
Final Pleistocene and Early Holocene at Sitio do Meio, Piauí, Brazil: Stratigraphy and comparison with Pedra Furada

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Abstract:

Sitio do Meio, in southern Piauí, Brazil, is the second most important rock shelter presenting fully Pleistocene dates and artefacts after Pedra Furada. Despite the anthropogenic origin of Pedra Furada artefacts having been questioned, SDM has a better chance of being accepted by the scientific community because of the absence of the most relevant stone breaking agents in this kind of site, *i.e.* waterfalls. This paper presents a critical review of the history of excavations (1980-2000), stratigraphy, chronology, and the archaeological content of the site (sector 2). At least 98 stone tools have been identified and described, all of them being older than 12,500 BP, *i.e.* belonging to the Upper Pleistocene phase of Pedra Furada 3, as defined in the close reference site. The lithic industry of Serra Talhada phase (Lower Holocene) is also presented and compared with Paleoindian sites of North-Eastern and Central Brazil.

Keywords: Upper Pleistocene; Lower Holocene; Brazil; lithic industries; excavations; radiocarbon dating; first peopling of the Americas

Resumé:

Le Sitio do meio, dans le Piauí méridional (Brésil) est le deuxième abri sous roche de la région ayant livré des dates pléistocènes en dehors du site de la Pedra Furada. L'article présente une révision critique des fouilles (1980-2000), la chronostratigraphie et le contenu archéologique du secteur 2. Une centaine d'outils lithiques sont décrits, ils sont plus anciens de 12,5 ka BP et correspondent à la phase Pléistocène Pedra Furada 3 définie dans le site éponyme de référence. On présente aussi l'industrie lithique de la phase Serra Talhada (Holocène ancien) en la comparant aux industries paléindiennes du Nord-Est et du centre du Brésil.

Mots-clés: Pléistocène supérieur; Holocène inférieur; Brésil; industries lithiques; fouilles; radiocarbone



1. Introduction

For a long time Pleistocene peopling of the Americas has been the focus of possibly the most copious and inconclusive debate in the field of prehistory. In the last twenty years, the issues on the top spot of this important but yet unsolved chapter of human and natural history range from the genetic background of the ancestral stock(s) which originated the first Americans (Anderson & Gillam 2000, Perego *et al.* 2009), with the associated issue of the number and timing of peopling events (Lanata *et al.* 2008), the palaeogeographic and palaeoclimatic conditions for such events (Pitblado 2011), as well as the "routes" of peopling (Bryan & Ghrun 2003, Dillehay 2008). At the very core of these hypothesis, theories or simply conjectures is - in the ultimate level - the humble nature of artefacts and the stratigraphic context of each site.

Brazilian *lowlands* have been for almost two decades at the centre of action for the Southern continent because of the presence of several sites with radiocarbon dates > 12,000 BP and the debated nature of the associated cultural material. Since 1980, in South-Eastern Piauí, the franco-brazilian team led by Niéde Guidon conducted many research projects on rock-art chronology (Guidon 1985), "pre-Clovis" archaeological sites (Guidon & Delibrias 1986, Guidon & Arnaud 1991), as well as palaeontological (Guérin & Faure 2008) and palaeoenvironmental data (Chaves *et al.* 2008). The longest chronological sequence in the region is Boqueirão da Pedra Furada (BPF) rock-shelter which has been published in details (Parenti 2001, Santos *et al.* 2003) after an harsh debate (Meltzer *et al.* 1994, Parenti *et al.* 1996). The final Pleistocene layers at BPF (PF 3) show a slight evolution in lithic tool-kit, although a gap in the radiocarbon sequence between 14,300±210 (GIF 6159) and 10,400±180 (GIF 5862) has been recorded. This gap, as shown below, is partially represented in another rockshelter, named Sítio do Meio (SDM), located in Figure 1 in relation with the reference site of Pedra Furada.

In this paper we present the available data on past excavations at SDM, obtained on the basis of published data (Guidon & Andreatta 1980, Guidon & Pessis 1993, Pinheiro de Melo 2000) and four unpublished dissertations (Aimola 2008, Andrade 2010, Mota 2010, Pinheiro De Melo 2007), focusing both on the existence of cultural remains in the final Pleistocene and on the significance of lithic tool-kit in early Holocene, in the context of the prehistory of North-Eastern Brazil (Martin 1997).

2. Regional setting: Serra da Capivara National Park, Sítio do Meio rockshelter and the archaeological excavations

Southern Piauí is dominated by the contrast between the wide pre-Cambrian plain and the Palaeozoic *plateau* of Piauí-Maranhão basin. The bulk of more than 1,300 sites actually recorded in the *Serra da Capivara* National Park and its surroundings are sandstone shelters with rock paintings, mainly dated to early and mid-Holocene. As usual in Northern Brazil, the shelters are mostly created by differential erosion of the *cuesta* cliffs, as in the close (1,500 m) reference site of Pedra Furada, incised in a silty layer interbedded in the Silurian sandstone of *Serra Grande* formation.

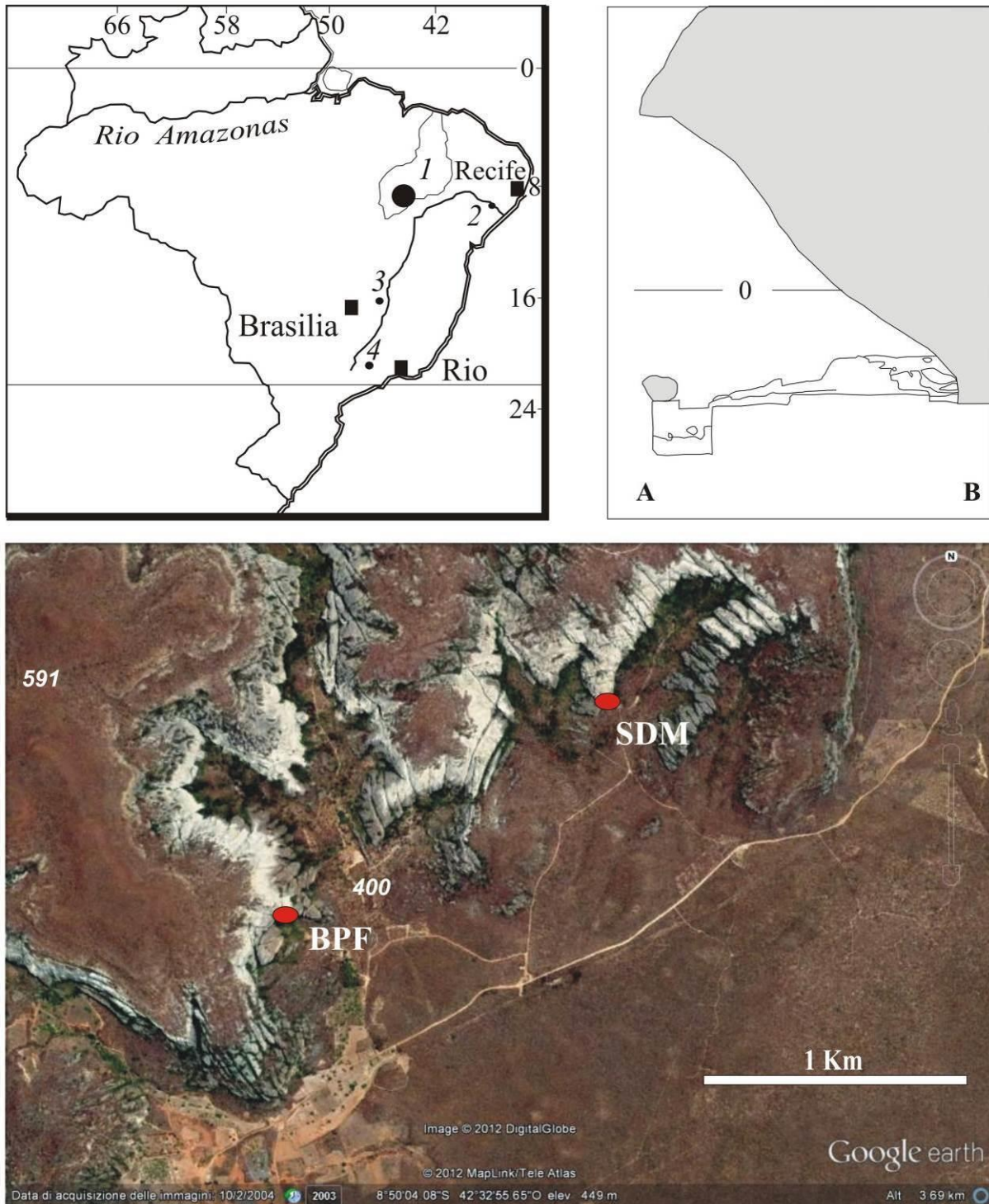


Figure 1. Position of sites: Sitio Do Meio (SDM) and Boqueirão da Pedra Furada (BPF.). Aerial image from Google Earth (2014).

At SDM the available surface is defined by an impressive talus of collapsed sandstone blocks, noticed as soon as the site was discovered (Guidon & Andreatta, 1980). Behind the blocks is the most protected portion of the sheltered area (86 m^2), with red-painted panels of *Serra Talhada* tradition on the wall and engravings on some blocks (Cisneiros 2008). During past excavations hundreds of these blocks have been removed, their length ranging from 0.4 to 18 m. The shelter is 64 m long, its width ranging from two to 17 meters due to the irregularities of the sandstone wall. The maximum elevation of the roof is about 29 m, which

allows the most intense rainstorms penetrate the outer part of the site, as in BPF (See Figure 1). The conventional limit between "inner" and "outer" sector of the site adopted in past excavation reports is almost parallel to the drip line (See Figure 2). Collapsed blocks were found in both sectors, excavations in the inner part often had to be interrupted because of the presence of such blocks. The deposition of these is the main agent of the filling of rock-shelters in semi-arid landscapes, as documented also in the case of BPF. In the majority of shelters in Serra da Capivara area, the filling is usually not older than lower Holocene, but in some cases it has been protected from erosion, which was stronger in the final Pleistocene moister conditions.

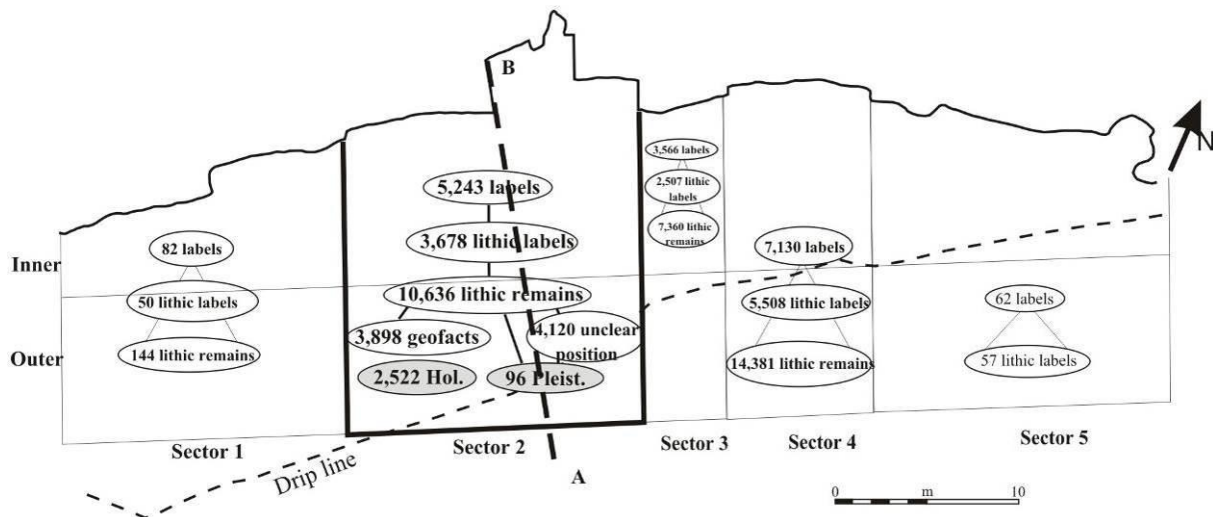


Figure 2. Site plan with labels and artifacts per sector, comprising both inner and outer part.

The interpretation of data from Sítio do Meio is a difficult task, mainly because of the complicated history of its excavations (sectors and materials are represented in Figure 2). About 80% of the upper layers of the site have been excavated, but the lowermost Pleistocene units have been unearthed only in the central part of the sheltered area. More recent soundings have been conducted in 2012 by Eric Boeda and co-workers in the eastern portion of the shelter (Boeda *et al.* 2013, fig. 24.1).

From 1973 to 2000, six field campaigns have been undergone (listed in Table 1), all coordinated by Niéde Guidon, but in collaboration with several field-leaders, in different sectors or -sometimes- in the same sector, but employing different data recording techniques and with different scientific goals. The most difficult task the archaeologists faced in this site was the recognition, definition and removing of each -supposed- sedimentary unit. This is mainly because the lateral discontinuity of sandy lenses in rock-shelters, an old nightmare for prehistoric archaeologists (Bordes 1975), but also because of the abundance and heterogeneity of fallen blocks. For these reasons, the similar numbers observed in the field reports of SDM does not have any stratigraphic meaning and does not imply any correspondence or correlation. Therefore, each specific object or structure considered in this study has been submitted to a careful verification of its position before its inclusion in the database with a firm chronological attribution.

In order to reconstruct the sequence of excavations, to have a reliable synopsis of the stratigraphy and to clearly identify the Pleistocene units of past excavations, one of us (GA) conducted a detailed philological reading of the documentation available in FUMDHAM archives in 2008, proceeding as follows: 1) control of the dip of sedimentary units recorded in the sections; 2) synopsis of field notebooks; the most complete for stratigraphic remarks and

topographic details are those of 1978 and 1980 campaigns, which served as a basis to reconstruct a stratigraphy with the dip of each excavation campaign.

Table 1. Excavation campaigns at SDM: 1978-2000

Year	Days	Leader	Survey equipment	Dimensions	M ³	Progressive M ³	Sectors
1978	13	Guidon	Grid, transit level	5x5x2.5	62.5	62.5	2: abcde squares
1980	14	Guidon	Grid, transit level	3x5x4	60	122.5	2: fgh squares
1980		Guidon	Grid, transit level	4x3x2.1	25.4	147.9	4
1991	47	Team	Grid, transit alidade	2x7;2x3	20	167.9	2
1991		Team	Grid, transit alidade	2x2;5x2	14	181.9	4
1992	12	Team	Grid, transit alidade	4.5x3x5;9.2x2x2;3x2x5.6	135.5	317.36	2
1993	6	Team	Grid, transit alidade	5x4x2.4	48	365.36	4
2000	?	Pinheiro	Total station	5x5x1.6	41.25	406.61	3
2000	?	Pinheiro	Total station	5x4x1.6	32	438.61	4
Tot	>92					2210.64	

The site was discovered in 1973; in March 1978, a small trench measuring one by two meter and 1.1 meter deep was opened, stopped by sandstone blocks. In July 1978, excavations were extended up to an area of 5 x 7 m, with the same depth in each square, except on F and G sectors, because of the presence of collapsed blocks. Two radiocarbon dates were obtained from charcoal: 12,200±600 BP (GIF 4628) and 13,900±300 BP (GIF 4927). In 1980, a trench of 3 x 4 m was dug, one meter deep. At the end of this campaign, an assemblage of 79 lithics (30 on siltstone small slabs) was collected and another two dates were obtained: 12,440±230 (GIF 5403) and 14,300±40 (GIF 5399).

Although yielding interesting dates from the Pleistocene-Holocene boundary, the excavations at SDM were interrupted for over a decade, due to the much older chronology observed at BPF. In fact, the quite old Pleistocene dates obtained there in 1978 and 1980 called for larger surface excavations from 1982 onwards. It is not unreasonable to say that from 1984 to 1988, BPF drew almost any effort by Guidon's team, with one of us (FP) coordinating the main campaigns from 1987 to 1988. Sitio do Meio excavations were resumed in June 1991 in order to try to confirm the very old dates obtained from BPF (Figure 3). In those days, the huge sandstone blocks at the entrance of the shelter still protected the sections of older excavations, the sequence of which was - obviously - used as reference for the new ones. Modern surface was completely surveyed, and the site was subdivided in inner and outer parts and in 5 sectors: sectors 1, 3, 5 remained preserved and new research was undertaken in sectors 2 and 4, the same ones of the earlier excavations. After the removal of larger blocks, in sector 2 (17 x 16 m) and 4 (17 x 8 m) a new metrical grid system was established and excavation was (supposedly) conducted by natural layers (french *décapages*), and each *décapage* was subdivided in excavation phases. Due to the granulometrical homogeneity combined with a lateral discontinuity of the sediment, sometimes this recording system lead to a lack of correspondence between the excavations units (*décapage* or phase) and the sedimentary bodies effectively recorded in final sections. In sector 2 (comprising an area of 272 m², the largest one), a surface collecting of re-worked remains was undertaken: post-contact ware, lithics, bovinds and equids remains, charcoal and modern feces. Below the disturbed sediment, the first true *décapage* was performed: a rich lithic industry, charcoal, ochre and two fragments of painted sandstone were recovered; moreover, a fireplace was identified and excavated. Two trenches for stratigraphic control were opened in this sector. Afterwards the entire sector was excavated and all blocks removed. Although charcoal and

lithics were recovered in the lower layers, no datings were obtained in this campaign. In sector 4, two trenches were opened when the excavated surface was at 4th phase of the second *décapage*, in order to attain the same level of 1980 trenches (named - unfortunately - as in sector 2, "Trench 1" and "2", 1991). In 1993, the bottom in sector 4 was finally reached and the outer portion of sector 2 was explored with a trench which was perpendicular to the sandstone wall. Below another collapsed block, more archaeological layers with charcoal fragments and lithics were discovered. On July 29th, the excavations reached the sandstone at the bottom, just below a sterile layer of fine sand, with comminuted (probably natural) charcoal fragments dated at $20,280\pm 450$ (Beta 65350) and $25,170\pm 140$ (GIF 9542) uncal. years BP. During the 1993 campaign almost the entire sector 4 was excavated; in its North-eastern part, at 1.3 m from the top-soil, a fireplace was uncovered and dated at $8,800\pm 60$ (Beta 47494) uncal. years BP, and it was not excavated. Despite the loss of some of field notes, we know that one hearth was found, dated at $9,200\pm 60$ (BETA 65856) uncal. years BP and (apparently) associated with a polished axe (Guidon & Pessis 1993).

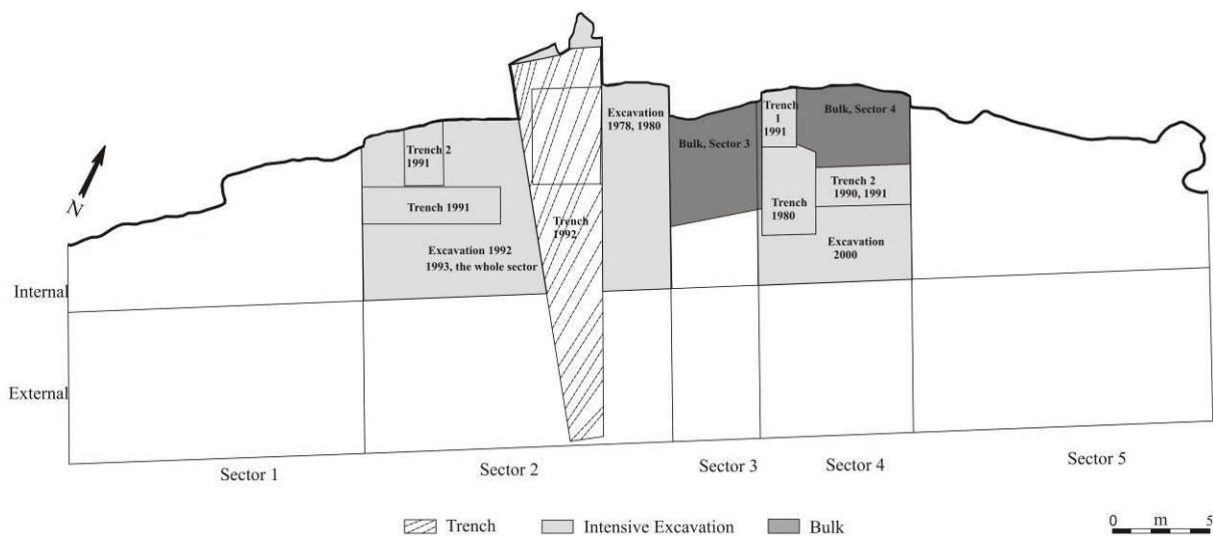


Figure 3. Succession of excavations 1978-2000.

Excavations were interrupted at an (archaeologically) "sterile" layer at 2.4 m of depth. In 1999 and 2000, P. Pinheiro de Melo carried out new research in sector 4 where the preserved blocks were excavated till the bedrock, providing six fireplaces, the precise position of them, however, is unclear. Sector 3 (6 x 5 m) was also excavated in order to link the previous sections of sectors 2 and 4; but the term *décapage* was, in this case, referred to natural strata, *i.e.* units of variable thickness, instead of regular excavation phases inside each stratum. After the usual cleaning of modern sediments, 12 fireplaces were unearthed. One of them is morphologically remarkable and dated to $8,805\pm 50$ (LY 10138) uncal. years BP. (Discussed further in Section 5.) Just below, another structure with sandstone slabs and an ochre *plaquette* with a string of graminaceous seeds were recovered along with human teeth from a four to nine years-old individual. This funerary structure was dated at $8,920\pm 50$ (LY 10134) uncal. years BP. The excavation continued until the *in situ* sandstone, but the available documentation is not very informative and, therefore, it will not be considered here. All 14C dates are listed in Table 2.

In 2012 a new excavation project took place at SDM, led by Boeda and co-workers (Boeda *et al.* 2013). In this paper, the short chapter dedicated to SDM (p. 457-459) is mainly devoted to lithic technology and is not as informative as necessary in order to understand the relationship between new and old excavations. In the few lines devoted to the stratigraphy of the shelter, it seems that Boeda and co-workers adopted the stratigraphic synopsis proposed

by of Pinheiro de Melo (2000), without assessing its reliability: A- Holocene unit, B- undated, C -half a meter dated at the bottom between 23,000 and 25,000 BP. It is exactly this subdivision that we carefully re-considered and checked in the Master thesis of one of us (Aimola, 2008), concluding that, because the lack of homogeneity of excavation techniques and documentation, it is not as firm as proposed. Starting from this stratigraphically unfirm terrain, Boeda and co-workers, on the basis of a small trench, announce the “surprising discovery” of a stone blocks structure “filled with a large number of small cobbles”. The issue of stone structures at SDM is well known and it has been considered since a long time; in FUMDHAM deposits are stored 517 sandstone blocks or slabs and 238 quartz cobbles from 57 recorded structures which, according to field notes (when available) are described as clearly of anthropic origin, sometime polished, with percussion marks and, often, associated with charcoal. But also for these important remains the previous documentation is cryptic, even if in this case almost all structures have been drawn. One of us (CA) has provided a careful revision of this documentation for her dissertation (Andrade, 2010). Moreover, one of these structures, a fireplace romantically called “stonehenge”, is the most expressive example of B3 structure type of existing classification (Parenti 2001, p. 116; fig. 11); it is on display at the *Museu do Homem Americano*. May be Boeda and co-workers did not gain access to the available reports on this crucial matter (Pinheiro, 2000, 2007; Andrade 2010) as long as to the many shelves in FUMDHAM deposits full with sandstone blocks and cobbles from SDM structures.

3. Stratigraphy and chronology

Below the disturbed surface sediments (30-40 cm), the sub-horizontal Holocene layers are composed mainly by colluvial sands and quartz pebbles with sandstone or siltstone *plaquettes* from the wall. Based on sections available at FUMDHAM files, on notes by J. dos Santos (Santos 2007: 93) and on personal field observations, the sediment can be described as follows, from bottom to top: I) Palaeozoic sandstone of *Serra Grande* formation; II) very thin layer of fine sands, thickening close to the outer portion of the shelter; III) sand with rounded quartzitic cobbles and siltstone fragments; IV) fallen heterometric sandstone blocks; V) small gravel with angular and sub-angular quartz pebbles in matrix of poorly sorted medium sand. Units III-IV are visible in Figure 4.

Throughout the 1978-2000 campaigns, a total 29 radiocarbon dates have been obtained, all from charcoal. Among these dates, only 16 (13 in sector 2) have a precise position and will be considered here (shaded in Table 2). In any case, beneath the $12,640 \pm 210$ uncal. years BP (GIF 9541), -2.40 m below *datum*, all samples resulted in fully Pleistocene dates, therefore all the associated material from sector 2 will be retained in this analysis. At the very bottom of the sequence a date of $25,170 \pm 140$ (GIF 9542) uncal. years BP was obtained from a charcoal fragment from the unit 2, a possible fluvial sediment thicker in the outer part of the shelter, not associated with any artifact. This is the *terminus post quem* for the archaeological presence at the site (Figure 5).

4. Lithic industry

According to our revision of FUMDHAM collections, sector 2 has yielded a gross total of 10,636 inventoried lithic remains, collected in 3,678 topographic points, according to which a label number was attributed (Figure 2). The vast majority of these remains are splitted pebbles of quartz without any intentional flaking evidence (collected either for comparative purposes or because they present evidence of heating) or sandstone slabs that belonged to purported fireplaces or other structures. We should note, however, some sampling bias between different field seasons: in 1978 and 1980 only purported artifacts had been

recovered, whereas in following campaigns all lithic remains were collected. Out of these 10,636 remains, 96 are from Pleistocene and 2,522 from Holocene layers (here defined by elevation), 3,851 were classified as geofacts by Pinheiro De Melo (2007) and the remaining 4,167 have uncertain stratigraphic position and therefore were excluded from this analysis. Moreover, sector 2 - the largest one - has been extensively excavated and roughly 130 m² are outside the drip-line and, because of this, more exposed to the intrusion of geofacts from the outer stream.

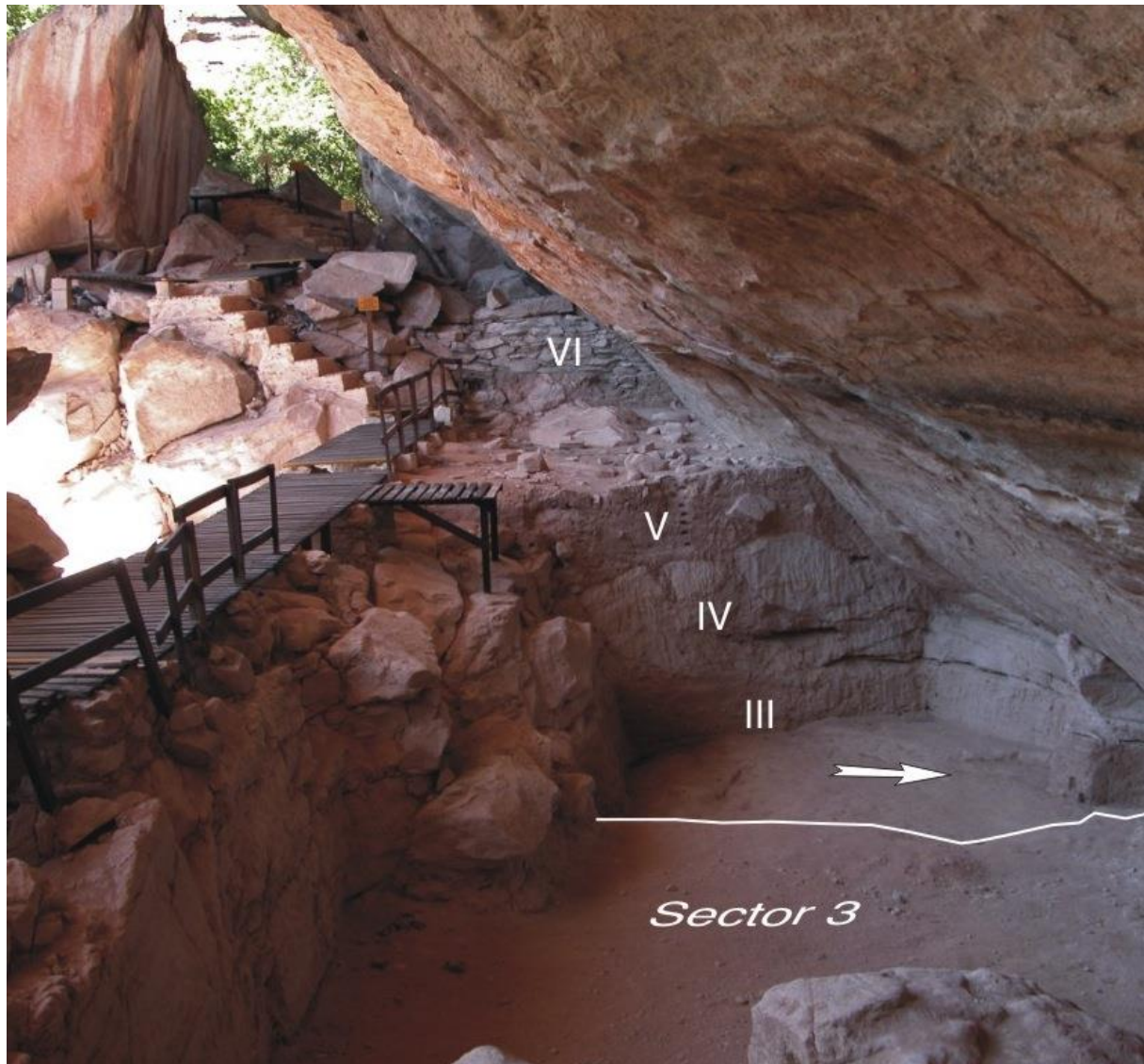


Figure 4. Sector 2 and main section, looking West. (Photo by G. Aimola.)

Given this sampling context, the selection of lithics, both from Pleistocene and Holocene units, has been conducted on the base of the natural gravitative fractures observed in BPF site (Parenti 2001: 135-150). This decision took into account the fact that both, topography and sedimentology at SDM and BPF share similar conditions: both sites lay at the bottom of the *cuesta* and are located between two canyons; SDM, however, is different because: 1) it does not present any active talus of quartz cobbles and pebbles originated by near waterfalls as BPF (however SDM was probably flooded before the first block collapse); 2) the outline of *cuesta* in front of SDM is convex and narrow, unlike that of BPF, which is large and concave; this probably leads to a lesser water volume during rainfalls; 3) finally, differently from BPF

with its East-West average dip of 10°, sedimentary units at SDM have a sub-horizontal dip; this means that the entry of pebbles inside the drip-line is much more uncommon than in the outer portion of the shelter, as documented by the fine matrix of sedimentary unit V (see Figure 4). In sum, we included in this study any flaked pebble with at least two adjacent flake-scars >10 mm and any flake with striking platform angle < 90°.

Table 2. 14C dates from SDM, shaded considered dates with a precise position. Calibration with Calpal

Dates	+/-	Calibration	N° Lab.	Label	Year	Sector	Elevation
97	0,7		AMS- Ua18143	29386	1991	2	Top
7.240	45	6.216-6.009	LY 10137	58758	2000	3	
8.100	90	7.411-6.669	GIF 9409	41069	1992	2	
8.760	100		GIF 8988	34302/34340	1991	2	
8.800	60		Beta 47494	39603	1992	2	-1,3
8.804	53	8.200-7.655	LY 10138	58026	2000	3	
8.920	50	8.260-7.925	LY 10134	59201/59226	2000	3	
8.925	55	8.262-7.923	LY 10136	58530	2000	3	
8.960	70		Beta 47493	38219/38210	1992	4	-1,64
9.080	60	10.370-10.330	Beta 148099	59244/59261	2000	3	
9.110	60		LY 10141	59663/59724	2000	4	-2,12
9.110	80	8.342-7.982	GIF 9407	40664/40663	1992	2	-1,60
9.150	60	10.480-10.205	Beta 133792	50225/50226	1999	4	
9.200	60		Beta 65856	41542/41540	1993	4	-2,05
9.270	100	8.584-8.063	GIF 9408	40758	1992	2	-1,67
9.400	60		GIF 9027	36837	1991	2	
9.450	70		Beta 65349	41278	1993	2	
9.826	55	9.345-9.220	LY 10135	59181/59481	2000	3	
10.110	55	9.993-9.361	LY 10139	58275	2000	3	
12.200	600		GIF 4628	2618	1978	2	Lev. V
12.440	230		GIF 5403	45	1980	2	Lev. XV
12.640	210	13.595-12.289	GIF 9541	40961	1992	2	-2,41
12.870	40	13.553-12.941	GIF 9540	40959	1992	2	-2,57
13.100	50	13.905-13.338	GIF 9410	40904	1992	2	
13.180	130		LY 6094	40952	1992	2	-2,51
13.900	300		GIF 4927	2623	1978	2	Lev. VI
14.300	400		GIF 5399	83	1980	2	Lev. XVIII
20.280	450		Beta 65350	41302/41304	1993	2	-4,91
25.170	140		GIF 9542	41145	1993	2	-5,88 ext.

The distribution of the 96 confirmed Pleistocene artifacts of sector 2 is: three choppers, 23 cores, 39 flakes, eight retouched pieces, and 23 fragments (see Figures 6, 7, 8, & 9). All raw materials are from local origin: quartz and quartzite (66%) and – interestingly – the softer siltstone (32%). The absence of chalcedony and flint in final Pleistocene layers has already been described in BPF and it represents one of the most intriguing archaeological problems in this region (Parenti 2001). No clear hammerstones have been recovered from the Pleistocene units. Core tools (choppers + cores) presented an average of 3.9 flake scars, (compared to only 2.3 at BPF), pointing, along with a remarkable number of flakes, to a possible function of SDM as flaking stand or – at least in sector 2 - to the presence of a lithic workshop. Flaking is quite expedient also at SDM as in the Pleistocene layers of BPF, because cores have no prepared striking platforms and flakes have mostly (38%) cortical butts. Ten retouched tools have been recorded: three choppers and seven flake tools.

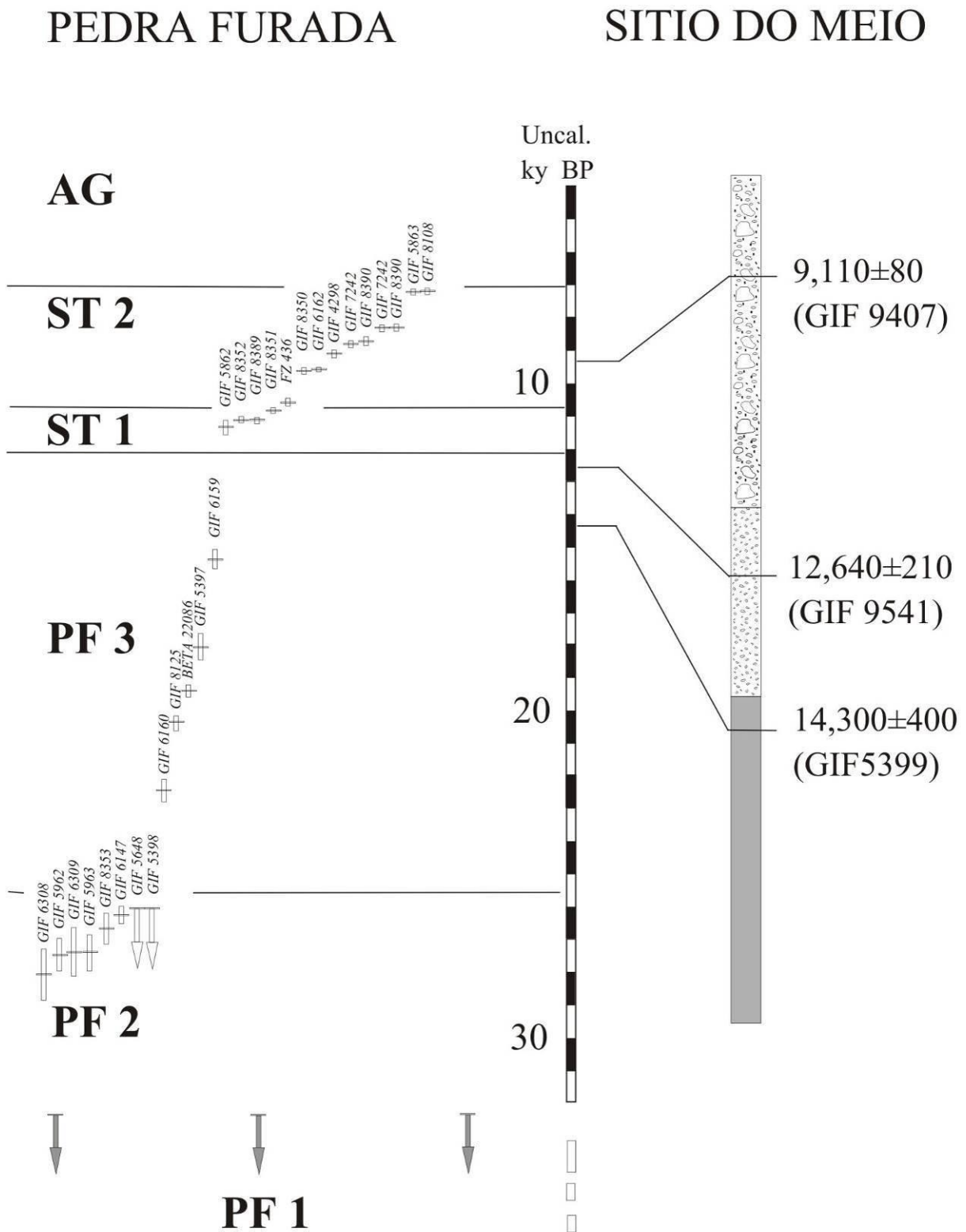


Figure 5. Stratigraphy and chronology of SDM, compared with BPF.

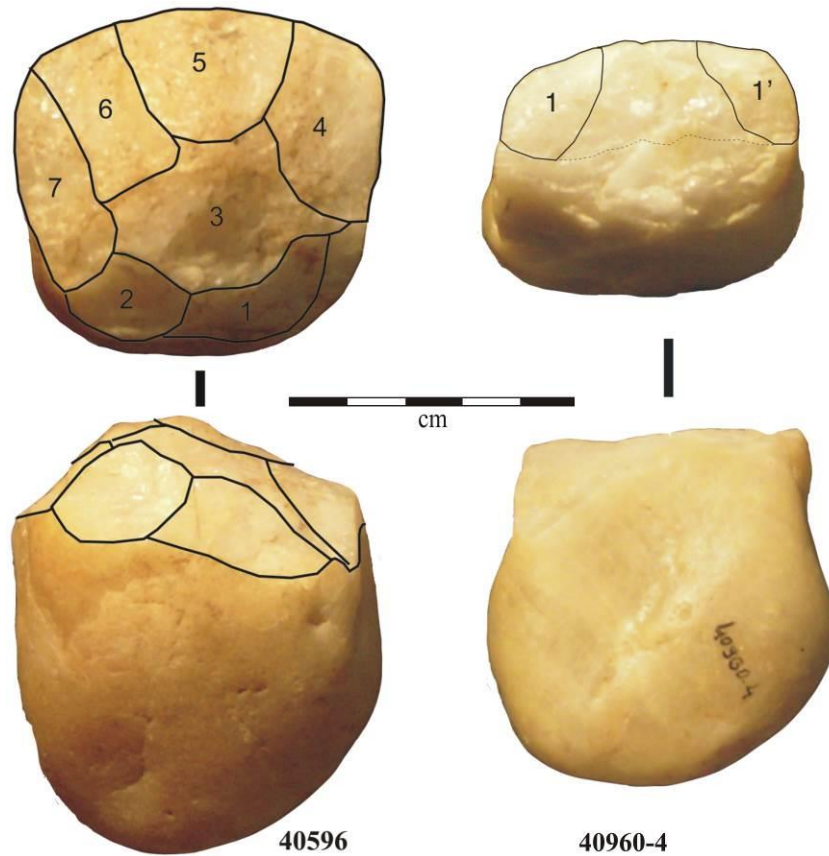


Figure 6. Core tools on quartz pebbles from Pleistocene layer of Sitio do Meio, Pedra Furada 3 phase, older than uncal. 12,640 BP. Numbers refer to FUMDHAM inventory. (Photo by G. Aimola.)

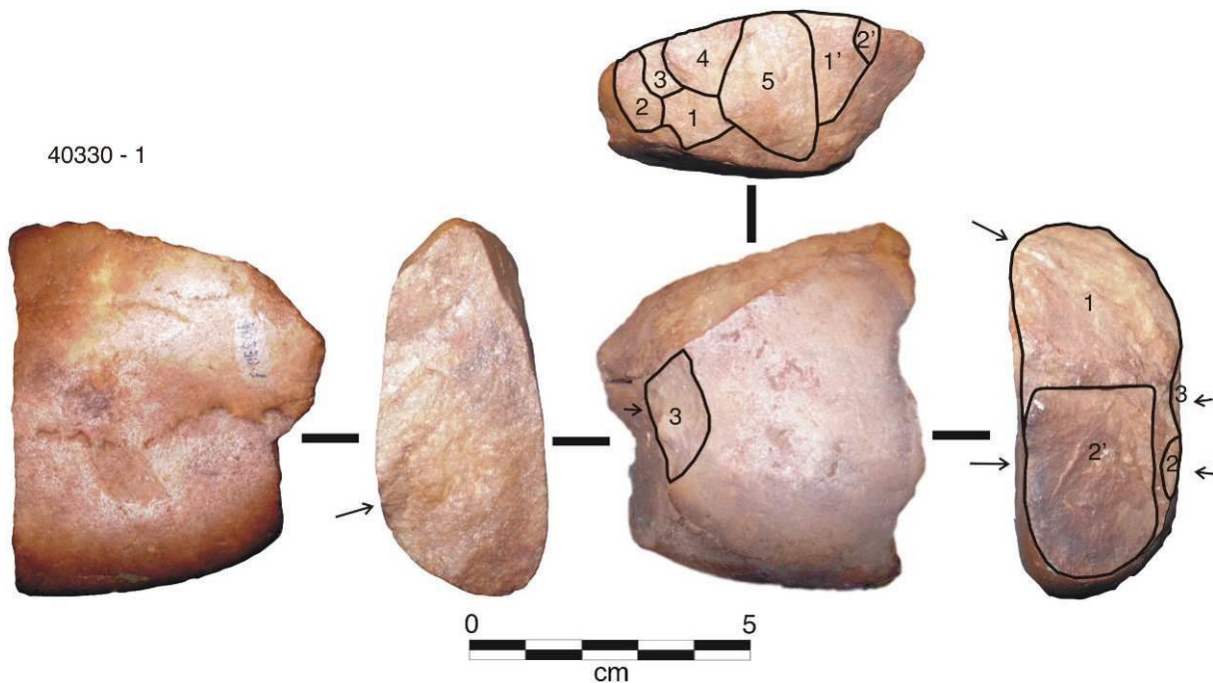


Figure 7. Core on quartz pebbles from Pleistocene layer of Sitio do Meio, Pedra Furada 3 phase, older than uncal. 12,640 BP. Note the high number of flake-scars. (Photo by G. Aimola.)

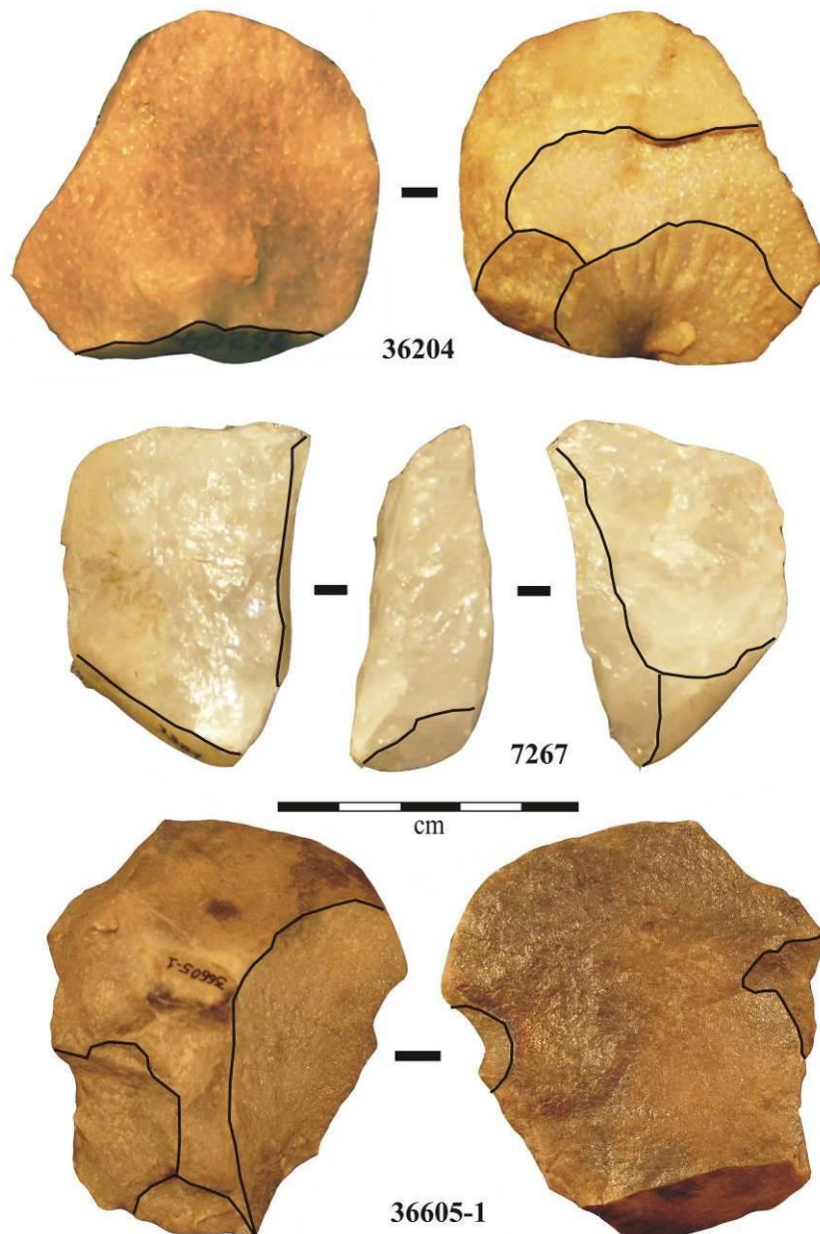


Figure 8. Flakes in quartz and quartzite from Pleistocene layer of Sitio do Meio, Pedra Furada 3 phase, older than uncal. 12,640 BP. Numbers refer to FUMDHAM inventory. (Photo by G. Aimola.)

In the Holocene units of sector 2, 2,522 lithic artifacts have been recovered (sampled in Figure 10), all from the inner portion, in sedimentary units comprised between $9,400 \pm 60$ (GIF 9027) and $8,100 \pm 90$ (GIF 9409) uncal. years BP, subdivided as follows: two hammerstones, 29 choppers (1,1%), 207 cores (8,2%), 579 flakes (23%), 1,549 chunks and small flakes (42%). Quartz and quartzite, locally available, sum up to 95%, with some artifacts made on silicified sandstone (1%), chalcedony (2%) and siltstone (2%) (Figure 10). The 207 cores present an average weight of about 200 g and they retain 6.5 flake-scars each, almost twice of the observed in the Pleistocene layers. Flakes have mostly cortical butts (61,3%), but plane (36,2%), faceted (0,35%), and punctiform butts (1,6%) were also observed. Eleven flakes have been made by bipolar technique.

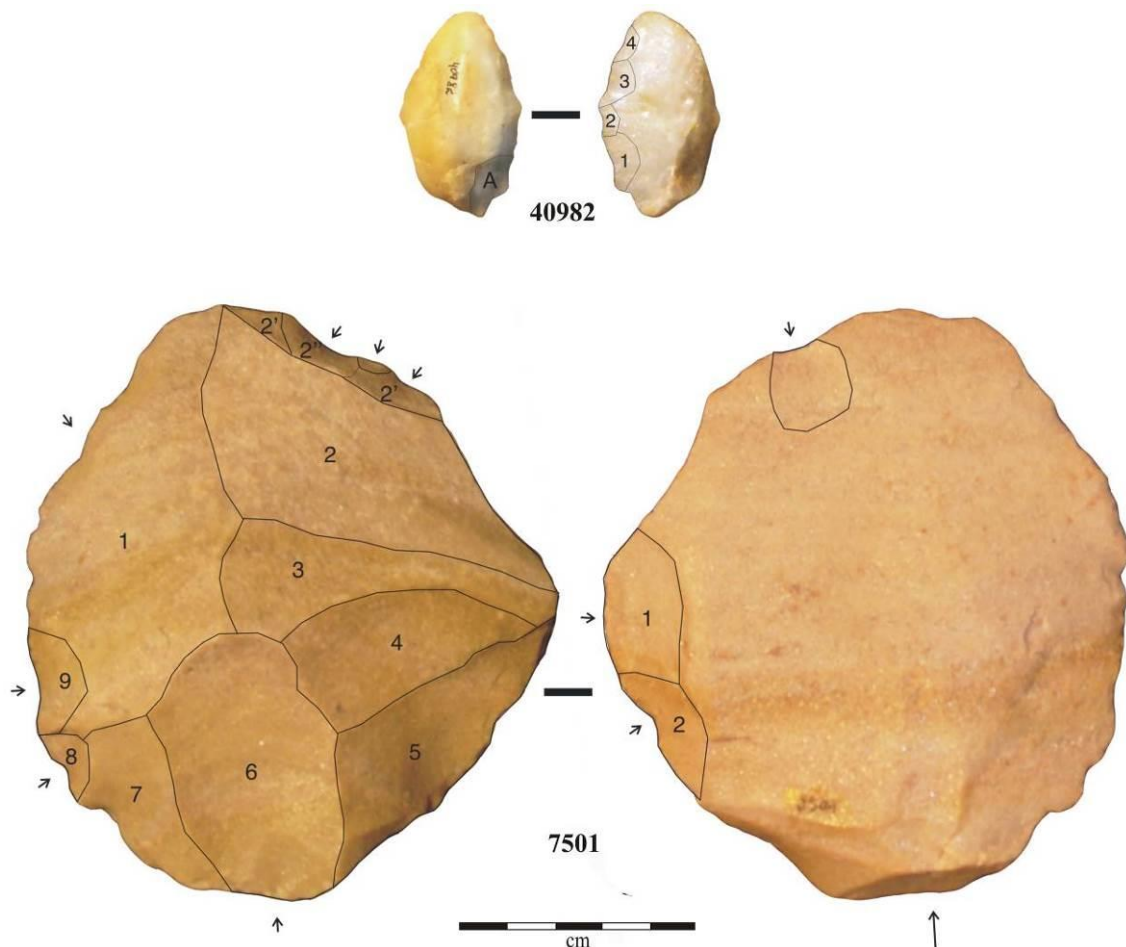


Figure 9. Flakes in quartz and quartzite from Pleistocene layer of Sitio do Meio, Pedra Furada 3 phase, older than uncal. 12,640 BP. Numbers refer to FUMDHAM inventory; retouched pieces: 40982 end-scraper in quartz; 7501: retouched flake in siltstone. (Photo by G. Aimola.)

In such rich deposits as the ones observed during the lower Holocene in Brazilian Northeast, morphological typology still makes sense, mainly for comparative purposes. For this reason we have organized the 82 SDM Holocene retouched artifacts according to the type-list previously adopted for BPF: 1) half of the artifacts (40) were made from flakes, mainly quartzitic flakes; 2) core tools sum up to 35% 3) only one *limace* is present; this is a completely retouched unifacial scraper traditionally considered as the reference tool for the lower Holocene in Brazilian *Planalto* (Lourdeau 2010). It is worth noting that only five tools were made from chalcedony, the prized raw material from which the majority of finished tools have been usually obtained in the rock-shelters toolkit of Southern Piauí. The majority of small flakes have been struck from quartz and quartzite, meaning a greater use of endogenous rocks in comparison to the BPF Holocene layers.

5. Stone structures, paintings, palynological and faunal remains

A total of 57 structures, including fireplaces, cairns and lithic workshops, have been recorded at SDM, but reliable documentation is available for only 10 stone structures from sector 4 and five structures from sector 2 (all structures from sector 2 were dated). Structures were made mainly of small fallen sandstone slabs and quartz cobbles. The majority of such structures has no clear borders and do not show any evident difference in their surface as observed in BPF. However, some of the structures are impressive, clearly structured hearths (as the one presented in Figure 11) or – sometimes – possible funerary cairns. Remarkably,

the dating of one structure (n° 1/18, 1992) gave a final Pleistocene age: 13,180±130 (LY 6094).



Figure 10. Artifacts from lower Holocene of Sitio do Meio, Serra Talhada I phase. Numbers refer to FUMDHAM inventory. 40631-3: chopper, 34109-1: flake, 36635-3: denticulate, 29094: simple scraper, 29085: flake, 31444: chopper, 29060: convex scraper. (Photo by L. Mota.)



Figure 11. Hearth 32, sector 3, 8,804 \pm 53 (LY 10138) (Photo by Fumdham Archive)

A very peculiar and popular artifact from SDM is a kind of anvil, unifacial or bifacial, obtained from large siltstone slabs; 115 of them have been recovered, almost all in sector 2, and 77 attributed to Pleistocene layers (Pinheiro De Melo 2007). Optical analysis using a binocular microscope suggest they have been used as polishers or grinders for seeds, nuts and pigments, the last ones frequently recovered as red or yellow ochre. In this regard, parietal art at SDM (paintings and engravings) is attributed to the Nordeste tradition, dated to lower Holocene (Cisneiros 2008), based only on stylistic ground. Some figures have been engraved on fallen blocks after 8,100 \pm 90 years BP (GIF 9409). Finally it is worth mentioning that a polished axe in granodiorite has been described (Guidon & Pessis 1993) as coming from a layer dated at 9,200 \pm 60 years BP, in sector 4 (Beta 65856) as well as a fragment of coarse ware from sector. 2, dated at 8,960 \pm 70 years BP (Beta 47493). Both remains, although relevant, need to be considered with caution because of the complex stratigraphy of the site, as well as the problems associated to the documentation and field recording of the excavations.

Palaeoenvironmental data from SDM come from studies on palynological and faunal remains. Pollen has been obtained from 30 coprolites and the most relevant result (Chaves 1997) shows that, between 12,000 and 8,000 BP, vegetation was typical of *Cerrado* (arboreal savanna of northern South America), and around 7,000 BP a *Caatinga* formation (shrubby savanna, as the current one) took over, pointing for a moister climate at the Pleistocene-Holocene transition. Because of the sediment acidity, faunal remains have been recovered only in the upper layers. They consist in about 2,150 remains of small mammals, very similar to the current faunal composition (Schmalz 1998).

6. Discussion and conclusion: Sítio do Meio in its context

With regards to stone tools, it seems that SDM did not play the central function that BPF did in the regional settlement system. If the lithic industry in the last millennia of Pleistocene at SDM can be reliably compared only with that from BPF, between 11 and 8,000 BP, an overview at a macro-regional scale can be established. Both SDM and BPF share main technical traits of the Palaeoindian so-called *Itaparica* “tradition” of Brazilian *Planalto*, present on a wide area, from Goiás to Pernambuco states (Lourdeau 2010). This tradition has been characterized by generally unifacial flaking with occasional occurrence of bifacial projectile points, as observed in Lapa do Boquete, Santana do Riacho, Perna I, and BPF. In some cases, like SDM, Santana do Riacho and Sítio do Justino, bipolar flaking has been observed (Fogaça 2001).

In this context the palaeoanthropological evidence, for the period encompassed by SDM sequence, can be summarized as follows: 1) at the very end of the Pleistocene an archaic and robust human morphology is present in the region, as documented by the cranial and dental remains from Garrincho, a limestone cave just 15 km SW from SDM (Peyre *et al.* 1998). The remains have been dated at 12,170±40 uncal. years BP (Beta 1366204), dating just after the first preserved occupations at SDM (Guidon *et al.* 2000); 2) at Toca do Paraguaio, another sandstone shelter close to SDM with funerary evidence, two penecontemporaneous burials (dated at 8,800-8,500 uncal. BP) presented two distinct cranial types, one of Austro-Melanesian/African morphology and the other much more similar to present mongoloid forms (Bernardo & Neves 2009). The authors of this study propose that in Lower Holocene two different human groups were present in Northern South America at the same time, probably the product of two different migration waves. This is exactly the period in which all the sites in the region show an impressive change regarding essential cultural traits such as lithic toolkit, rock-art and burials.

In this paper we presented the revision of the available information on the stratigraphy and archaeology of SDM, presenting analytical data on its lithic industries and showing that a considerable amount of evidence from the main sector can be reliably exploited. A minimum of about one hundred artifacts can be undoubtedly associated to the layers dated from the Late Pleistocene, deserving to be attentively considered in the debate about the earliest peopling of South America.

Just close to Pedra Furada, Sítio do Meio is the second archaeological Late Pleistocene site in North-Eastern Brazil with stone tools associated with structures. Just because the anthropic origin of BPF artifacts has been questioned, SDM is extremely important because of the absence of the main physical force potentially creating geofacts in this kind of site, i.e. waterfalls. Certainly, we should have more data on the sedimentary history of the deposit and on the taphonomy of lower units, which could still be possible on sector 1. The next research goal, in our opinion, should be the comparison of the artifact sample we presented here, surely Pleistocene in age, with both the artifacts recovered from Boeda team in 2012 and 2013 campaigns and the assemblage of PF3 phase of BPF, along with the toolkit from the recently published Vale da Pedra Furada and Tira Peia sites (Lahaye *et al.*, 2013). For so doing, it is essential to adopt a common methodology and a clear-cut classificatory toolkit. In any case, SDM not only confirm the presence of humans in Northeastern Brazil well before the bewitched chronological boundary of the end of Pleistocene, but it also provides the first step for a systematic intra-site analysis of the Southern fringe of the *Cuesta* of Serra da Capivara.

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