First notice of a Paleoindian site in central São Paulo State, Brazil: Bastos site, Dourado County

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Abstract:

Bastos site, located in central São Paulo State, provided ages between 7,600 and 12,600 cal BP. The lithic industry is composed by flakes on silicified sandstone, with rare unifacial retouch, without formal artifacts. The site probably represents a habitation area in a river terrace, later covered by a colluvial fan. Refitting pieces attest the overall integrity of the spatial positioning of the archaeological materials. The site is the oldest found in São Paulo, and is contemporaneous to sites from Lagoa Santa and Pains regions, in Minas Gerais State. However, the lithic industry is unrelated to the ones found in these areas, suggesting the existence of a different Paleoindian group.

Keywords: Paleoindians; Brazil; São Paulo State; Lithic industry; Geoarchaeology

Resumo:

O Sítio Bastos, localizado na região central do Estado de São Paulo, obteve datas entre 7.600 e 12.600 cal AP. A indústria lítica é composta de lascas em arenito silicificado com pouco retoque unifacial e ausente de artefatos formais. O sítio provavelmente representa uma área de habitação próxima a um terraço de rio, posteriormente recoberto por um evento de colúvio. A remontagem de peças atesta a integridade do posicionamento espacial do material arqueológico. Este é o sítio mais antigo encontrado em São Paulo, é contemporâneo aos sítios de Lagoa Santa e Pains no estado de Minas Gerais. No entanto, a indústria lítica não se relaciona com as encontradas nessas áreas, sugerindo a existência de um grupo distinto de Paleoíndios.

Palavras-Chave: Paleoíndios; Brasil; São Paulo; Indústria lítica; Geoarqueologia

1. Introduction

Archaeological sites of the Paleoindian Period (>12,000 to 8,000 cal BP) in Brazil are generally found in rockshelters. Most of these sites are located in the states of Minas Gerais and Piauí, and to a lesser extent in other states of the Northeast, as well as Amazonas, Mato Grosso and Goiás, with some occurrences in Rio Grande do Sul (Araujo *et al.* 2006). Such a state of knowledge implies an extensive gap, with few exceptions (Tunas rockshelter, Paraná, dated 10,990 cal AP - Chmyz *et al.* 2008). Another problem in this context is the supposed absence or low frequency of Paleoindian open-air sites. Until recently, the only site with these characteristics would be Alice Boer Site, located in Rio Claro (Beltrão 2000; Beltrão *et al.*

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1983), with an assumed age of more than 14,000 years BP, but challenged by some authors (e.g. Prous 1995).

In 2010 we started a research project called "The Paleoindian Occupation of São Paulo State: A Geoarchaeological Approach", whose objectives were explicitly aimed to the discovery of Paleoindian sites in a poorly known area. This resulted in the detection of two open-air Paleoindian sites: Lagoa do Camargo 1, dated 10,500 years cal AP (Araujo *et al.* 2016), and Bastos (figure 1). In the next sections we will explore the preliminary data obtained for Bastos site.

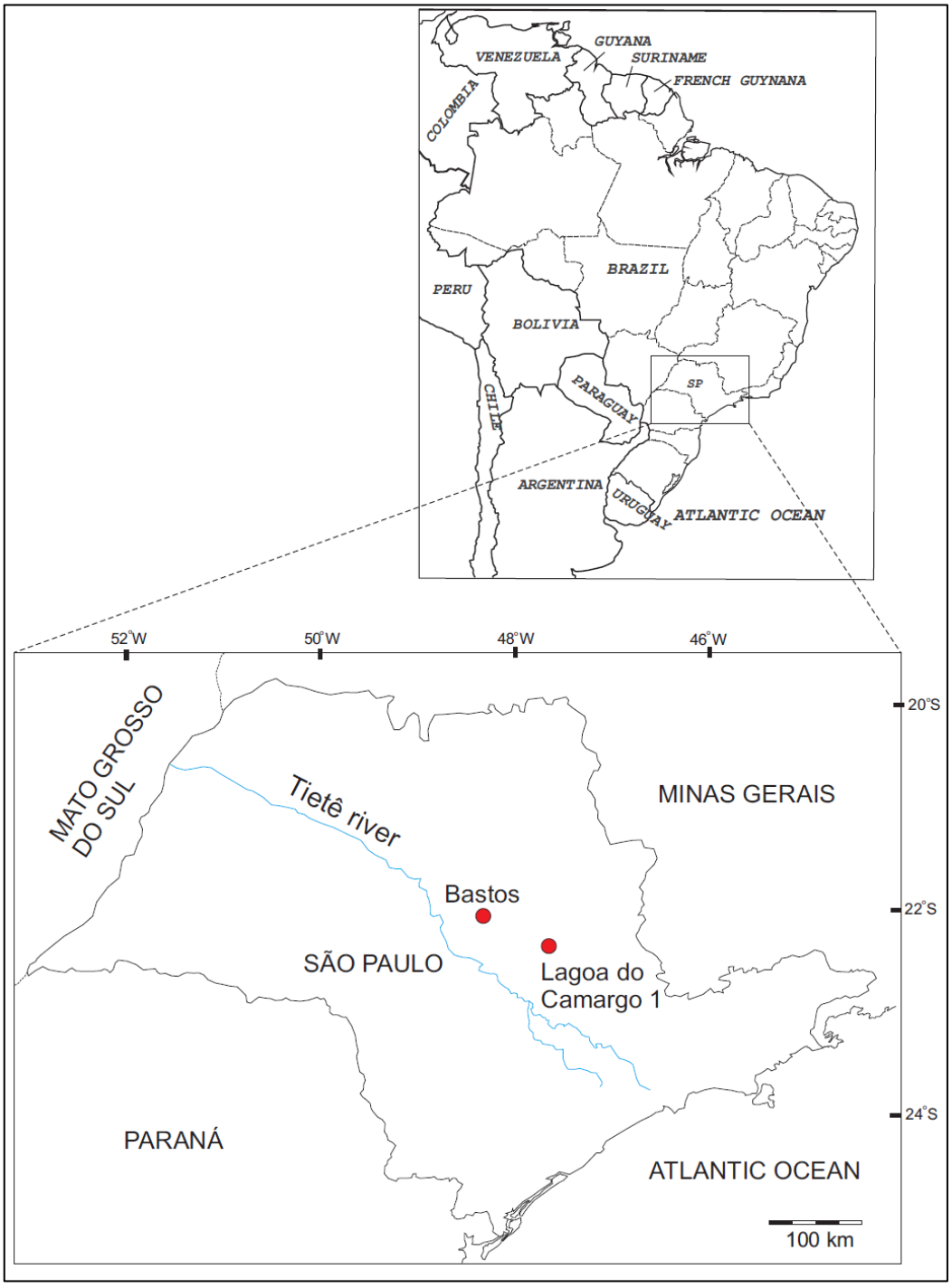

Figure 1. Location of Bastos and Lagoa do Camargo 1 sites.

2. Bastos Site: Location and Environmental Setting

Bastos site is located in Dourado County, in the central-East portion of the State of São Paulo. The site is situated in a lower slope terrace, very close to Monte Verde creek. Currently the place is a grazing area and this situation facilitated the detection during a survey where the lithic material appeared on cattle tracks (figure 2).

The formation processes operating at the site can be related to two main events. The first is an event of solifluction, forming a colluvial fan (figure 3). We found buried surfaces composed of angular basalt pebbles together with the lithic materials, forming pavements (Figure 4). As we proceeded the excavation in 2016, the deeper stratigraphic levels showed different features, and the presence of archaeological materials in discrete layers of clayey soil was clear, probably related to the influence of the fluvial system.

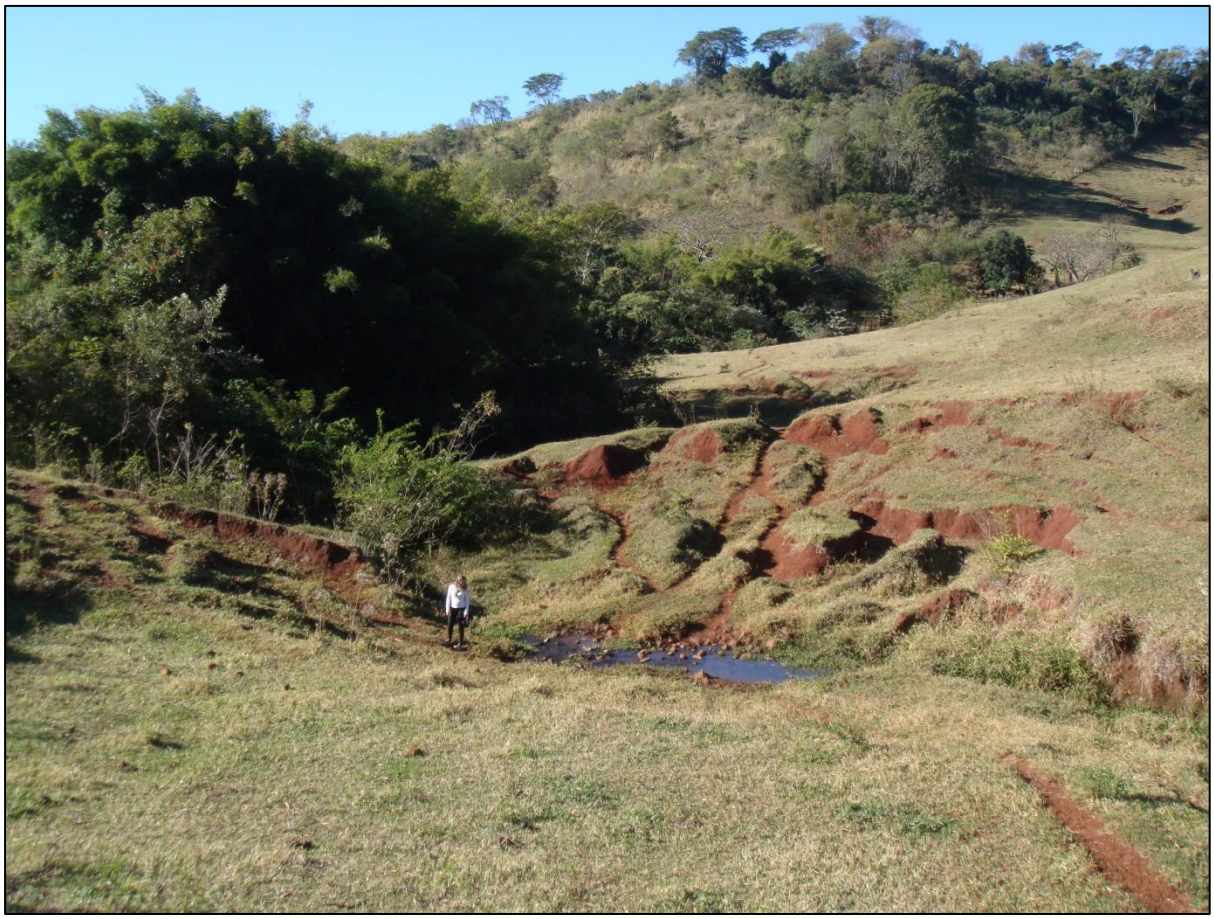

Figure 2. Aspect of the site during the survey, where cattle tracks exposed archaeological materials. Photo: Mercedes Okumura.

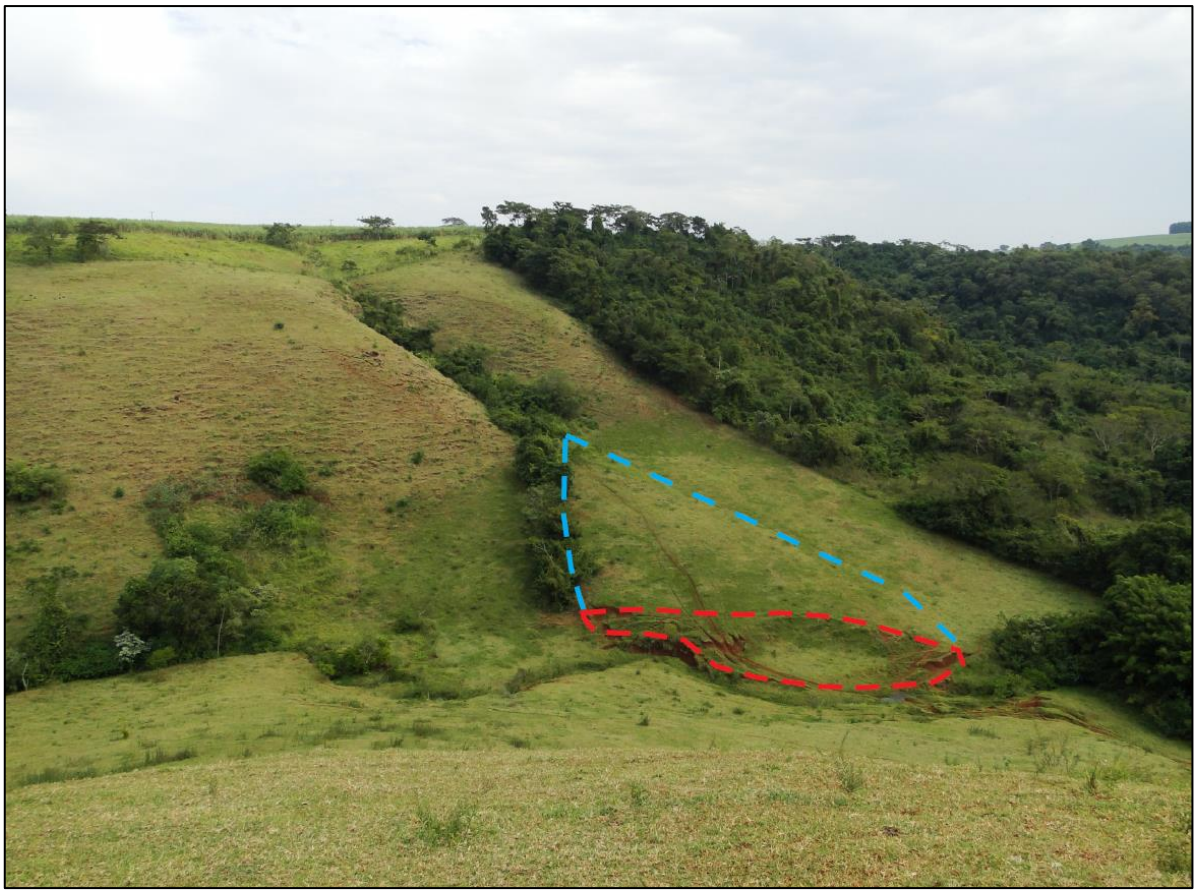

Figure 3. Aspect of the Bastos Site. The red line indicates the area of dispersion of the archaeological materials; the blue line shows the limit of the colluvial fan.

Figure 4. Aspect of a buried paleosurface composed of basalt pebbles and archaeological materials.

3. Methods

3.1. Excavation and sampling procedures

Bastos site was subject to three fieldwork seasons during 2014 and 2016, with an excavation area of 9 m^2.

The soil at the site is clayey and very hard, and the excavation was done by means of throwels and small hoes. All archaeological materials larger than 2 cm were individually plotted by means of a Gowin TKS-202 total station, and all sediment was sieved through a 3mm mesh.

The only archaeological remains found at Bastos are lithics and small pieces of charcoal. We also collected samples for soil micromorphology and luminescence dating, both being processed.

A total of 449 lithics were retrieved during the excavation, and the material is still under analysis. The raw material is composed exclusively by silicified sandstone. We found no evidence of human alteration on the basalt pebbles, whose occurrence inside the site is probably due to downslope movement.

3.2. Spatial Distribution of Artifacts and Samples

The individually recorded pieces were plotted against the west profile, and it is possible to perceive that the archaeological materials were deposited in discreet layers (Figure 5). This, together with the occurrence of refitting pieces found in a single 1m^2 excavation unit (see item 3.4), suggests that the site presents an *in situ* record of human activities, not subject to significant post-depositional alteration.

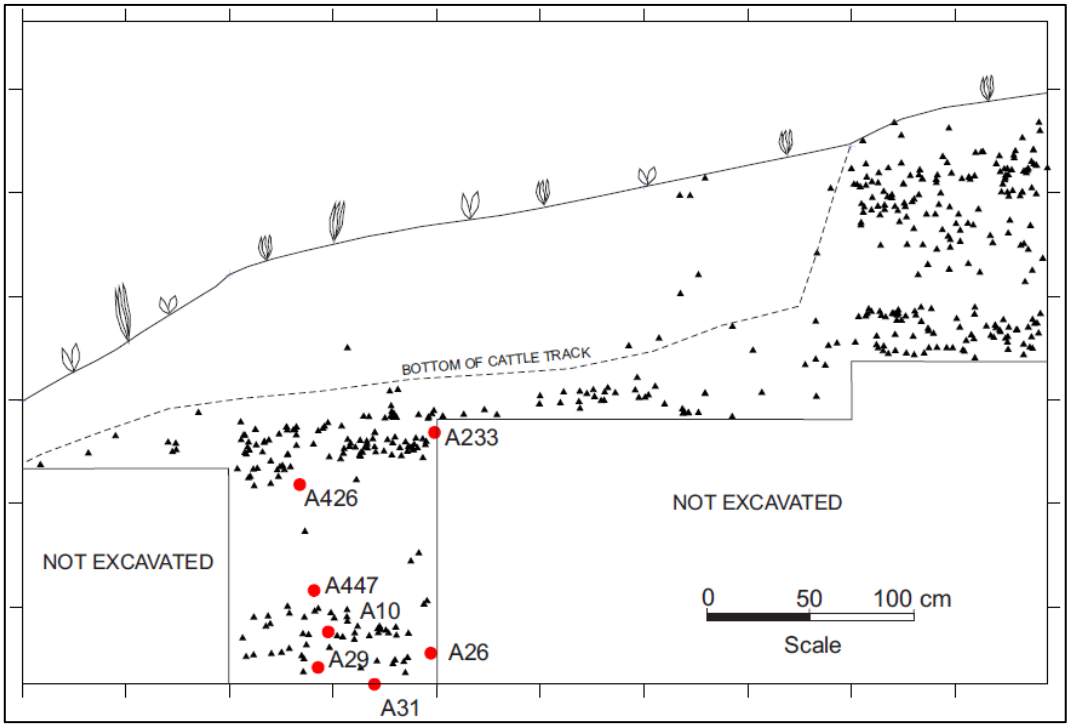

Figure 5. Bastos site, West Profile of the excavation with projected position of the archaeological materials (black triangles) and samples (red circles).

3.3. Chronology

The radiocarbon samples are shown in Figure 5. The samples show a very good fit between depth and age, the only exception being sample A 31 (Table 1), which is slightly younger than expected. Bastos site presented the following radiocarbon ages:

Table 1. Radiocarbon ages obtained at Bastos site.

Sample	Lab no.	Level	Material	Conventional Radiocarbon Age	Calibrated date (Cal Pal)[1]
A 233	Beta-390822	14	Soil organic matter	6,810 ± 30 BP	7,650 ± 30 BP
A 426	Beta-433580	17	Charcoal	7,980 ± 30 BP	8,870 ± 90 BP
A 447	Beta-433581	22	Charcoal	10,560 ± 30 BP	12,630 ± 40 BP
A 10	Beta-442554	24	Charcoal	10,490 ± 30 BP	12,500 ± 100 BP
A 26	Beta-442555	25	Charcoal	10,370 ± 40 BP	12,300 ± 150 BP
A 31	Beta-442557	26	Charcoal	9,650 ± 40 BP	11,010 ± 140 BP
A 29	Beta-442556	26	Charcoal	10,590 ± 40 BP	12,640 ± 40 BP

When we compare the obtained ages with the density of pieces, it seems that the site shows at least two different occupation levels, one younger than 9 ka, the other dating around 12.5 ka. There also seems to be a hiatus between these two occupations. However, other samples of charcoal are being selected for dating the upper part of the excavation and so to establish a more precise chronology for the site.

3.4. Lithic analysis

Here we will discuss only the material coming from the excavated units, not taking into account the surface finds. The defined classes are shown in Table 2.

Table 2. Lithic industry of Bastos site.

Class	Quantity	%
Flake	49	16
Fragmented flake	73	23,7
Flake fragment	80	26
Residue (waste)	85	27,6
Core	8	2,6
Retouch Flake (< 2cm)	11	3,6
Raw material (unmodified)	2	0,50
Total	**308**	**100**

We will address whole flakes and flakes that preserve the proximal end (fragmented flakes) because of their higher informative potential (n=122).

At Bastos site the most common accident is the “siret” fracture (almost 15%). This type of accident occurs when the blow delivered by the hammerstone is too strong, and it is also linked with the quality of the raw material (Patten 2015). The second type of accident are the hinge fractures, which happen when the applied force does not run its full course before energy is lost, allowing hinges to occur (op. cit.)

In this collection 51,63% (n=63) the platforms are mostly flat and a few with preparation to increase the angle before the knapping process. Their length varies between 12 and 134 mm, width between 12 and 115 mm, and thickness between 2 and 44 mm. The distal end of the material consists most in broken termination and is represented in 73 of the flakes (59,83%) followed by 23% (n=28) of feathered termination as it is possible to observe in table 3.

[1] All radiocarbon ages calibrated using CalPal 2007 (Weninger *et al.* 2012).

Table 3. Types of striking platforms identifying lithic industry of Bastos site.

Platform types	Quantity	%
Cortical	26	21,31
Dihedral	6	4,96
Faceted	7	5,73
Smashed	2	1,63
Linear	4	3,27
Flat	63	51,63
Partially Broken	14	11,47
Total	**122**	**100**

The percentage of cortical flakes is 31,14% (n=38), 21,31% are found in the striking platform. The only type of cortex detected was caused by weathering, in less than 50% of the material.

Table 4. Types of distal parts identifying lithic industry of Bastos site.

Distal end	Quantity	%
Feathered	28	23
Broken	73	59,83
Reflected	17	13,9
Retouched	4	3,27
Total	**122**	**100**

Retouch was detected in 2% of the pieces (n=6). Their shape is distributed in irregular, convex and regular. The most common retouch is direct type, followed by inverse type. They occurr in all parts of the artifact (proximal, mesial and distal), most comprising short removals with semi-abrupt angles, ranging between 55º and 78º.

Some of the flakes show evidence of patina formation (n=27). The patina reaches 2mm of thickness, turning the color of the rock into lighter tones, whereas the texture was not significantly modified.

It was also possible to refit three pieces in this collection, all coming from the same 1 m^2 excavation unit. The first refit is composed by two parts of the same flake, both pieces found in the same level (Figure 6).

Figure 6. Refitting of two pieces composing a single flake, found in the same level. Note patina formation on the dorsal face (right). Photo: Ader Gotardo.

The second refit is also composed by two halves of the same flake. They were found in a vertical distance of 18cm from each other. (Figure 7).

Figure 7. Refitting of two pieces composing a single flake, found within a vertical distance of 18 cm. Ventral face (left) and dorsal face (right). Photo: Ader Gotardo.

The last refit is composed by two parts of a flake detached from a core found within a vertical distance of 4 cm (Figure 8).

Figure 8. Core reassembled (left) and the two refitting parts (right). Photo: Ader Gotardo.

4. Discussion

Preliminary observations suggest that all the raw materials came from the Itaqueri Fm, found at the top of the plateau above the site. The amount of cortex suggests that the initial flintknapping activities occurred outside the site, maybe next to the raw material sources. Some pieces show signs of being (re)flaked after a patina was formed over previous flake scars. This suggests core recycling (Figure 9).

The refitted pieces were found on the same level or at least within few centimeters apart, strongly suggesting the result of *in situ* activities, at least for the lower, Paleoindian layers. Another line of evidence is that gravitational processes would tend to result in the accumulation of larger materials in the flatter lower terrace (Rick 1976), but instead we found a large quantity of small flakes in the site (less than 2 cm).

It is possible to note flakes with faceted platforms, which is indicative of more care and effort expended in tool production (Andrefsky 2005).

Figure 9. . Patinated cores showing signals of flaking events at different times. Left: piece no. BST328; Right: piece BST 186. Photo: Ader Gotardo.

5. Conclusions

Our preliminary interpretation is that Bastos represents an habitation area, a place where activities such as flintknapping, tool use, retouching and maintenance of lithic artifacts were occurring. Considering the characteristics exhibited by the majority of the flakes it is possible to affirm that this group was producing simple flakes that could serve as tools. Although the site presents a few pieces with signs of bifacial reduction, the retouch is predominantly unifacial, and no formal artifacts were found.

Bastos is nowadays the oldest site in São Paulo State, and contemporaneous to other Paleoindian sites in SE Brazil, such as the ones found at Lagoa Santa (Araujo *et al.* 2012) and Pains (Koole 2014). The lithic industry, however, is different from the ones found at these locations, suggesting the existence of a culturally distinct Paleoindian group. It is also important to note that we did not reach sterile levels, and future excavations may eventually provide older ages.

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