 18. Heating of clay minerals is visible in the absence of peaks in the OH region and the wide peak at 1033 cm-1 in the center of the hearth. The soil beneath the ashes was heated by the fire, as indicated by the minute peaks in the OH region and the 1035 cm-1 band of clay minerals. Both samples contain clay and quartz, with calcite only in the hearth's center. Temperature estimation based on comparison with experimental heating of oxisols from Villagran et al. (2017).

The darkened sediment layer evidenced under the layer of ashes was also analyzed and revealed burning temperatures between 500°C and 600°C (Figure 12). This result is interesting to think about how, in archaeological contexts, when hypothetically the superficial ash layer could have been removed by daily cleaning or other taphonomic processes, it is still possible to identify burning temperatures in combustion structures. In these cases, it would be necessary to consider that the spectra may present temperatures slightly inferior than those of the actual burning because it could represent the soil below the ash layer, heated by fire but with lower temperatures than the once-existing superficial ash layer.

THE *IVYPÉ*, ANOTHER FUEL FOR THE FIRING OF CERAMICS

In *Kwatinema*, Apeuna spoke about the use of bark as fuel for firing ceramics, or as the Asurini call it, *ivypé*. According to her, this fuel is not as good as *paabé,* because it burns slightly faster and cannot be used in the winter since it "gets wet". During the firing, the *ivypé* "moves" more than the *paabé*, displacing and exposing the pots, which does not provide an uniform color – "with the *paabé* it is better, everything becomes black", according to Apeuna.

The *paabé* remains structured for much longer than the *ivypé* in the firing process. This means that the stable structure of the *paabé* hearth allows the adequate circulation of air in its interior and an ideal body of fire to be formed, giving origin to a 'beautiful' firing of the pots.

The *ivypé*, in turn, although used to build a similar hearth structure that generates an adequate temperature for firing ceramics, creates a slightly unstable

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structure, which can lead to the exposition of the pots sooner than desired by the ceramist, generating a less controlled fire and possible spots on the surface of the pieces.

It is evident that in the ideal, beautiful firing, fuel plays an important role. However, the ceramist's expertise in choosing the right time to burn, handling the fuels and assembling the structure of the hearth, whether it is made with *paabé* or *ivypé*, is the main factor for the firing success.

During interviews and review of previous works, a preliminary and non-exhaustive list of trees whose bark would serve for ceramic firing was made (Table 4).

Table 4: List of plants used as fuel for the ceramic firing

Asurini Name	Gender/ Species	Family	Fuel classification	Source	Notes
Marita'iwa	*Attalea speciosa* Mart.	Arecaceae	*Paabé*	Lukesh 1976:44, Ribeiro, 1982:53, Müller, 1993:211, Silva, 2000:98, 2009:18, Balée & Moore, 1991:232, Balée, 1994:275	Updated botanical nomenclature
Maritauywa	–	Arecaceae	*Paabé*	Silva, 2000:69	Due to the Asurini name and use, possibly *Attalea phalerata* Mart. ex Spreng.
Anygirãna/ Maratieiro	*Enterolobium schomburgkii* (Benth.) Benth.	Fabaceae	*Ivypé*	Silva, 2000:68, 2008:229	
Ńi	*Bertholletia excelsa* Bonpl.	Lecythidaceae	*Ivypé*	Lukesh, 1976:61, Ribeiro, 1982:37, Silva, 2000:69, 2008:229	
Ywitityva/ Rendyva	*Eschweilera bracteosa* (Poepp. ex O. Berg) Miers	Lecythidaceae	*Ivypé*	Silva, 2000:69, 2008:229	Balée & Moore 1991:224, Iwitríwa – *Eschweilera coriácea* Mart. ex Berg.
Jayridi	*Lecythis lurida* (Miers) S.A. Mori	Lecythidaceae	*Ivypé*	Silva, 2000:69, 2008:229	
Akuti tiriwayva	*Pouteria macrophylla* (Lam.) Eyma	Sapotaceae	*Ivypé*	Balée, 1994:305, Silva, 2000:69, 2008:229	
Jeniparidyva	–	–	*Ivypé*	Silva, 2000:69	Due to the Asurini name and use, possibly *Genipa americana* L., Rubiacea

continues...

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Asurini Name	Gender/ Species	Family	Fuel classification	Source	Notes
Jayrana	_	_	*Ivypé*	Silva, 2000:69	Balée & Moore 1991:224 – Yairana – *Lecythis cf. chartacea* Berg.
Ivypékatinga	_	_	*Ivypé*	Silva, 2000:69	
Murureywa	_	_	*Ivypé*	Silva, 2000:69	
Iagyva	_	_	*Ivypé*	Silva, 2000:69	Maybe yawi'iwa as in Balée & Moore, 1991:219, *Xylopia sp.*

This survey revealed the choice of certain species belonging to different botanical families in order to be used as *Ivypé*. An important characteristic for this choice is the similarity in the form of detachment of the rhytidome, or external bark, in consistent plates or lenses. It can be understood, therefore, that the classification system of fuels of the *ivypé* type is directly related to the form the bark detaches from the trees.

THE CERAMIC HEARTHS OF APEUNA

Apeuna built a hearth to fire three small pots simultaneously. She set up a circular area with fragments of bricks and pieces of clay structures that originally belonged to the walls of a house or oven, and filled it with pieces of *paabé*. The three vessels were placed on the structure, and afterwards the conical *paabé* structure was assembled (Figure 13).

Figure 13: Comparison of behavior between the *paabé* (top) and the *ivypé* hearths. As the firing progresses, the first type remains more structured than the second.
Photos: Caroline F. Caromano and Leandro M. Cascon (2014).

In the first five minutes of burning, the fire reached beyond 600°C. Before completing 10 minutes of firing, the temperature had already exceeded 800°C, reaching a peak after 12 minutes, with more than 900°C (Figure 14). The fire remained between 820°C and 930°C in the interval between 11 and 21 minutes from the beginning of the firing and, after that, it began to progressively lose intensity. After 25 minutes of firing, the *paabé* that covered two of the pots were completely consumed by the fire, leaving them exposed. After 40 minutes of firing, all the pots were already completely exposed and the *paabé* in the center of the hearth continued to be consumed by a low flame, with a temperature of around 300°C.

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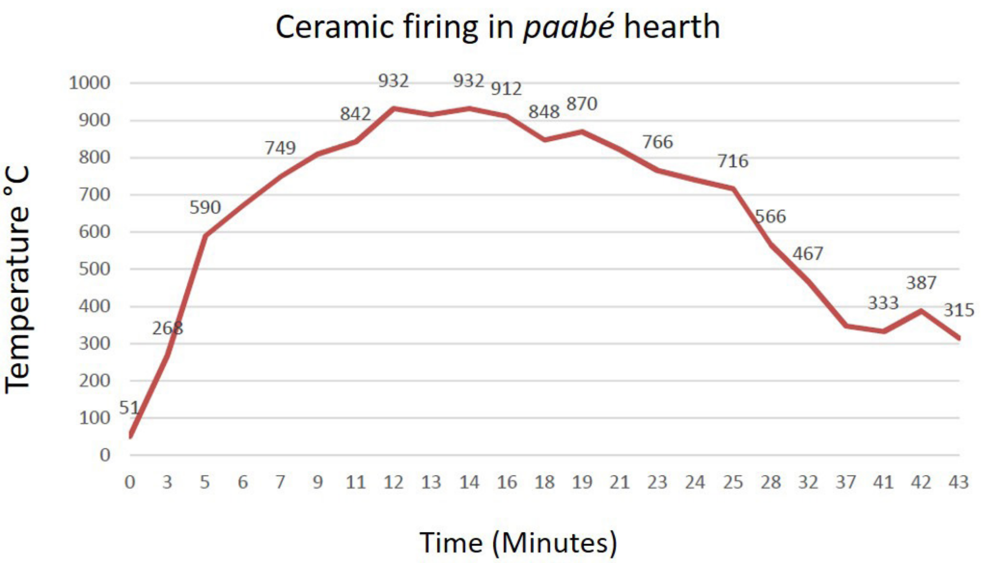

Figure 14: Temperatures reached by Apeuna's *paabé* hearth for firing pottery

Later, Leandro Cascon accompanied Apeuna in the firing with the use of *ivypé* fuel of four medium-sized ceramic artifacts, specifically three bowls and a plate. Due to the size of the pieces, the hearth assembled was larger than those previously documented in this research, measuring approximately 90cm in diameter.

The fire temperature began to be recorded five minutes after the start of the firing and reached 577°C. After 10 minutes of burning, the fire was over 600°C; at 15 minutes it was already close to 800°C and between 17 and 29 minutes it remained with temperatures around 900°C.

After 30 minutes of firing, the ceramics were completely exposed and the calorific power of the hearth decreased, dropping to temperatures around 600°C, with peaks of increase and decrease (Figura 15). These variations in temperature are most likely related to the type of fuel, the *ivypé*, which, unlike *paabé*, is not uniformly consumed by the fire, breaking more easily.

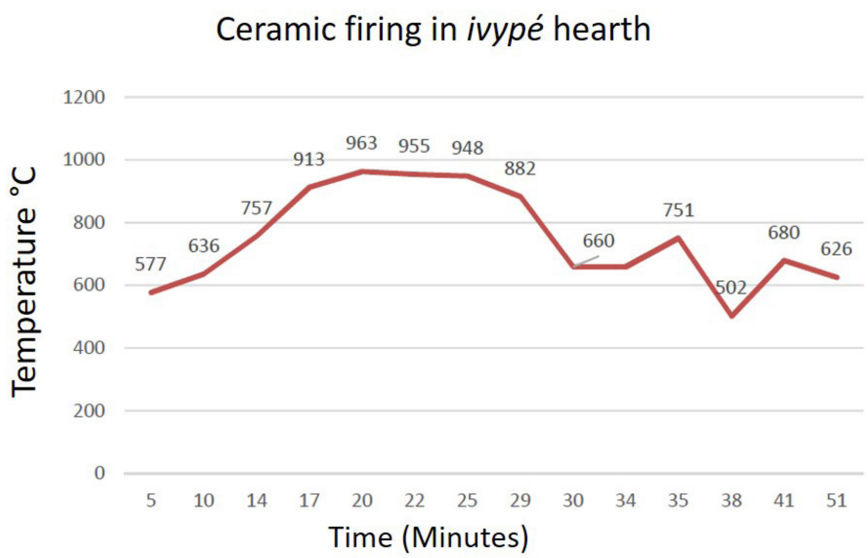

Figura 15: Temperatures reached by Apeuna's *ivypé* hearth for firing pottery

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After 51 minutes of burning, the fire remained with temperatures around 600°C, consuming fragments of *ivypé* accumulated in the center of the hearth.

One aspect stands out in these two records of Apeuna's hearths, be it the hearth with *paabé* for firing small pots, or the one with *ivypé* for firing a set of medium pots, is that they exceeded the temperatures recorded in *Itaaka* during this research and in *Kwatinema* as previously recorded by Silva (2000). Unlike Silva's prediction that hearths with sets of medium pots could reach temperatures around 800°C, Apeuna's fire hearths reached marks above 900°C.

It is possible to assume that this firing temperature, above 800°C, may influence the degree of porosity of Apeuna's ceramics, giving them greater resistance, for example. This can be better explored in the future with further comparative analysis of temperature measurement methods, and also of the paste of the ceramics fired at different temperatures by Asurini women.

INTEGRATING DATA ON DOMESTIC HEARTHS

The investigation of Asurini domestic hearths and other fires had as one of its foundations the premise that fire is a type of material culture marked by its ephemerality, being necessary to investigate it through a set of analysis methods in order to understand it in all of its complexity.

One of these methods of analysis was through the description of domestic hearths observed in the villages of *Kwatinema* and *Itaaka*, allowing the documentation of the diversity of these structures and observing correlations between certain shapes of hearths, specific components and intentions of use.

Hearths used for cooking food, which in turn can be used in one or more stages of ceramic production, appear to have a relatively large diversity of types of wood charcoal, while hearths used for the firing ceramics house a much smaller volume of charcoal, reflecting the observed use of non-wood fuels, such as palm spathes and tree bark.

Individual description of hearths provided comparative data on the forms and materials constituting each structure and its function. These data, in association with information on their spatial distribution in the village of *Itaaka,* resulted in a set of information on how to think about areas of activity and different types of fires.

The temperature data on the firing of ceramics obtained with the use of infrared thermometry allowed the dialogue with other temperature measurement methods and data obtained in previous research, through the use of pyrometric cones, as well as new laboratory analysis, with the application of the FTIR- ATR technique.

These data, coming from different proxies, demonstrate how distinct methods of analysis can provide comparable results on the temperature reached by different types of Asurini fires.

In addition to comparable quantitative information on fire temperature, the methodology used also allowed us to observe the ways in which Asurini fires influence the people who interact with them. For example, the agency of fire in the movement of people was evident when observing the necessary care for its maintenance, where sequences of movements must be performed repeatedly, so that the ideal fire is created.

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CONCLUSION

Among the Asurini, fires are interconnected with each other and with people's lives. The fire opens the land of the swidden and allows the cultivation (CAROMANO; CASCON; MURRIETA, 2016). The oven produces the flour that will be added to recipes. The cooking hearth performs its function, transforming foods which contribute to the construction of Asurini bodies, also performing with its flames a stage that precedes the use of the ceramic hearth. The ceramic hearth produces the pottery that will be used in cooking hearths and also in ritual life. In the *Tavyva*, the house of the dead, the central hearth produces the body of the ritual ceramic *Tauva Rukaia*, an essential part for the rites of passage of the young, giving continuity to the life cycle of people and of the fire itself (CAROMANO, 2018).

If fire does indeed mean different things to different people (PARKER PEARSON; RICHARDS, 1994), what does fire mean to the Asurini? When in dialogue with the existing literature on the Asurini, the information obtained in the field demonstrates that the use of fire by this people is governed by some of the basic principles of their culture, such as the relations between Asurini men and women (MÜLLER, 1993, p. 26).

The relationship of equivalence between the sexes has as one of its expressions the establishment of cooperative strategies in the production of material culture, including fire, and in the carrying out of activities (SILVA, 2008, p. 222).

Cooking fire and ceramic fire are essentially feminine and under the control of women, but men are also related to this activity in their initial stages, as they also participate by collecting wood.

Asurini agriculture is a female activity (RIBEIRO, 1982; MÜLLER, 1993), but the burning of swidden areas is a male activity and swiddens are usually called by the names of the men who opened them (MÜLLER, 1993, p. 73). However, as previously discussed by Caromano and collaborators (2016), for the great burning of the swidden it is necessary the intermediation of *Aí*, a female entity and holder of the ability to make the 'beautiful fire', demonstrating a relation between the sexes that possesses several levels and extends to the realm of the supernatural.

In the early 1980s, after contact, the participation of women in the Asurini economy stood out through the production of handicrafts for sale, which allowed them to obtain industrialized goods "which they can no longer do without and which are no longer supplied free of charge by the official governmental body". Among these were matches, kerosene, flashlights, batteries and articles of clothing, "highly sought after due to the huge amount of *piuns* (mosquitoes) that infest the area" (RIBEIRO, 1982, p. 44). These items are here highlighted from the original listing made by Ribeiro since they have functions that would be traditionally performed by fire and its associated paraphernalia.

Before the use of the match, the Asurini fire was produced using specific woods for ignition and, before kerosene, leaves and diverse wood materials provided different rhythms for the combustion. The flames brought light to the Asurini night, dispensing flashlights and batteries, and the smoke produced by the fire helped keep insects away.

Asurini culture is dynamic and possesses the ability to absorb innovations without giving up their ways of life and vision of the world (SILVA, 2013). Thus, today matches, lighters and kerosene are used to ignite the fires of the cultivation fields, but in combination with babassu leaves to start the patches of fire which intensify and spread this fire. Cooking hearths are no longer restricted to the circular or elliptical shapes, being able to take the form of a barbecue grill of 'the white' and of archaeological excavation units, and leftover construction material and even school desks are transformed into supports for food preparation. In some cases, the metal structure used in the cooking hearth is, in fact, an original part of a gas stove, demonstrating that for the Asurini the boundaries between the traditional and the modern are always being reconstructed according to new circumstances and with references from the past, but also from the present.

The flashlight, in turn, can be understood as an element of material culture that ends up distancing the Asurini from the use of certain types of fires, but this item also brought to the Asurini new ways of conducting their hunting and fishing, together with the introduction of firearms and motorized boats. The light from the flashlight did not obfuscate that one produced by the flames of fire, but instead came to join it in the Asurini repertoire of light production.

During the diverse moments in which they were forced to flee their villages in order to avoid being killed in conflicts, the Asurini were deprived of the use of fire: the opening of swiddens greatly decreased and the use of fire for this purpose, or the simple smoke produced by domestic fires were dangerous as they carried the risk of denouncing their whereabouts.

Decades of escaping led to the reduction and even the loss of fire-related practices and knowledge, but the contact also led to other changes in this sense. The interruption of the traditional form of living in communal houses and the construction of smaller houses, restricted to nuclear families, excluded hearths from the interior of houses. One can ask to what extent the rupture of traditional practices such as the presence of hearths inside the houses also does not imply ruptures of multiple socialities, both those among the Asurini as well as the relationships they establish with non-human agents.

To learn to investigate fire is also a long process. Measuring temperatures with an infrared thermometer was an interesting method for documenting combustion structures and for comparing the results with existing data. The method, however, has limitations. For example, as we found out, the heat of a slightly larger hearth for firing ceramics was already uncomfortable at certain moments (which all the Asurini women already knew, because apart from an archaeologist with her thermometer, none of them stayed next to the fire hearths while the flames did not subside).

This research is an invitation to an exercise of looking, a gaze directly at the fire, which is routinely in the background of archaeological research even though it is almost always present. Although the effort undertaken here has placed into focus certain aspects of the fire among the Asurini, it is expected that the results and discussions presented serve as a provocation for thinking about other contexts.

Research among and in collaboration with indigenous peoples has continuously shown how things until then understudied by archaeology are often those that have relevance as heritage, such as foods, places, traditional cultivation techniques, and ways of making. If one of the objectives of archaeology in the 21st century is to constitute a science increasingly guided by collaboration with indigenous and traditional populations, perhaps a key issue lies in the effort to rethink what our "objects of study" are, be they permanent, or ephemeral like fire.

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ACENDENDO A VIDA: FOGUEIRAS DOMÉSTICAS DOS ASURINI DO XINGU

Resumo: *evidências do uso do fogo são quase onipresentes em sítios arqueológicos. No entanto, poucos são os casos em que o fogo é o principal objeto de estudo das pesquisas. Com essa contradição em mente, este artigo apresenta parte dos resultados de uma arqueologia do fogo realizada entre os Asurini do Xingu. O objetivo da pesquisa foi documentar aspectos técnicos e simbólicos do uso do fogo no cotidiano dos Asurini, identificando e classificando os tipos de estrutura de combustão e o emprego do fogo nas atividades domésticas. Os dados de temperatura coletados em campo com termômetro infravermelho foram comparados com análises de espectroscopia FTIR realizadas em sedimentos de fogueiras e forno. Por fim, a pesquisa pretendeu demonstrar como a compreensão do fogo como cultura material pode ampliar as possibilidades de sua investigação no presente, servindo também como fonte interpretativa do fogo no registro arqueológico.*

Palavras-chave: *Asurini do Xingu. Estudos do Fogo. Fogo Doméstico. Arqueologia do Fogo.*

ILUMINANDO LA VIDA: FUEGOS DOMÉSTICOS DE LOS ASURINI DO XINGU

Resumen: *la evidencia del uso del fuego es casi omnipresente en los sitios arqueológicos. Sin embargo, son pocos los casos en los que el fuego es el principal objeto de investigación. Con esta contradicción en mente, este artículo presenta parte de los resultados de una arqueología del fuego realizada entre los Asurini del Xingu. El objetivo de la investigación fue documentar aspectos técnicos y simbólicos del uso del fuego en el cotidiano de los Asurini, identificando y clasificando los tipos de estructura de combustión y el uso del fuego en las actividades domésticas. Los datos de temperatura recolectados en el campo con un termómetro infrarrojo se compararon con los análisis de espectroscopía FTIR realizados en sedimentos de hogueras y hornos. Finalmente, la investigación pretendió demostrar cómo la comprensión del fuego como cultura material puede ampliar las posibilidades de su investigación en el presente, sirviendo también como fuente interpretativa del fuego en el registro arqueológico.*

Palabras clave: *Asurini del Xingu. Estudios del Fuego. Fuego Doméstico. Arqueología del Fuego.*

Notas

1 This paper presents a short review about previous works that discussed fire with a focus on Amazonian Archaeology, but the interest about fire in Archaeology goes beyond the questions here presented. About the Archaeology of fire, see Gheorghiu and Nash (2007) and the review on the topic made on the first chapter of Caromano (2018). More recently, Bensen (2020) published an overview of the origins of anthropogenic fire. For the Ethnoarchaeology of fire in other contexts, see, for example, Henry and collaborators (2018) and Beck et al. (2022). Friesem (2018) wrote a review on the Geo-ethnoarchaeology of fire. Fire as a research topic is not limited to the practical aspects of daily use in domestic and open areas, being an inspiring theme for several indigenous peoples, as demonstrated by Lévi-Straus in his *Mythologiques* (1964, 1966, 1968, 1971).

2 The Asurini of Xingu speak the Asurini language, belonging to the Tupi-Guarani Linguistic Family. They inhabit the right side of the middle-lower Xingu River basin, at the Koatinemo Indigenous Land. There is a considerable amount of research carried out among and in collaboration with the Asurini of Xingu, with special attention to the Asurini history, ways of life and material culture. Among the main research, especially important are the works of Anton Lukesch (1976), Berta Ribeiro (1982), Regina Müller (1993) and Fabíola Silva (2000).

3 Thermometer model CEM-DT-9862S, with temperature range between -50°C and 2200°C, integrated camera, thermocouple and type-K probe for subsurface temperature measurement. Anemometer model ITAN 720.

4 FTIR analyses were performed by Ximena S. Villagran at LabMicro (MAE/USP) with software EssentialFTIR. Spectra were collected using a Cary 670 series equipment (Agilient Technologies) and Resolutions Pro software by FTIR-ATR (attenuated total reflectance) between 400–4000cm-1 with a resolution of 4cm-1. All spectra were collected at the Institut für Naturwissenschaftliche Archäologie, Universität Tübingen. To estimate the temperatures of clay heating, the spectra were compared with the experimental burning of oxisols from the Brazilian Cerrado, in Lagoa Santa, Brazil (VILLLAGRAN et al., 2017).

5 Gas stoves present in external kitchens and, eventually, inside the houses, were not included in the survey. *Itaaka* and *Kwatinema* fire structures maps are available on Caromano (2018).

6 At the *Tavyva*, the first author registered and counted only the central hearth. There are other fire hearths along the *Tavyva*, since it has also been used as a house, but during the fieldwork, the aforementioned author considered that it would be invasive to circulate among the belongings of the dead and photograph other areas. The only internal image recorded at *Tavyva* was of the central hearth, a structure visible even outside the large house, between the two opposite doors.

7 To follow the steps of building the hearth for firing ceramics, Arambé, in *Itaaka,* and Apeuna and Matuia, in *Kwatinema*, were accompanied during several stages of the process, from the collection of fuel, through the modeling and pre-firing of pots, to the construction of the hearth for ceramics and their burning.

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