HISTORICAL ARCHAEOLOGY OF THE BATTLE OF VUELT A DE OBLIGADO, PROVINCE OF BUENOS AIRES, ARGENTINA

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Abstract

This paper is about the research on the Historical Archaeology we have carried out for over more than a decade at Vuelta de Obligado Site, San Pedro, northeast of the Province of Buenos Aires. Our objectives are to know the dynamics of the strategy followed in the battlefield by the two groups who fought: Anglo-French and Argentine, and the results produced by a set of agents of formation and transformation of the archaeological record. To compare the stated expectations, we have used several sources of information: archaeological record, written documents, Argentine and European plans and sketches as well as the data provided by the present inhabitants. We have considered several, which are specified and used in our research. Finally, we have taken into account various perspectives, with regard to the objectives and stated hypothesis.

Keywords: Vuelta de Obligado; spatial analysis; archaeological records; written documents; distributional studies

Introduction

At the middle of the 1840s, English and French tried to force militarily the fluvial paths towards the northeast of Argentina and Paraguay, where they expected to exchange goods through their free trade policies. This war strategy is part of the War of Paraná (1845-1846), which also includes the blockade to River de la Plata (Luque 2007; Ramos et al. 2010a and 2010b). All this hostile activity represents a reprisal the two European powers took against the Confederation government. Previously, its main authority, Juan Manuel de Rosas had seiged the city of Montevideo and isolated its port from foreign trade relations as the...
main opposition centre to Rosas’ federalism was settled in Uruguay. In contrast, the French army seiged Buenos Aires (Gelman 2009).

Although sometimes, they fought for the same markets; the French allied the English on some occasions. In this way, the Anglo-French fleet made a raid, whose main objective was to force Rosas to abandon the seige of Montevideo. The Europeans developed a strategy which included several attacks. One of them took place on November 20th, 1845 at 18 kms to the north of San Pedro, Province of Buenos Aires. This event is known as the Battle of Vuelta de Obligado, which together with other war events (Tonelero, Quebracho, San Lorenzo), is part of the War of Paraná. The confrontation between the Argentine defenses, displayed on slopes, beaches and water and the powerful European fleet lasted 8 hours and used important human and war resources.

From the interdisciplinary research project on one battle: Vuelta de Obligado, we started the fieldwork in the archaeological site in 2000. Later, we included other sites of the War of Paraná. In this paper, we deal some issues of Vuelta de Obligado, considering several sources of information: archaeological records, written documents and plans of the battle. Likewise, we state and evaluate some hypothesis. On the other hand, our theoretical frame is linked to the Archaeology of the Violence.

**Archaeology of Violence**

One branch of the Archaeology (Ramos 2000, 2003; Rocchietti 2003) is the *Archaeology of Violence*, which became a specialization of the prehistorical conflicts as, at the beginning, the archaeologists focused on the fights of the communities considered as “primitive”. Clastres researched on the causes and functions of the group violence, i.e. the war, an activity aimed to destroy the enemy (Clastres 1990). Others have recently updated the issue on the base of new cases (Guilaine and Zammit 2002). Following the prehistorical archaeologists, the historical ones focused on the problems of war. In America, this perspective is founded on the data from the archaeological records and the documents written by explorers, missionaries, travellers and sailos who participated in the European conquest of the world since the 15th century. In other places, studies of war conflicts from the perspectives of the Historical Archaeology have a strong development, which is observed in journals as the *Journal of Conflict Archaeology*. Furthermore, there are bi-
annual conferences as the *Fields of Conflict Conference*, creating a work academic group as the *European Studies of Terrains of Conflict* (ESTOC). In Argentina, there is not a periodical journal on battlefields; however, the *Revista de Arqueología Histórica Argentina y Latinoamericana* (Argentine and Latin American Historical Archaeology Magazine) publishes studies of military archaeology (for example, Leoni 2009; Landa et al. 2009). This interest in a scientific analysis of war from the perspective of the Historical Archaeology is recent in Argentina (Ramos et al. 2003, 2006, 2010a; Ramos and Socolovsky 2005; Helfer 2004; Helfer and Rivas 2004; Luque 2007; Landa et al. 2010), which differentiates us from the Anglo-Saxon nations. It must be considered that the field of the War Archaeology extends from Prehistory to the present. This extent of space and time makes the close relationship between research groups (graduated as archaeologists, historians, biologists, sociologists, etc.), who work on projects rather linked to studies of the same period, more difficult.

Furthermore, the methods developed to research these events and the war processes in general differ from those applied in the Archaeology of historical settlements and even of the military campaign structures such as forts, bunkers and cantons (among others, Gómez Romero and Ramos 1994; Ramos and Gómez Romero 1997; Gómez Romero 1999; Merlo 1997; Mugueta et al. 2002; Tapia et al. 2005; Leoni 2009); these were buildings that were not attacked in general, which did not make them fighting areas. On the other hand, we must take into account that a battlefield is not always on everlasting structures as the events that took place there usually lasted shortly, from a few hours to some months as in the case of defensive facilities in Vuelta de Obligado where building large and strong structures were not justified. This is why in Europe, for instance, there is a greater development of the excavation techniques supported on geo-spatial analysis from the use of the Geographical Information Systems. It must also be considered that the wars did not only take place in the battlefields; the Conflict Archaeology includes other areas that also offer important data such as the geoarchaeological study of fortresses, the soldiers buried in communal graves and the war trenches of the 19th and 20th centuries as in Belgium (Pollard and Banks 2005); the studies on the heritage of the battles or the collective and historical memory (Falquina Aparicio et al. 2008) of these events.

New specializations arose in the Historical Archaeology and the Archaeology of the Violence at the end of the 20th century. Argentina was a pioneer in the recovery and revision of the history of the state terrorism and the genocide carried out by the last civic-military
dictatorship, which started in 1976 and lasted 8 years. The Equipo Argentino de Antropología Forense (Argentine Forensic Anthropology Team, *EAAF in Spanish*), Madres y Abuelas de Plaza de Mayo (Mothers and Grandmothers of Plaza de Mayo) and Human Rights Organizations worked in the recovery and identification of the missing people’s remains, the identity of the kids born in captivity or kidnapped by the repressive forces (*EAAF 1992, 2006; Ramos 2009, etc.*). These activities are also being developed in other Third World countries (Guatemala, Cambodia, Ethiopia, etc.) and in Spain with the shot, missing and forced workers of the Civil War (*Falquina Aparicio et al. 2008*). All these issues are framed within concepts of memory, history and politics. At this point, we highlight the importance of the collective memory, which is so difficult to accept as in the post-Franco Spain because “...any history of the war that does not fit the parameters proposed by the regime was not considered morally or politically valid. The memory was reduced to a familiar field, off the authentic and universal history. With the return of the democracy, the academic media started to rescue the defeated people’s speech” (*Falquina Aparicio et al. 2008: 2*). It is convenient to differentiate the collective memory from the historical memory as the last is contradictory and ambiguous but it also claims something essential: the other memories are also authentic history, despite having been ostracized and forgotten by political and historiographical regimes (*Falquina Aparicio et al. 2008*).

Likewise, even if it depends on the singularity of each case, many facts of the Argentine history were buried, “missed” or considered “taboo” by those who wrote the official histories, which were generally liberal in the 19th and 20th centuries (*Ramos et al. 2008*). The Battle of Vuelta de obligado, which was rescued by the revisionist historians in the 1930s and 1970s, is one of the cases that had been considered “taboo” up to some decades ago.

**Specific Objectives and Hypothesis**

The overall project on the War of Paraná and specifically, on Vuelta de Obligado Site has several objectives, some of which have been taken for this paper:

- To propose the accurate location of the defensive structures, camp-bases and the campaign hospital, through the combined use of historical plans and aerial photographs.
- To know the dimensions and boundaries of the archaeological site.
• To explain the palimpsest contexts.
• To assess the information provided by the written documents, the local inhabitants and the plans of the accurate location of the “battle cores” and other structures, from the archaeology perspective.

Hypothesis
1- The structures settled in the current Vuelta de Obligado Site would cover a minimum extension of 3 km long by 1 km wide.
2. The defences and camp-bases would be scattered in several sectors of the current archaeological site.
3- The density of the current archaeological record would provide important differences about various considered areas, either batteries, beaches or camp-bases.

The site: some environmental aspects and the archaeological excavations

The archaeological site is composed by several war structures as the batteries, the camp-base, the hospital and the settlement of the defensive chains. The four batteries of Vuelta de Obligado were displayed on the right bank of River Paraná, approximately south-north oriented. The batteries were called Restaurador Rosas, commanded by Álvaro de Alzogaray, Almirante Brown, commanded by Eduardo Brown – Admiral Guillermo Brown’s son and (Guillermo Brown was Commander of the Argentine squad), General Mansilla, commanded by Felipe Palacios and Manuelita, commanded by Juan Thorne.

It is important to highlight that the site is within the native scrubland, which covers great part of Vuelta de Obligado Reserve, with a great deal of flora and fauna. With regard to this, the slope cutting woodland is part of the south boundary of the coverage of wild plants and animals that are typical in the northern scrubland. It is composed by white carob trees (Prosopis alba), sombra de toro (Jodina rhombifolia), tala (Celtis tala), gorses (Acacia caven), ombu (Phytolacca dioica), chucupí (Porliera microphylla) and molle (Schinus longifolius), associated with plentiful native epiphyte and herbaceous plants. Furthermore, the stream de Los Cueros and the bank of River Paraná have a forest of Tembetari (Fagara hyemalis), which can only be found on Martín García Island, Province of Buenos Aires (Report by Fundación Félix de Azara 2004; Sierra 2001, 2010).

In the area of San Pedro and Vuelta de Obligado, there are 250 species of permanent
birds, being the most typical the golden-eyed mosqueta (Hemitriccus margaritaceinventer), the common little woodpecker (Picumus cirratus), the green pepitero (Saltator similis), the Black gaviotín (Chlidonias Niger) and the red pigeon (Columbina talpacoti), together with some migratory species.

With regard to the typical mammals of the area, we find the overa and red weasel; the otter or coypu (Myocastor coypus) and the capybara (Hydrochaeris hydrochaeris), threatened by the hunting and destruction of the habitat; the little river wolf (Lontra longicaudis) and three species of bats, one of which is fruvigora, that live in the caves of Obligado. In the water of River Paraná, there is a great deal of fishes, such as the river ray (potamotrygon sp.), the shad (Prochilodus lineatus), the catfish (Pimelodus albicans) and the boga (Leporinus obtusidens). There are also reptiles as the water snakes (Helicops leopardinus), the common pit viper (Bothrops neuweidii), the overo lizard (Tupinambis merianae) – in danger of extinction-, the green wall lizards (Teius teyou y Teius oculatus) and occasionally with high tide, the overo or pug-nosed cayman (Caiman latirostris) (Sierra 2010).

Since the beginning of the field activities, we have worked in the places where the first and second batteries were assumed to be, on the slopes at over 10 mts high. The third battery was at low-level, that means, almost at sea-level and it was on the beach that makes a bay, according to written information. Due to the intense river activity, which always removes the sediments, and the low visibility caused by the vegetation, we could only get some pieces of European bombs. The fourth battery was placed northern on a 15-metre-high slope where neighbour Toro Bayo’s house is settled now. The place, which is very strategic as it allows the observation of a wide extension of River Paraná, would have been used by the Chief-of-Defence- General Lucio Mansilla to sight the movements of the European fleet and lead the defence. At present, this place can be seen very modified, due to the after-battle human activity as there are houses, pavements, unevenness with stairs and yards.

To locate the archaeological contexts of the site, we used: 1- detection devices, such as metal detectors and electro-magnetometres; 2. visual prospecting on land and beaches; 3- analysis of plans, aerial photographs and satellite images; 4. observation and surface collection; 5. excavations and soundings.

Up to now, over 200 sq. metres have been excavated and drilled; over 10,000 objects
have been found, out of which about 6,500 have been processed; some lab studies have been done (analysis of metal objects, dated by $^{14}$C, identification of vegetal species on burnt wood) and even lines of Experimental Archaeology have been developed (tracks of trampling and stamping; glass thermoalteration).

From 2000 to 2004, we excavated a 15 sq. metre-grid where the first battery was supposed to be. However, we did not come with a structure as we did not find traces that would enable us to assure these were remains of a battery: just some nails, pieces of bombs and indigenous pottery. Also, from 2000 to 2010, we kept on with the excavations in the area where the second battery, called General Brown, was supposed to be. According to Piccirilli et al. (1973), it had a bronze 24-pound cannon of the Argentine ship Vigilante, two iron 18-pound cannons, one bronze 16-pound and another 12-pound cannons of the brigantine Republicano. Up to now, we have excavated over 100 sq metres in this area of important findings.

In 2004, thanks to the information provided by the local people, we could find the location of a 5-by-20 metre embankment in which the grid III (5 sq metre) was excavated with few results. There, we cut a perpendicular area of a half-moon-shaped-built embankement of sized 5m wide by 20 m long, placed at 50 m. to the west of the battery Restaurador Rosas. We also excavated in other places in the west, where part of the camp-base was supposed to be, according to our maps.

In 2008, thanks to the information of written documents, which matches a previous study (Rizzo et al. 2004), and the data provided by the neighbours, the place where the main campaign hospital (a brick building of square plan and tile roof) was located could be known: at about 2 km north from the battlefield. We have surveyed but have not excavated it yet.

Between 2008 and 2009, thanks to the data provided by the local people, we excavated several grids, trenches and soundings, which covered 56 sq metres inside the scrubland, in those places where the main core of the Argentine camp-base was supposed to be. In several areas, we found glass, china, bone and metal in small concentrations; however, we could not find bullets, dustholes or parapet structures made by fenceprints. The composition of the archaeological record allows us to keep the hypothesis that there would be camp-areas in this wide territory.
Some problems of the site

The archaeological sites resulted from great battles—in water and on land—of the Modern Period, in which sophisticated armament is used and thousands of men participate, are very complex and the interpretation of the archaeological record is difficult as numerous variables interfere. In the case of Vuelta de Obligado Site, the main problems are centred on:

1. The dimensions and boundaries of the site.
2. The relatively high fragmentation of the artefacts in several areas.
3. To be accurate about the battle cores; that means, those places where there was more intense fighting.
4. The identification and assessment of the action of the formation and transformation agents, which include man’s activity as a geomorphic agent.
5. The explanation of the causes of formation of palimpsest areas.

Also, these must be considered: 1. the types of objects found in the different areas of the site and 2. the status and conditions of the findings. Aimed to this, the intensity of the activity of the formation and transformation agents of these types of sites as well as the eventual replacement by other agents that go on producing changes on the original deposits must be taken into account.

Results

Spatial inferences about Captain Sulivan’s plan

Among the plans and sketches of the Battle of Vuelta de Obligado, we have the “Plan of Obligado”, done by Captain B. J. Sulivan of the Royal Navy, who participated in the War of Paraná and in the battle as the leader of the English brigantine “Philomel”. The plan is very detailed and enables the observation of the accurate location of the European and Argentine ships at 9 a.m. when the battle started, at 12.30 p.m. and in the evening when the battle ended. It also shows the locations of the batteries, the camp-bases and the Argentine military squads. According to the sketch, the first battery had 7 cannons and 2 others to the southwest; the second battery had 5 cannons, the third had 7 cannons (this number matches an engraving done by Chavanne) and the fourth battery had 9 cannons. It also shows the invading troops’ landing place and land route. The copy of the plan, which is in the Museo Naval de la Nación (National Navy Museum), Tigre, Province of Buenos Aires
(Figure 1), enabled us to infer the positions the Argentine military troops occupied.

The use of the free software MapAnalyst 1.3.6 made the extrapolation of the data of the plan to an aerial photograph of the 1980s easier. In this way, it was possible to know the approximate location of the Argentine battalions and camp-bases as well as the place of the body-to-body confrontations that took place after the Anglo-French landing in the area. The archaeological implication of this information is large as, despite knowing the location of the Argentine batteries historically and archaeologically (the location of the Battery Admiral Brown was excavated with very positive results), little was known about the location of the camp-bases and the battalions. The good results of the use of this software were proved in another paper on a different topic by one of the authors (Bognanni 2010).

Figure 1. Piece of Captain Sullivan’s map

The first step for the extrapolation of the historical plan to the aerial photograph
was the identification of the matching areas in both images. For this case, six pairs of recognizable spots –from north to south- of the bank geomorphology were taken: two spots on the slope where the battery La Manuelita was settled, one spot in the artificial mound, where the chains were tied, one spot on the slope where the battery Admiral Brown was, one spot on a natural rock and one spot in the slope area, near the mouth of the Stream de los Cueros. The identification of the last was the most difficult as it is in an area that was highly modified by the accumulation of sedimentary deposits during the last 165 years.

After the identification of the similar spots on both images (Sulivan’s map and aerial photograph), a distortion mesh was created (Figure 2); “The rotated, compressed, or enlarged meshes of a distortion grid reflect the local deformation and rotation of the old map” (Jenny et al. 2007), which allows to adjust one image to the other one.

![Figure 2. Distortion mesh between Sulivan’s map and the aerial photograph](image)

As a result, for the old map, the distortion mesh shows a 31º rotation in X and an 18º rotation in Y, causing a horizontal scale of 1:3800 and a vertical scale of 1:3200, with a standard deviation of +/- 10 m and a position error of +/- 14 m. The greater mesh distortion is in the centre and is caused by the fourth reference spot (the slope where the battery Admiral Brown was). Despite this, a great mesh distortion is not observed, possibly due to the low number of matching spots between both images.

Once the spatial relations of the aerial photograph were extrapolated to the old plan, it is also possible to do the other way round: to extrapolate differentially scattered features on the old map to the present image in order to get the location of the areas with greater archaeological potential.

Besides the batteries, one of the areas with greater archaeological interest is the camp-base as the military battalion commanded by General Mansilla lived there for about
three months before the battle.

In the Figure 3, the area where the camp-base was set and the location of the battalions are observed. Unfortunately, the symbol used by Captain Sullivan is the same for both features (a black rectangle); therefore, it is not possible to differentiate them. Where the camp-base was set, a great deal of archaeological material from the time of the battle was found on surface and excavation. The average density of the artefacts in this area is over 50% (See Table 1), being the highest in the entire site. Glass is represented by 40.3% followed by china (34.1%), potter’s clay (13.9%), metal (7%), European pottery (2%), indigenous pottery (1.4%), animal bone remains (09.9%) and wood (0.3%).

Figure 3. Aereal photograph with the location of the camp-base, the battalions and the confrontation areas. Note how the deposition of sediments in the mouth of the Arroyo de los Cueros modified the Anglo-French landing area.
<table>
<thead>
<tr>
<th>Quadrant and transect</th>
<th>Excavated surface</th>
<th>Collection surface</th>
<th>Bone</th>
<th>Indigenous pottery</th>
<th>Lithic</th>
<th>Creole-European pottery</th>
<th>Glass</th>
<th>Metal</th>
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<th>Density</th>
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<td>2</td>
<td>39</td>
<td>0</td>
<td>0,028</td>
<td></td>
<td>0,49</td>
<td></td>
<td>North beach</td>
<td></td>
<td></td>
<td>0,49</td>
</tr>
<tr>
<td>Transect C</td>
<td>450 m</td>
<td>1</td>
<td>280</td>
<td>1</td>
<td>2</td>
<td>79</td>
<td>0</td>
<td></td>
<td>0,4</td>
<td></td>
<td>Central beach</td>
<td></td>
<td></td>
<td>0,4</td>
</tr>
<tr>
<td>Transect S</td>
<td>600 m</td>
<td>16</td>
<td>227</td>
<td>1</td>
<td>2</td>
<td>1037</td>
<td>1,07</td>
<td></td>
<td>1,07</td>
<td></td>
<td>South beach</td>
<td></td>
<td></td>
<td>1,07</td>
</tr>
<tr>
<td>Total findings</td>
<td>597</td>
<td>1917</td>
<td>18</td>
<td>605</td>
<td>1787</td>
<td>1349</td>
<td>276</td>
<td>13</td>
<td></td>
<td></td>
<td>13</td>
<td></td>
<td></td>
<td>13</td>
</tr>
<tr>
<td>Total m²</td>
<td>188</td>
<td>1800 x 2 =3600</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 1. Frequency and percentage of found rests
At present, the Anglo-French landing and invasion area is inside a full-of-vegetation and difficult-to-reach natural reserve. Anyway, it must be considered that this place is described in Sullivan’s map as wooded or covered by “thick wood”. The boundary between the area used for the invading troops’ landing and the river is represented on the map as a place with sharp or steep slope, surrounded by low and marshy lands. At present, only the bank line is low and marshy in this area while the rest is not even during the high tide. This is why, we infer that this accumulation of sediments, non-flooding now, took place after the battle and therefore, after Sullivan’s map.

To sum up, we can state that the use of this type of software enabled to have a greater accuracy of the location of the Argentine Confederation camp-base, the layout of the battalions and the “body-to-body” confrontation areas. It also allowed to recognize some geomorphical differences that affected the bank from deposition phenomena caused by the great volume of sediments carried by River Paraná-Guazú.

The zooarchaeological remains

These objects are at the first stage of analysis. They were prepared (washed and labelled) and quantified from the NSP. Their anatomical and taxonomical identification was started together with the analysis of the bone modifications (either natural or anthropic). The same method used in previous works was applied for the zooarchaeological analysis (Lanza 2006, 2008; Ramos et al. 2008), based on the concepts and criteria commonly used in Archaeology for the analysis of fauna in prehistorical (among others, Chaix and Meniel 2005; Grayson 1984; Mengoni Goñalons 1999; Lyman 1994) and historical sites (Landon 1996; Silveira 1995).

The advances of the zooarchaeological analysis of the remains recovered in the stratigraphic excavation grids (I, II, IV, V, VI, VII, VIII, IX, X and XII) are presented. The total NSP of the zooarchaeological collection is 460 specimen and is composed by 446 bones (complete, pieces or broken) and 14 malacological (complete or broken) remains, which represent a 3% of the sample. In the Table 2, the distribution and frequency of the zooarchaeological collection and its location in the site are presented.
<table>
<thead>
<tr>
<th>Grid</th>
<th>NSP</th>
<th>Percentage</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>100</td>
<td>22%</td>
<td>Malacological remains (N = 12). 7 dental pieces. 4 thermoaltered pieces</td>
</tr>
<tr>
<td>II</td>
<td>38</td>
<td>8%</td>
<td></td>
</tr>
<tr>
<td>IV</td>
<td>34</td>
<td>7%</td>
<td>1 dental piece. 4 thermoaltered pieces</td>
</tr>
<tr>
<td>V</td>
<td>13</td>
<td>3%</td>
<td>1 thermoaltered piece</td>
</tr>
<tr>
<td>VI</td>
<td>15</td>
<td>3%</td>
<td>1 dental piece. 1 thermoaltered piece</td>
</tr>
<tr>
<td>VII</td>
<td>52</td>
<td>11%</td>
<td>Malacological remains (N = 1). 5 dental pieces. 1 thermoaltered piece</td>
</tr>
<tr>
<td>VIII</td>
<td>21</td>
<td>5%</td>
<td>Malacological remains (N = 1)</td>
</tr>
<tr>
<td>IX</td>
<td>17</td>
<td>4%</td>
<td></td>
</tr>
<tr>
<td>X</td>
<td>88</td>
<td>19%</td>
<td>5 dental pieces. 64 thermoaltered pieces</td>
</tr>
<tr>
<td>XI</td>
<td>78</td>
<td>17%</td>
<td>6 thermoaltered pieces</td>
</tr>
<tr>
<td>XII</td>
<td>4</td>
<td>1%</td>
<td></td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>460</strong></td>
<td><strong>100%</strong></td>
<td></td>
</tr>
</tbody>
</table>

Table 2. Composition of the zooarchaeological record

The zooarchaeological analysis represents a 12% of the complete collection. The sample, which was analysed at this stage, is composed by a total NSP of 53 bone specimen; among which there is a malacological remain (piece of valve). Out of the total remains, the 79% (42) were taxonomically identified and 21% (11) are undetermined pieces, due to their size (< 1 cm) and the lack of diagnosis areas. These remains come from grids I (46 remains, 87%) and IV (7 remains, 13%). The taxonomical identification was done at the level of Order and Type, Genre and Species. The results were: *Bos taurus* (cow) 22 bone specimen; Dasipodidae (armadillo) 3; undetermined Mammalia (large and medium mammals) 17 bone specimen. In general, this faunistic collection is made up by pieces smaller than 5 cm; most of them are between 1 and 3 cm long; 90% of the remains are black, probably as a consequence of the wet environment where they were found, a shiny adherence and traces of rolling, in some cases. The remains identified as *Bos taurus* are fitting dark ochre-coloured pieces of a coxal, some of them have stains of ferrous rust and are weathered. Finally, the undetermined pieces are smaller than 1 cm; 3 of which are completely carbonized.

*The metals*

The total number of complete and broken metal objects is 1,236 and belong to the close grids I, II, IV, V (south), VI, VII, VIII, IX and to different drillings of the site. Some of them would be directly linked to the war as in the case of the cannon bullets of different calibers (Figure 4), the pieces of bullets with part of the thread where the detonator was
placed, devices of firearms, melted lead elements (Figure 5). Other objects of the 19th century related to the war would be square-headed nails of different types and sizes, pieces of iron bars, two large wedges, a fork, screws, a chain with lock for a chest or drawer, hinges, among other findings. Nails with red and reddish adherences heterogeneously distributed in the body and head – 10% - stand out in this collection (Helfer and Rivas 2004). In some cases, they would be associated to thermoalteration by high temperature while in others, they would resemble remains of some type of intentionally-placed paint.

The highest percentage of metal objects belongs to different types of nails, which were assigned an approximate chronology considering their shape and head. The cylindrical-bodied nails would be from the 20th century (started being manufactured in Argentina in the 1890s); the square-headed nails of the 19th century would be from the battle, unique Creole-European occupation of the site during this period.

Figure 4. Left: 44-diameter cannon bullet weighing 293.93 gs found in grid VI; possibly called “caliber 6”. Right: piece of large-caliber cannon bullet
Remains of melted lead together with burnt wood, thermoaltered sediment, pits and traces of explosions were found in grid I. The remains of melted lead do not have a determined shape; therefore, it is not possible to recognize which artefacts they belong to. However, it is possible to associate them with fire, probably with a great fire. Some of the remains contain particles of coal, result of a melting and cooling process. Due to its characteristics, the lead was used as basic material for the manufacture of bullets and have a very low fusion point, near 328º C.

Most of the metal objects are complete (70%); the higher percentage belongs to square-headed nails, between 17 and 133 mm long. The great variety and quantity would indicate they were used for different structures during the 19th century.

The spatial distribution of nails (some with reddish colour as paint) associated with burnt wood in the sections 9 and 7 of grid IV would enable to suppose they were affected by fire or other agents in a unique event.

Metal objects have a high percentage of rust (78%); each one of them has over 70% of corrosion. Corrosion intensity could be considered as a mean term, allowing to
distinguish the shape of the objects.

**Glass**

From the excavations between 2000 and 2010, the total number of glass pieces is 864 and 2 complete objects: a transparent jar of 5 cm high and a small ball. The pieces of glass found in the excavation are very broken (< 5 cm) and with scarce presence of diagnosis features. The highest percentage of findings represents bottles of alcoholic drinks (Figure 6). On surface collections on the beaches, 1,155 pieces were raised (Helfer 2004; Ramos and Socolovsky 2005; Ramos *et al.* 2003, 2006). These objects have patinas, adherences and in general, rollings caused by the water movement; they are in better conditions than those found in stratigraphy and were possibly affected by anthropic trampling and stamping or by explosions during the battle.

![Figure 6. A: pieces of glass bottles of the 19th century (Grid I). B: wine bottle, Cantón de Junín. C: gin bottle, Museum of Mercedes C. Ameghino. Pieces similar to B and C were found in Vuelta de Obligado.](image)

In the grid V, next to grids I and IV that would belong to Battery Guillermo Brown, a piece of dark green glass bottle of square section with bubbles (Figure 7) was found. According to the characteristics of the bubbles, it was determined that the glass pastry is from the 19th century. It shows colour (turquoise) and texture change in part of the surface, which would indicate some heating process at high temperature.
Out of the total of glass pieces found in excavations, the highest percentage is from the 19\textsuperscript{th} century (41\%) and the 20\textsuperscript{th} century (18\%); however, there is a high undetermined percentage (41\%), due to the lack of diagnosis areas and the level of fragmentation of the sample.

The glass collection was found in two definite areas: 1. on the slopes and battle cores and 2. on the scrubland (at about 200 mt), that was the camp-base area. The highest percentage of glass is on the scrubland (64\%), meeting the expectations about this activity area. Greater percentage and variability of glass pieces of the 19\textsuperscript{th} century and lower fragmentation (as the glass jar and the little ball) are expected in this area. In the area of the batteries, the frequency of findings is lower and the pieces are smaller. Table 3 summarises this:
Table 3. Quantity and percentage of glass of the 19\textsuperscript{th} and 20\textsuperscript{th} centuries, recovered in excavations per areas

<table>
<thead>
<tr>
<th>Area</th>
<th>Possible chronology</th>
<th>Quantity</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Barranca</td>
<td>20\textsuperscript{th} century</td>
<td>46</td>
<td>7%</td>
</tr>
<tr>
<td></td>
<td>19\textsuperscript{th} century</td>
<td>110</td>
<td>17%</td>
</tr>
<tr>
<td></td>
<td>Undetermined</td>
<td>75</td>
<td>12%</td>
</tr>
<tr>
<td>Bosque</td>
<td>20\textsuperscript{th} century</td>
<td>10</td>
<td>2%</td>
</tr>
<tr>
<td></td>
<td>19\textsuperscript{th} century</td>
<td>206</td>
<td>33%</td>
</tr>
<tr>
<td></td>
<td>Undetermined</td>
<td>186</td>
<td>29%</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>633</td>
<td>100%</td>
</tr>
</tbody>
</table>

Due to the characteristics of the glass collection, it is very difficult to differentiate the pieces made in the first half of the 19\textsuperscript{th} century from those made in the second half because a same type of bottle had a distribution over a period of several decades.

*The Creole-European pottery*

The sample we have analysed up to now is only from November 2008 excavation campaign, when the greatest quantity of historical pottery was found at Vuelta de Obligado. The sample has 430 pieces and, in general, it is composed by potter’s clay, Whiteware, Pearlware, utilitarian pottery and olive jar (table 4).

A common characteristic in all types of pottery is the high level of fragmentation, which seems to be related with the consequences of the battle. The low variety of pottery types could be associated with the specific context of the battery, where the presence of potter’s clay stands out -95.54% of the cases are gin containers while the remaining cases are beer containers-.

With regard to the Whiteware, most decorated pieces have the same phytomorphic design - deep red and black petals and branches- with few different shapes, among them, plates and cups could be identified. On the other hand, the Pearlware is very little represented and also some pieces of the mentioned decoration appear, which reinforces the idea that the crockery was replaced according to the decorative design rather than its quality.
Furthermore, the high presence of red-pastry utilitarian pottery, from which several types of containers were identified, is one of the most significant aspects as this must have been the pottery used by the Argentine troops; however, its presence is even with the china. A piece of slightly lighter and badly-manufactured pottery could indicate the presence of nationally-manufactured containers even if their presence is very scarce. The remains of olive jar as a pottery type includes not only the appearance of olive jar, but also of another type of vessel made of the same material that was commonly re-used in the 19th century.

In general, the studied objects match the chronology of the battle, except for two pieces of brick of the 20th century that were collected on surface.

<table>
<thead>
<tr>
<th>Type</th>
<th>Absolute quantities</th>
<th>Percentages</th>
</tr>
</thead>
<tbody>
<tr>
<td>Potter’s clay</td>
<td>112</td>
<td>26,05</td>
</tr>
<tr>
<td>Whiteware</td>
<td>148</td>
<td>34,42</td>
</tr>
<tr>
<td>Pearlware</td>
<td>10</td>
<td>2,33</td>
</tr>
<tr>
<td>Oil bottle</td>
<td>35</td>
<td>8,14</td>
</tr>
<tr>
<td>Red-pastry pottery</td>
<td>122</td>
<td>28,37</td>
</tr>
<tr>
<td>Orange-pastry pottery</td>
<td>1</td>
<td>0,23</td>
</tr>
<tr>
<td>Brick</td>
<td>2</td>
<td>0,46</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>430</strong></td>
<td><strong>100,00</strong></td>
</tr>
</tbody>
</table>

Table 4. Absolute quantities and percentages of pottery types

The Indigenous pottery

Before the settlement of the defences for the battle, in the place where the site is now, there were Native settlements. These groups lived on the banks of River Paraná during an undetermined period, leaving pottery, rock artefacts and fauna remains. In the excavations and surface collections on beaches, banks and slopes we found pieces of pottery whose study is being developed. Some results of the analysis of just over 2,000 pottery pieces found up to 2006 are presented. Most pottery -1,571 pieces- were found in excavations and the remaining -467 pieces- on surface collections, mainly on beaches.

Figure 8 shows a comparison of the average of the sizes (length, width and thickness) of the pottery pieces. Clearly, two large groups can be observed: 1. composed by smaller-sized material found in the stratigraphically-excavated grids (I, II, III, IV, V, VII and VIII) and 2.
composed by larger-sized pieces, collected on the surfaces of the south, centre and south-centre beaches, together with other material of a cave in the south beach and the material found in the area of the Batteries Almirante Brown and Restaurador Rosas as well as in the path that communicates them now. The difference of sizes between both collections could be explained by the place where the materials were found: the material found in the grids is associated with other Creole-European objects of the battle core area, making a palimpsest. On the other hand, the material found on the bank surface responds to a secondary context caused by ascent and descent of the level of the river. This material is not found in the area of greater impact of bullets and therefore, has less fragmentation as well as the material found on surface in the area of the batteries and the path, as a consequence of the post-depositional processes caused by the pluvial action and the eventual human and animal stamping and trampling.

On the other hand, the condition of each piece, with regard to the rounded-shape of its edges (rolled), was analysed, which provided very important data: 62.6% of the Indigenous pottery found in the excavation has this shape while this percentage rises to 90% on the beaches (Figure 9). The high percentage of rolling is mainly due to causes of the action of River Paraná water, of trampling and stamping. The first cause affected the piece

![Figure 8. Average size of the pieces of Indigenous pottery. The Roman numbers are the excavation grids](image-url)
from its abandonment up to the recovery moment while the other two causes took place during the systemic context and then, during the archaeological context (*sensu* Schiffer 1990). In this sense, the consequences of the battle could have contributed to the transformation of the pieces at some extent.

Figure 9. Percentage of rolled Indigenous pottery. The absolute quantities can be observed in the upper part.

**Other findings**

Remains of thermoaltered wood of a variety of the nandubay (*Prosopis affinis*) were also found. Twelve postholes, dug in the structural rock (*tosca*) are placed in a half-circle (about 0.2 m diameter by 0.45 deep); there are also 5 rectangular marks sized 0.05 m deep, 0.30 m wide and 3 m long and other smaller marks where planks to set the cannons would have been placed. Furthermore, a square hole of 1 m side by 1 m deep, with two circular holes of less diameter and less deep, were found at each side. Other findings were two circular stains of thermoaltered sediment that would be explosion marks.

**Overall assessment**

The main mentioned problems are much more boosted when the occupation and use of the site, which became an archaeological site later, are not related to every-day peaceful life events but to war issues in which armed ships and bank batteries that shoot
constantly are used as well as infantries and animals in constant movement. It is worth remembering that before the Battle of Vuelta de Obligado, the artefacts that composed the batteries and camp-bases would have a neat and organized distribution, according to the military rules and plans as it happened in the military camp-bases and defences at the middle of the 19th century (see Figure 10).

![Figure 10. Sight of the camp-base and defences in Curuzú (N-S), 20/09/1866. Painting by Cándido López, 1891. Paintings on the War of Paraguay, Museo Nacional de Bellas Artes (National Museum of Art)](image)

During the battle, that layout and distribution were affected by the consequences of the cannon and hand firearms bullets as well as by cavalry and infantries (Figure 11). As another collection, the objects from previous Indigenous occupations, already removed during the settlement of the batteries and the military camp-base, must be added. Several thousands of combatants were involved in all the war actions. When moving, they produced trampling, stamping and eventual fragmentation of objects. That means the dynamics of the individual and group human activity reached complex levels. As a consequence of this dynamics, the associations of the objects in the strata do not exclusively reflect the behaviour during the time of the battle but leave palimpsest areas as a result.
Figure 11. Cartoon of national history events, as the Battle of Vuelta de Obligado. The neat
distribution would suffer a result similar to that observed (Oesterheld and Durañona 2004).

One of the most repeated associations in the site is given by the metal artefacts
(nails, pieces of metal sheets, of bombs, etc), faunistic remains found in the battery Brown,
which were quite complete, pieces of glass, pieces of European-Creole china together with
Indigenous pottery and rock artefacts. This is explained as from August to November 1845,
the combatants worked on the setting of the defences, with spades, hoes, drop hammers
and other instruments to dig holes and bury posts to build the parapets, trenches,
embankments and ditches and to do other tasks of land removal (Figure 12). This activity
can be observed:
1. in the half-circle composed by circular holes, the rectangular marks dug with spade,
probably aimed to contain planks on which cannons were set; another square mark sided 1
m and a rectangular hole that was more than 1 m deep together with other two circular
ones. In these activities, sediments containing Indigenous artefacts and structures (the
previous inhabitants) were removed.
2. on November 20th, 1845, when the battle took place, many Anglo-French bullets of
different caliber and power hit the batteries and nearby. These explosions removed the
sediment, making new associations between objects (associated with the military event or
not). So, in the excavations, metal, glass and other objects of the battle were found together
with the Indigenous pottery and rock artefacts.

In this type of sites, one of the issues that must be considered is the condition of the
objects that participated in the battlefield. So, most of them can be affected and only pieces
are found, broken by the explosions and shoots, the body-to-body fight, men’s and animal
trampling and stamping. This could be understood from the composition and distribution of
the archaeological record found in the grids. With battle cores, we refer to the places where
strong war activities took place and therefore, left greater densities of objects and
structures in comparison with other areas of the site. These differences must be visualized
in the archaeological site as concentrations of material – thicker “stains” between specific
findings or diffusion of material. If we consider archaeological concentrations and
diffusions, the battle cores would be among the first. However, it is not simple to determine
the approximate number of objects that separate one category from another.

On the other hand, on the banks of Paraná Guazú River, there are different
quantities of archaeological material, depending on the collection moment as this is
modified by the characteristics and intensity of the river currents, the volume of water, the
movement of great ships and the waves they generate.
Figure 12. Half-circle of fenceprints, probably of a parapet. Rectangular and long marks next to perpendicular, stepped unevenness dug in the structural rock

These are some of the problems Vuelta de Obligado Site presents. Despite having great experience in many types of archaeological sites, our research and excavation team needed some years to know aspects of the archaeological stratigraphy of the site. At the
time of the interpretation, these issues must be handled with caution as it is difficult to discuss spatial aspects if there is not experience in several archaeological campaigns in this type of sites to have a first approach to the knowledge of the archaeological record. At this point, we can recall what several years ago, the European archaeologist Pyddoke stated about the interpretation “… while the basic principles of the stratification are universal, every type of site requires a different type of experience: great useful experience in excavations of the Bronze Age will not necessarily grant the archaeologist the skill to understand the stratification of the deposits in a Roman or medieval city” (Harris 1991: 65).

Other European specialists (for example, Quesada Sanz 2008, 2010) found difficulties similar to the problems of Vuelta de Obligado with regard to “fronts and rears” and the size of the battle fields, the visibility of the units, the disturbance produced by monuments and tourism.

Conclusions

In this type of rural sites, where several structures associated with the defence of the place were built for three months, the geo-environmental characteristics must be considered first. In this way, the following become important:

1. the shape of River Paraná and its dynamics in the area;
2. the slopes and beaches;
3. the closed scrubland and some beach areas (with low archaeological visibility)

All these sectors of Vuelta de Obligado were affected by the human activity with regard to the layout of the defence structures, the camp-bases and then, by the battle activities. In 1845, the areas with natural unevenness were levelled out with spade and hoe to set the batteries; this is why, the findings are in contact with the lays of humus-structural rock or directly on the plank of rock (cemented level by calcium carbonate). This was to look for a good support for the structures that held the cannons. Furthermore, trenches and embankments were made; scrubland areas were cleared out to set the camp-base and also to clear areas that would enable to sight the river better and point the cannons without disclosing the defences. All these defensive tasks included sediment removal and the building of an anthropic landscape.

The lateral and/or vertical displacement of the archaeological objects was produced
by different agents in the site. Some of them by human activity during the formation of the defences in the place; others, by causes of the battle and effect of the explosions, trampling, stamping and finally, others resulted from the human agents’ activity after the original deposit of the objects and structure (neighbours’ gathering, land removal to build monuments and landmarks in the 20th century or fishermen’s and some looters’ activity).

Based on the data provided by the sources of information, we consider that:

1. the archaeological record on three areas of the site (beaches, slope and scrubland) appears as a first organizer to assess if we are in areas of high or low artefact density (with concentrated or scattered material);

2. the main structure of the campaign hospital would have been located (soundings and excavations are still necessary);

3. the types and densities of the findings of the scrubland would indicate we are in the camp-area, which is the longest occupation;

4. the types of objects and their densities up to now are: on beaches, 0.49 per sq.m; grids I-XII, 24.5 per sq.m; scrubland, 50.05 per sq.m, which makes us consider activities related with the war event, but of a different type (staff activity on the battlefield, confrontations in different places near the batteries, activities in the camp-base, etc.) with the participation of different artefacts;

5. the types and the distribution of the findings allow the location of a battery. For this reason, the identification of the marks left by the structures, which would indicate the location of Battery Admiral Brown, was very important. This can be seen through the half-circle of postprints, which would have served to make a fence, and other isolated holes that could have contained posts for flagpoles (as shown in Sullivan’s plan). Also, the two marks of explosions on the sediment (to the east and south of grid I); holes as the square one in the north (1m per 1 m) in grids I-IV; a small bonfire, which would have been used to light the fuse of the cannon that would have been placed in a nearby square hole; the three marks sized 0.30 m wide, per 2m long and 0.05 m deep and other two (one to each side of those three) sized 0.10 m wide, 2 m long and 0.05 m deep dug in the structural rock, which would have served to contain the carriages of the cannons or, at least, to tighten planks of these sizes.

According to these positive and negative findings, we can state we are in front of the battery Admiral Brown. Also, according to the composition of the archaeological record and
the data of the plans, we can hold the hypothesis of the camp-base location, southwards from the bank batteries. On the other hand, there was not a disposal of objects in this type of sites (as in exclusively-human inhabited sites), except for sectors of the camp-base where many objects were left when it was abandoned. These objects could have continued in use if the moments of the battle had not taken place.

To sum up, with regard to the stated hypothesis, we can state:

1. The structures set in Vuelta de Obligado Site would cover a minimum extension of 3 km long per 1 km wide, considering the distribution of the defences between the Stream de Los Cueros and the campaign hospital, and the findings of the camp-base behind the bank defences.

2. According to the findings and the data of the written documents, the defences and the camp-bases would be placed scattered on several sectors of the present archaeological site.

3. It is confirmed that the written documents only inform many issues about the human movements and activities in the place partially, as they do not provide details of the defensive constructions.

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