

Paleoindian Occupations in the Archaeological Locality Touro Passo, Brazil.

Ocupações Paleoindígenas na Localidade Arqueológica Touro Passo, Brasil

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Abstract: This paper summarizes and discusses the initial occupation (10,800-9,903 years AP) of the archaeological locality Touro Passo, municipality of Uruguaiana, western region of Rio Grande do Sul, Brazil. In the first place are presented the results obtained by the “Paleoindian Research Program” - PROPA (1972-1978) - Smithsonian Institution, headed by Eurico Miller (1972-1978) and his remarkable contributions to the study of paleoindian sites in Brazil. Additionally, is a synthesis of the studies performed by Milder (1994) in the sites investigated by the PROPA team in the 70s. The author has made an important review of Ibicui Stage based on the evaluation of Miller (1972-1978), identifying inconsistencies between the chronological and stratigraphic data. During the last decade, Pouey Vidal (2011-2018) has conducted geoarchaeological research in the area; relocating the paleoindian sites previously studied by PROPA, and looking for new paleoindian sites with outstanding scientific potential. A geoarchaeological approach has enhanced the understanding of the stratigraphic sequences, identifying the “in-situ” archaeological material beneath the Pleistocene Sedimentary Formation Touro Passo horizons, the perturbation and the site formation process of sites in fluvial subenvironments. The results have shed light to the Lamitic level with new 14C dates records.

KeyWords: Geoarcheology; Paleoindian, Pleistocene-Holocene.

Ocupações Paleoindígenas na Localidade Arqueológica Touro Passo, Brasil

Resumo: O artigo resume e discute a ocupação inicial (10.800-9.903 anos AP) da localidade arqueológica Touro Passo, município de Uruguaiana, região oeste do Rio Grande do Sul, Brasil. Em primeiro lugar são apresentados os resultados obtidos pelo “Paleoindian Research Program” - PROPA (1972-1978) - Smithsonian Institution, coordenado por Eurico Miller (1972-1978) e suas importantes contribuições para o estudo dos sítios paleoindígenas no Brasil. Na sequência é realizada uma síntese dos estudos retomados por Milder (1994) nos sítios pesquisados pela equipe do PROPA na década de 70. O autor fez uma importante revisão da Fase Ibicuí a partir da avaliação de Miller (1972-1978), identificando inconsistências entre os dados cronológicos e estratigráficos. Na última década, as pesquisas na área foram retomadas por Pouey Vidal (2011-2018) a autora realocizou os sítios paleoindígenas estudados durante o PROPA, além de localizar novos sítios paleoindígenas com amplo potencial de estudos científicos. O enfoque geoarqueológico da pesquisa permitiu a compreensão da sequência estratigráfica, identificação de material “in situ” nos horizontes da formação sedimentar Touro Passo e dos processos de formação e perturbação postdeposicional dos sítios arqueológicos em ambiente fluvial. Além de oferecer novas datações 14C para a área de estudo, que situam a ocupação caçadora-coletores como contemporânea as registradas em importantes sítios datados no Uruguay.

Palavras - Chave: Geoarqueologia; Paleoíndio, Pleistoceno-Holoceno.

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1. Introduction

The pioneering archaeological researches from the southwestern region of the State of Rio Grande do Sul were conducted during the PRONAPA (1965-1970)³ and PROPA (1972-1978)⁴ research programs. E. Miller's interest in the study of the archaeological sites of the Late Pleistocene- Early Holocene began with the discovery of the RS-I-50 site: Lajeado dos Fósseis, in 1968. The data acquired on this site allowed Miller to create the Paleo-indigenous Investigations Program - PROPA. The sites identified in this program were investigated through the concept of archaeological phases and traditions, which were categorized based on the typological symmetries of the artifacts (Dias, 2003, 2007).

Thus, this article presents a synthesis of the studies produced by the PROPA team, coordinated by Eurico Miller (1972-1978) and their relevant contributions to the archeology of paleoindian sites, as well as the valuable chronological data obtained. Initially is described the Archaeological Phases of Ibicuí and Uruguay and their characteristics found during PROPA. Then is presented an approach of Milder's (1994) studies in an effort to review E. Miller's work from the Archaeological Locality Touro Passo sites, located in Uruguaiana and neighboring municipalities. In his studies, the author obtained new chronological dating for the Rudáceo member of the Touro Passo Sedimentary Formation and searched for similarities between this and the Sopas Formation in Uruguay already pointed out by Bombin (1976).

From this point of view, is presented a synthesis of the regional model proposed by Bombin (1976) for the Pleistocene Sedimentary Formation Touro Passo in order to correlate it with the Sopas Formation in Uruguay defined by Antón (1975). It is crucial to discuss the review by Ubilla (1996) based on new paleontological studies and radiochronological analysis, in which identifies a divergent temporal and climatic scenario to that suggested by Antón (1975) for Fm. Sopas, and thus rejects the established regional correlations.

The interest in studying paleoindian occupations at the Archaeological Locality Touro Passo has been undertaken by Pouey Vidal (2011-2018) from a geoarchaeological perspective. Throughout the survey work the author located some of the sites identified during the 1970s by the PROPA team, they are RS-I-66: Milton Almeida; RS-I-67: Touro Passo; Barranca Grande

³ National Program of Archaeological Research.

⁴ Paleoindian Program of South America.

(Touro Passo Stream) and RS-I-69: Laranjito; RS-I-96: Fagundes (Uruguay River). The activities also involved the location of new sites with geoarchaeological and paleoenvironmental interest in the municipality of Uruguaiana / RS. Among the 17 sites surveyed and listed during the thesis investigation, 5 were from the Late Pleistocene-Early Holocene transition phase presenting archaeological material “in situ” at Fm. Touro Passo. In the Uruguay River region, the following sites were selected: RS-I-69 Site: Laranjito and Casualidade Site. In the Touro Passo stream, the following sites were selected: RS-I-66 Milton Almeida Site, Comis II Site and Barranca Grande Site due to their archaeological and paleontological occurrence. In this synthesis, are approached the results obtained from Barranca Grande site located in the specific area where Bombin (1976) defined the Fm. Touro Passo. Therefore, the correlation of the previous data and the ongoing geoarchaeological studies with new chronological data, allow an understanding of the context of hunter-gatherer occupations in the Touro Passo locality, as well as, to rethink the established regional correlations.

2. The Ibicuí Archeological Stage

The Ibicuí paleoindian archeological stage consists of three open-air sites related to the tributary banks of the Ibicuí and Quaraí rivers: 1) RS-I-50: Lajeado dos Fósseis, 2) RS-Q-2: Passo da Cruz 2 and 3) RS-I-107. The sum of evidence from this phase covers 46 lithic pieces for the total of the sites, composed by unipolar splinters without alteration or with random touches, like choppers, “rough” scrapers and pebble sets, splinters without evidence of use, chisels, in addition to the others fossil, animal and vegetable testimonies. This stage has only a direct dating of 12,770 + 220 years ¹⁴C AP (SI-801) for the site RS-I-50: Lajeado dos Fósseis, based on the analysis of a skull of *Glossotherium myloides* (Miller, 1987).

Nevertheless, the archaeological studies performed on the site were limited only to the collection of surface lithic evidence and a brief survey in the area where the fossil was found. Regarding that, Miller (1987) previously emphasized the urgency for new research to understand the sites “there is a shortage of major excavations based on a few hundred artifacts, in order to be able to indisputably stipulate the affiliation of the Ibicuí Stage to the paleoindian tradition with or without projectile points”(Miller, 1987: 48).

Saul Milder (1994) reinitiated the research on the Ibicuí sites again, in order to evaluate the effects of post-depositional processes in the composition of the archaeological record. From the

new fieldwork, based on surveying and observation of stratigraphic profiles, the author concluded that the association found on the RS-I-50: Lajeado dos Fósseis site should be questioned. It is important to note that the *Glossotherium* skull was discovered in a more recent clay layer, which indicates sediment redeposition. Considering the sedimentation processes of Sanga da Cruz, it is observed that the skull was located at the rivers outlet, an area that frequently receives deposits of sediments, and may have moved from the headwaters or may have been redeposited by the Ibicuí River itself that completely submerges the place in periods of floods (Milder, 1994). In this case, after consulting Miller's field diaries (1972-1978) and the lithic collection collected at the sites, he concludes that the connection between the skull and the 12 artifacts associated with the RS-I-50 site is also inconsistent. The descriptions in Miller's notes also mention that the lithic pieces were dispersed on the surface over 300 m, on both banks of the Sanga da Cruz, and show signs of natural splintering, generated by river drag (Milder, 2000).

The two remaining sites of the Ibicuí stage were indirectly dated, and show similar sedimentary conditions related to discontinuous deposits of lithic and fossiliferous materials, probably also resulting from taphonomic processes and river drag. The RS-Q-2: Passo da Cruz 2 site, located on the banks of Sanga do Salso, a tributary of the Quaraí River, in a territory located 4.5 km away, obtained an indirect dating of 12,690 ± 100 years ¹⁴C AP (SI-2351) from charred vegetable remains, without cultural association, and was recorded with the acronym RS-Q-2B: Sanga do Salso. There are still references in the literature on the Ibicuí stage with dates of 11,010 ± 190 years ¹⁴C AP (SI-9628), although they are related to the paleoclimatic studies in the area performed by Bombim (1976). This recent dating was based on the analysis of a carbonized trunk, without cultural association, with the purpose of chronologically situating the Touro Passo Sedimentary Formation, where the archaeological sites of this stage are related (Bombim, 1976; Bombim & Bryan, 1978; Milder, 2000).

For the lithic collection from Ibicuí Stage, in the RS-Q-2 site: Passo do Cruz 2 has been identified a 132 pieces complex, with 7 projectile pedunculated points with characteristics like the Uruguai stage, different from the data gathered by Miller (1987). There is no collection registered for the RS-I-107 site at the MARSUL, the depository of the PROPA collections (Milder, 1994, 1995). In this case, Milder (1995), after analyzing the data gathered on the previously mentioned paleoindian sites, affirms that the inconsistency of the stratigraphic data resulting from erosive

processes, the dubiousness of dating methods, and the river flushes characteristics of the lithic ensembles, demonstrate a phenomena of natural redeposition. Therefore, the Ibicuí stage loses its meaning because of its internal contradictions (Milder, 1994, 1995, Dias & Jacobus, 2003).

3. The Uruguay Archeological Stage

The Uruguay stage would be represented by 21 open-air sites, associated with the banks of Uruguay, Ibicuí, Quaraí rivers and their tributaries. For this period, 18 radiocarbon dates linked to 10 sites, comprising a period between 11,555 and 8,585 years ^{14}C AP. The archaeological collection of the Uruguay phase has no evidence of being related with megafauna. It consists of a total of 6,038 lithic pieces, including unipolar and bipolar splinter residues and bifacial artifacts in basalt, silicified sandstone, and chalcedony, among the artifacts stand out the pedunculated projectile tips and triangular body. Despite this, the analysis of these collections is still in an introductory position, as there was only a brief classification done with the intention of establishing typological criteria for defining the stage (Miller, 1976; 1987).

According to Miller's field notes (1969; 1976), initially there was an assumption that the Uruguay Stage belonged to a paleoindian tradition without projectile tips, however, from 1975 these began to be identified. The projectile points were found in the archaeological sites of the Late Pleistocene-Early Holocene where the most extensive excavations of PRONAPA were conducted. The existence of projectile points at these sites can be seen in the following sketch of the excavation of the RS-I-70 site: Imbaá 1, locality Imbaá, municipality of Uruguaiana / RS.

Dias & Jacobus (2003) also analyzed the documentation referring to field research in the southwest region of the State, available at MARSUL. When reviewing the data, the authors note that among the 21 sites considered by Miller (1985), as part of this phase, 11 (52%) do not have archaeological material identified in the Institution's collection, with four of these presenting only dated coal samples, probably of natural origin. The RS-IJ-68: Garruchos site has the oldest dating of the phase, 11,555 + 230 years old ^{14}C AP (SI-3750), without association with archaeological material. Of the remaining ten sites, seven experienced small interventions, evidenced by one or two surveys, and for four of these sites, seven dates were obtained with values between 9,855 + 130 (SI-3749) and 8,585 + 115 years ^{14}C AP (SI-2636) (sites RS-I-67: Touro Passo 1, RS-I-70: Imbaá 1, RS-I-72: Palmito 2 and RS-IJ-67: Pessegueiro). At the other sites were performed

exclusively surface collection (RS-Q-7: Passo da Revolta) and in two of these were conducted larger excavations (RS-I-69: Laranjito and RS-I-66: Milton Almeida).

The documentation from MARSUL attributed to these excavations, such as date sheets and inventory collection, proves that both sites have a good level of resolution in the connections between dated combustion structures and lithic complex, presenting in the RS-I-69 site: Laranjito a sequence of six dates between 10,985 + 100 years ¹⁴C AP (SI-2630) and 9,620 + 110 years ¹⁴C AP (SI-2631). However, these dates present some uncertainties according to the comments discussed in the laboratory files. Dias & Jacobus (2003) analyze the data from the referred sites and observe that the oldest dating for RS - I 69 Laranjito, of 10,985 + 100 years ¹⁴C AP (SI-2630), would be 2 m above the date of 9,620 + 110 years ¹⁴C AP (SI-2631), evidencing an stratigraphic inversion, caused by roots contamination. The latter would also be at the same depth as the dating of 10,240 + 80 years ¹⁴C AP (SI-3106), the one is more reliable considering the greater amount of coal in the sample. Hence, the sequence of dates accepted by the laboratory for this site, due to its low contamination and stratigraphic coherence, is represented by the remaining four dates, divided between 10,800 + 150 years ¹⁴C AP (N-2523) and 10,200 + 125 years ¹⁴C AP (N-2522) (Dias & Jacobus, 2003).

According to Miller's field notes (1972-1978) most of the lithic assemblies of Uruguay stage were collected in these excavations, however, there is a low density of material for the RS-I-69: Laranjito site. Considering that an area of (112 m²) was excavated having a greater agglutination of archaeological material in only 30 cm from the stratigraphy and registered originally with 3.7 m depth. Through the excavations, were recovered 898 paleoindian lithic materials carved in metamorphic sandstone, basalt and chalcedony. The archaeological collection recovered at the sites RS-I-69: Laranjito and RS-I-70: Imbaá - 1, consists of small scrapers, rough chopper type cutters, strikers, projectile tips, bifacial preforms, blades, cores and large amounts of splinter, mostly microsplinters resulting from chipping, specifically by pressure grinding.

However, when describing the archaeological collection, the author doesn't refer to the significant presence of a Fell projectile point and to the variety of pedunculated points, instead these are only illustrated in his article, in photographs. In terms of occupation periods of the sites, it is observed that among the 18 dates that define the Uruguay Stage, five represent specifically the pedunculated projectile points. The dates are associated with the sites: RS-1J-57, RS-IJ-68,

RS-I-69, RS-I-70, and RS-I-72, the oldest being 11555 ± 230 years old ^{14}C AP (SI-3750) and the most recent of 9120 ± 340 years ^{14}C AP (SI-2632). The analysis also includes percentages of frequencies and use of multiple raw materials for paleoindian sites. The representativeness of the rocks applied in the production of the artifacts indicates that 86% were manufactured in basalt, 10% in silicified sandstone and 4% in chalcedony, quartz and agate. Fossils of extinct Pleistocene fauna were also collected, and most of them exhibited "evidence of use by the paleoindian, represented by incisions and notches" (Miller, 1976; 1987).

4. Archaeological Sites in the Touro Passo Sedimentary Formation

The recent research in the Archaeological locality Touro Passo represented by Pouey Vidal's thesis research (2018) allowed the relocation of sites registered during the 1970s by the PROPA team, as well as the location of new sites of archaeological, geoarchaeological and paleoenvironmental relevance in city of Uruguaiana / RS. Among the 17 sites prospected and recorded during the investigation, 5 were selected during the Late Pleistocene-Early Holocene transition period for intensive studies with an emphasis on geoarchaeological methodologies.

In the region of the Uruguay River, the following sites were selected: the Sites RS-I-69: Laranjito and Casualdade, 152m apart in a straight line. In the sector of the Touro Passo stream, the following were chosen: Barranca Grande Site for its archaeological and paleontological record, RS-I-66 Milton Almeida Site only 150m from the first, and Comis II Site, with paleontological material, located to the west approximately at 1.5km away from the other two. All the sites are located on the banks of the Touro Passo stream (Pouey Vidal, 2018; 2019).

The geoarchaeological investigations performed at the sites of the Late Pleistocene-Early Holocene transition period, located in the banks of the Touro Passo stream, considered the archaeological sites of: Barranca Grande; RS-I-66 Milton Almeida and Comis II. In this paper, the results obtained at Barranca Grande Site will be briefly presented, in which two new dates were obtained from samples of coal and fossil trunk collected in the Lamitico Member of the Pleistocene Formation Touro Passo (Pouey Vidal, 2018; Pouey Vidal, Wagner, 2020; 2021).

The Barranca Grande site, positioned on the right bank of the Touro Passo stream under the geographic coordinates: $29^{\circ}40'31''$ S $56^{\circ}51'46$ W, is classified as a site with archaeological and paleontological potential. The site was discovered during the PROPA investigations (1976) and

studied by an interdisciplinary team: Bombin (geology), Miller (archeology) and Paula Couto (paleontology). The site was partially preserved during the first investigations and made it possible to study profiles with formidable stratigraphic resolutions.

In the ravines of this site, Bombin (1976) defined the Touro Passo Sedimentary Formation, consisting of two members separated by a diastem: (A) Rudáceo Member: deposited in erosive disagreement on the basalt of the Serra Geral Formation. (B) Lamítico Member placed on the previous one and with greater thickness, presenting locally a volcanic ash layer that the author proposed an age estimate between (10,000-9,000 AP) based on the results found by Heusser (1974) for the levels with volcanic ash in southern Chile profiles.

The chronology of the Touro Passo Formation was obtained through the observation of a sample of carbonized trunk, stratigraphically extracted near the base of the Lamítico member, placing it at $11,010 \pm 190$ years ^{14}C AP (I-9626). In the Rudaceo member, fossils of pleistocene mammals were identified, with deposition related to dates between 13,000 and 12,000 years ^{14}C AP (Bombin, 1976: 16). In the Lamitic member most of the fossils of the Touro Passo Formation were identified, "generally in situ as well as ancient archaeological material. It was deposited between 12,000-3,500 years AP" (Bombin, 1976: 16). In recent deposits have been found subfossils of freshwater mollusks and archaeological material from late traditions (3,500 AP to the present). Modern pedons can be found through the recent floodplain deposits (horizons A1 and B1) and in the lamítico member of the Fm. (Horizons IIB2; IIB3; IICca and IIR) (Bombin, 1976: 16). It is necessary to mention that Bombin (1976) when classifying the Touro Passo Formation in the guide profile, he did not date the recent deposits of the Lamitic member, he only related them to archaeological traditions from (3,500 AP). The author work is based on the archaeological data of Miller (1974) in which he affirms that the RS-66 Milton Almeida site, located in the same context, presents uninterrupted hunter gathering occupation until the surface. Regarding that, Miller (1974) includes the recent dark and clayey soils (units I and II) relating them to the Itaquí stage, Umbu archaeological tradition.

When describing the archaeological materials detected in the guide profile, Bombin (1976) specify "finally in the upper portion of the profile (horizons A1, B1 and IIB2), there are lithic elements of the São Bento Group, represented by arrowheads, bolas and lenticular stones (deep)". The author emphasizes that this last material represents the presence of the indigenous people who

came to historical times (Charruas and Minuanos)” (Bombin, 1976: 60). In the ongoing investigation, the artifacts correlated to the Umbu tradition (São Pedro Group) by the author, weren't found in situ in the sites located on the banks of the Touro Passo stream. However, in the current research, these artifacts were identified in surface occupations. In the guide profile quoted in his work, Bombin (1976) dedicated himself to the understanding of the stratigraphic levels from the deposits located in the lamitic member.

In Pouey Vidal's thesis investigation (2018), the Barranca Grande site was relocated in 2011, 150m to the east of the RS-66 Milton Almeida site, formed into a 4.50cm thick ravine including dark holocene soils and approximately 200m extension. The site annually experiences the floods that overflow the Uruguay River and flow into the stream, precipitating the process of deterioration in the area. The first geoarchaeological activities in the sites, located on the banks of the Touro Passo stream, part of the ongoing research project in 2013 through the registration of stratigraphic profiles that enable the identification of the levels of the Touro Passo Formation defined by Bombin (1976). It can be observed a highest concentration of CaCO_3 in the upper part of the Lamitic member. In this research, it was also decided to incorporate the dark holocene soils deposited on the Lamítico member of the Touro Passo Formation to fully understand the stratigraphic resolution of the archaeological sites.

The Profile 1 was evidenced in the thickest ravine of the Barranca Grande site under the geographical coordinates: $29^\circ 40'24.0''\text{S}$ $56^\circ 51'26.7''\text{W}$, in the type area where Bombin (1976) defined the Touro Passo sedimentary formation. In the current investigation has been identified some peculiarities already mentioned by the author in the 1970s, such as the presence of two rudaceous and lamitic members, volcanic ash and carbonized logs. Additionally, has been found new evidence such as coals associated with lithic material and micro bone fragments burned at 3.90m deep in the lamitic limb and pieces of carbonized logs and a fossil trunk buried at the base of the lamitic limb at 4.50m, in relation to the top of the bank. Profile 1 location was selected due to the presence of lithic artifacts "in situ" in the residues of the Touro Passo Formation, noticeable from 2.20m-3.70 of the exposed profile, extended to the register of volcanic ash lenses, detected at 3.30m.

The coal sample collected in Unit VI (3.90m) of Profile 1 was analyzed at the University of Arizona AMS Laboratory and resulted in a dating of 9.903 ± 35 years ^{14}C AP (AA108670). In

calendar years, AP (calibrated) the following age ranges were obtained: 11353 to 11201 calBP and 11284 to 11216 calBP (Pouey Vidal, 2018). At the base of the lamitic limb, at 4.50m were recovered carbonized logs, then the sample was sent for examination at the Radiocarbon Laboratory (ex Latyr) - Center for Geological Investigations, CONICET-UNLP, La Plata (Argentina) and resulted in a dating of $10,470 \pm 130$ years ^{14}C AP (LP) (Pouey Vidal, 2018). Bone micro-fragments were compiled together, in addition to a fossil trunk deposited between 4.40m-4.50m related to the genus "Salix humboldtiana" (Marchiori et. Al.2011). At 4.50m, sandy-clay sediments were identified with excessive presence of manganese oxides (MnO) concretions, presenting a grayish color due to hydromorphic conditions. At the base of the profile, the excavation was stopped, due to the proximity to the level of the Touro Passo stream; the drilling and the fossil trunk were submerged. Regarding to the presence of carbonized trunks at the base of the lamitic limb, mentioned above, the Touro Passo Formation dating was obtained through the analysis of "a carbonized trunk sample, stratigraphically extracted close to the base of the lamitic limb, placing it in $11,010 \pm 190$ years ^{14}C AP (I-9626)" (Bombin, 1976: 81).

The archaeological artifacts are found "in situ" in the stratigraphic horizons of the Touro Passo Formation and some are stuck in the sediment blocks displaced from the bank by the erosive action. Bombin (1976: 17) when detailing the sedimentological analysis of the lamitic limb from the Touro Passo Formation, considers that the limb is composed, in most cases, of clay or more sandy silt, and lenses of silty sand or silty-clay sand.

Bombin (1976) documented that the amount of volcanic ash in the context of the Touro Passo Formation may have been quite spreaded, since it was preserved not only in the Touro Passo stream, but also in outcrops in nearby regions, for example in the Sopas stream (Uruguay), 200km to the south, fact that reinforces this statement (Castiñera, 2008). In the typical area where the Touro Passo Formation was established, in April 2014 a small lens of volcanic ash was identified in the sediments of the lamitic limb. The paleontological research carried out by Kerber & Oliveira (2008; 2009) in the same study space on the Barranca Grande site showed 25 bone elements. It is important to note that "the bone elements are highly encrusted by CaCO_3 " (Kerber, 2009: 70).

5. Correlation Proposal Update between the Touro Passo Formation (Brazil) and the Sopas Formation (Uruguay)

Bombin (1976), when defining the Touro Passo Formation, proposed analogies with other formations in Rio Grande do Sul (most of which have not yet been described) and in neighboring countries Uruguay and Argentina. The correlations were based on chronological data, presence of volcanic ash, lithological aspects and with the record of pleistocene fauna. According to the author, "based on the mastozoic fauna, it can be correlated" bio-stratigraphically to the Touro Passo Formation with nequaternary deposits in RS; Uruguay and Argentina, such as Fm. Santa Vitória (Soliann Jr, 1973); Sopas Fm. (Antón, 1975), and the Luján Formation (Fidalgo et al, 1975), all belonging to the Equus-Competitor Zone "(Bombin, 1976: 60; Pouey Vidal; Wagner, 2021). Subsequently, Ubilla (1996) revised the regional paradigms, proposed by Antón (1975) and approved by Bombin (1976), and pointed out that these hypotheses were assumed by other researchers and thus influenced the chronological organization of the units. In addition to contributing to the base of the current model, Uruguay's deposits were referred as part of this scheme "in some cases considering it independently from the Mataojo and Sopas formations or as one solely unite" (Antón; 1975; Pellerin, 1976, Ubilla, 1986, entre outros).

Ubilla et al. (1996) analyzes this proposal and then presents some inquiries about its validity. Among the issues discussed stands out the work of Miller (1987), where the author presented, from a specifically archaeological perspective, a set of "radiocarbon dates ranging from 33.600 years B. P. and 8.585 years B.P., based on samples that may be referred to the Fm. Touro Passo sediment"(Ubilla, 1996: 174). Ubilla, 1996). However, this investigation was not considered by the specialists due to the questionable origin and validity of the dated samples (Bracco & Ures, 1995; Ubilla, 1996). The dates in some cases were determined by organic samples, in others by their mineral fraction, obtaining for the same level dates of 12,770 years AP (apatite) and 3,225 years AP (coal) (Stuckenrath & Mielke, 1973; Miller, 1987; Ubilla, 1996).

An attempt to review the studies of Miller (1987) is proposed by Milder (1994) accepting that the "*Rudáceo Member from Fm. Touro Passo has an antiquity of 30,000 years while the Lamitic Member is more modern, as it was suggested by Anton (1975) in the description of Mataojo and Sopas formation*" (Ubilla, 1996: 179). Despite this, the dates presented by Milder (1994) were also contested and ignored by the experts, as the author does not clarify the origins of

the dated samples, as well as the stratigraphic profiles that allowed his new interpretations of the sedimentary units of the Touro Passo Formation.

Ubilla's (1996) review, based on new paleontological research and radiochronological analysis, proposes a diverse temporal and climatic scenario to the one proposed by Antón (1975) for Sopas Formation, thus rejecting the regional correlations. The new radiocarbon dating obtained for Sopas Formation demonstrated dates greater than those presented by previous models. During the research, "*C14 dates of more than 43.000 and 45.0000 years the maximum resolution the technic could allow and the TL/OSL dates of en límite de resolución de la técnica y edades TL/OSL en el entorno 36.000 y 43.000 años A.P.*" (Martinez y Ubilla, 2004 apud Castiñeira, 2008:118). In addition to the different dates proposed for the Sopas and Touro Passo Formations, archaeological studies "could not confirm Anton (1975) expectations of discovering cultural material in situ from the Fm. Sopas deposits" (Castiñeira, 2008; Suárez, 2010).

Conclusions

During this study, it is possible to conclude that the archaeological investigations in the Touro Passo locality, performed four decades ago by the PROPA team, with the objective of understanding the period of introductory human occupation in the region were indispensable for Brazilian archeology. The research coordinated by Eurico T. Miller (1972-1978) had an interdisciplinary group and provided relevant scientific and chronological data for the paleoindian sites located in the municipality of Uruguaiana, a region localized between the Argentina and Uruguay border.

After this period, attempts to revise Miller works (1972-1978), presented in Milder research (1994), contributed significantly to rethinking the paleoindian Ibicuí stage by analyzing the action of post-depositional processes in the formation of the archaeological record. However, specifically for the locality Touro Passo under study, the author didn't contextualize the archaeological sites in Fm. Touro Passo stratigraphically, culturally nor chronologically. Nevertheless, Oliveira and Kerber paleontological research completed between the 1990 / 2000 identified several extinct megafauna fossils, "in situ" at the Barranca Grande and Comis I and II sites, and represented a vital scientific contribution to the archaeological sites located in the banks of the Touro Passo stream.

Investigations in the Touro Passo Locality were restarted by Pouey Vidal (2011-2018). The successful geoarchaeological studies in the sites associated with the Touro Passo Formation have provided an understanding of the stratigraphic sequence and the diverse processes of formation and postdepositional disturbance that occurred in the archaeological sites of river environment. The stratigraphic units of the archaeological excavation were recognized at the RS-I-69: Laranjito site and those identified in the profiles registered in the ravines and in the field surveys from the sites selected to be part of an extensive geoarchaeological study. In addition were performed sedimentary and geochemical analysis that provided data about texture, organic matter, pH, Fe, and Pho.

In the archaeological sites RS-I-69: Laranjito and Casualidade, were found fractured lithic artifacts, cores, wools, biface, chips, beaters, pebbles that allow the reassembly process, indicating that the materials remained in the context of the sites, where they were manufactured and reactivated. In the Casualidade site, the set of chips and micro-chips in the different raw materials, resulting from events of single-sided and two-sided carving vertically in the Touro Passo Formation, also allowed reassembly. Although the erosive processes in the area of the sites may have eliminated many other evidence, such as those mentioned, the small sample corroborates the idea that hunter-gatherers occupied the floodplains, where they performed intensive woodcutting, manufacturing and revitalization of lithic artifacts.

During the geoarchaeological investigations at the Barranca Grande Profile 1 site, were recovered samples of archaeological coal and carbonized fossil trunks, resulting in two new dates for the sites in the Touro Passo Formation. It should be noted that the dating based on archaeological coal, was not performed before at the Barranca Grande site. Even though the coal was found at a depth of 3.90m in profile 1, a lamitic member associated with lithic artifacts provided an age for human occupation at the archaeological site at: $9,903 \pm 35$ years ^{14}C AP (11,216 to 11,279 cal. Years AP). The second dating was obtained from a sample of carbonized logs recovered at the base of the limb at a depth of 4.50m, which resulted in a dating of $10,470 \pm 130$ years ^{14}C AP (12,062 to 12,544 years AP).

The current chronology for the Barranca Grande site could be related with the dating obtained by Miller (1969) for the attached site RS-I-66: Milton Almeida, located chronologically at $10,810 + 275$ years ^{14}C AP (SI-2622). However, it is important to point out that the author dated

only the oldest portion of the sequence (Milder 2000; Dias & Jacobus 2003). At the site RS-I-69: Laranjito, also located in the town of Touro Passo on the banks of the Uruguay River, Miller's (1972/1974) investigations generated a series of six dates. Nevertheless, the revisions by Dias & Jacobus (2003) found in the PROPA field documentation, identified inconsistencies on some dates produced without stratigraphic control. In this case, the chronology sequence accepted by the laboratory for the site RS-I-69: Laranjito, for presenting low contamination and stratigraphic coherence, is represented by four remaining dates, distributed between 10,800 + 150 years ¹⁴C AP (N-2523) and 10,200 + 125 years ¹⁴C AP (N-2522) (Dias & Jacobus 2003).

In this perspective, the new chronology obtained for the Barranca Grande site at a local level resulted in a tremendous understanding of the basic process of hunter-gatherers occupation during the Pleistocene-Holocene transition in the sites assemblage associated with the Touro Passo Formation in the city of Uruguaiana / RS. At regional level, the new chronology sequences obtained are similar to those registered for the temporal sites currently investigated in Uruguay, a neighboring country, where the early process of human occupation during the Pleistocene-Holocene transition is chronologically around 10,400 years. ¹⁴C AP (Castiñeira 2008, Suárez 2011).

The geo-archaeological record of the profiles at the sites discovered in the banks close to the Touro Passo stream provided the stratigraphic contextualization of the lithic artifacts with adhesions of the CaCO₃ concretions recovered on the surface with the lamitic member. These concretions aren't seen in the stratigraphic units of the Holocene that are recorded above, where there wasn't any evidence either of archaeological artifacts during the investigation. Nevertheless, the continuity of geoarchaeological researches for the documentation of new stratigraphic profiles must confirm the absence or presence of cultural evidence in the dark units of the Holocene above the lamitic member of the Touro Passo Formation.

In this member of the Fm. Touro Passo, as mentioned before, concretions are plentiful and lithic artifacts were found "in situ", volcanic ash, coals and logs that resulted in new dating for the Barranca Grande site. The detailed study of the stratigraphic profiles validated that the lamitic member of the Touro Passo Formation corresponds to the Late Pleistocene-Holocene transition and have obtained ages from both moments in this member, thus confirming the "in situ" disposal

of archaeological material. The site constituted a unit of fluvial landscape evidently occupied, where the paleoindigenous groups performed various activities.

Based on the various evidences it appears that the sites close to the banks of the Touro Passo stream had been occupied at the same time. Specifically the sites dated, RS-I-66: Milton Almeida and Barranca Grande, as well as the sites located in the same region, and in the ravines of the Uruguay River: site RS-I-69: Laranjito and Casualidade, with artifacts "in situ" in the stratigraphic horizons of the Touro Passo Formation, are contemporaneous, belong to the same cultural system and they also have similarities corresponding to the stratigraphic position, lithic technology and the ways of supplying rocks.

In the regional context, the new data collected in the scope of Pouey Vidal's geoarchaeological research (2018) compared to those obtained by Suárez (2011) and Hilbert (1985), supports the proposed hypothesis which sustains that the initial hunter-gatherer occupation process at the archaeological site Touro Passo was contemporary to that registered at the Pay Paso 1 and K87 sites in Uruguay. Archaeological, chronological and stratigraphic information still allows us to position the process of human occupation in the locality of Touro Passo in the archaeological context of America's oldest occupations, with a recorded start of about 11,000 AP ¹⁴C (Steele and Politis 2009). (Steele and Politis 2009).

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