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THE PRINCELY CART FROM ERETUM

1. The Sabine necropolis of Colle del Forno

The necropolis of Colle del Forno, brought to light during the excavations conducted from 1970 to 1980 by the Centro di Studio per l'Archeologia Etrusco-Italica of the Italian National Research Council (CNR), is the nucleus of the cemetery area of Eretum, a Sabine settlement (Santoro 1977; Santoro 1983). Ancient itineraries and circumstantial evidence suggest that this settlement was situated not far from the Tiber at the 17th, 19th or 20th mile of the Via Salaria, where it was intersected by the Via Nomentana (Fig. 1).

Specific surveys conducted at the site (Gigli, Santoro 1995) verified that the information gathered from historical sources and the hypotheses formulated by topographers of the past century, in particular Ashby and Ogilvie, were reliable, and that the settlement on the hills of Casacotta, adjacent to the hill of Colle del Forno, did in fact already exist in the first phase of the Iron Age. During the second half of the 7th and the first half of the 6th century BC, the settlement expanded over an area of about 20 hectares and was organised according to urban parameters, with well defined spaces being used for the settlement and the necropolises.

The excavations of the necropolis of Colle del Forno, which, thanks to its geographical location is an excellent case study for archaeological research, have allowed us to gather a great deal of information about the social and cultural history of the settlement, especially in relation to the transitional phase at the end of the 7th and the beginning of the 6th century BC. During this period the Sabine settlements in the Tiber valley pass from a pre-urban phase to an urban one, in other words, from a tribal family aggregation governed by a leader who holds complete power to an urban phase with a more complex society. The research conducted in the 1970s defined the chronological *excursus* of the necropolis, the topographical organisation of the tombs and the chronological phases of occupation of the hill.

The necropolis is made up of underground chamber tombs aligned along two sides of the hill; at first the higher ground and the area in a direct line of vision from the settlement were used, then a more regular use of space was made. The type of tomb was a chamber with *loculi* cut into the walls, sealed by tiles, or having deposition shelves, with *dromoi* of various lengths and doors closed off with tufa blocks or gypseous limestone slabs. The hill was used as a burial area from the end of the 7th century until the end of the 4th century BC. The chamber tombs are family tombs that were used for the burial of entire generations, especially in the 6th century.

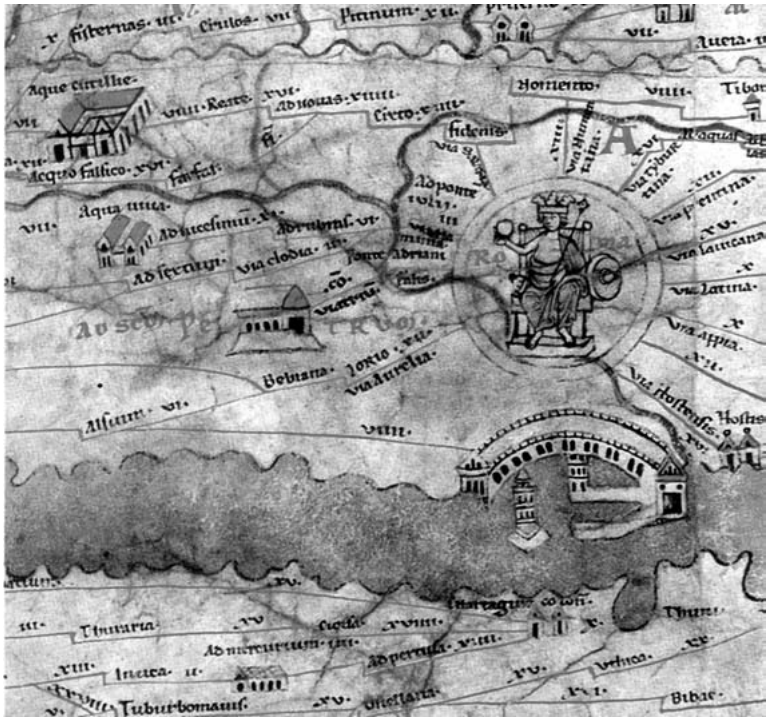

Fig. 1 – The Sabine settlement of Eretum in the *Tabula Peutingeriana*.

Only one tomb, topographically isolated on the peak of the hill, contained a single burial and the grave goods indicated that the tomb belonged to a prominent member who held control over the expanding village. When this tomb, called Tomb XI, was found it was evident that it had been looted; this illegal entry not only damaged the architectural structure but was also the reason for a notable amount of the grave goods to be lost.

The archaeological investigation of the tomb was therefore directed mainly to the floor levels that had remained untouched. The material that was found revealed that this tomb was the most important one in the necropolis, at least of those belonging to the same chronological period, discovered up to that time. An in-depth investigation was then started, focusing on the main original nucleus of the grave goods. Thanks to the collaboration both of local people, some of whom had witnessed the destruction of the tomb, and scholars, who had had the chance to visit the storerooms of foreign museums, it was ascertained that the finds from Tomb XI had been purchased by the Ny Carlsberg Glyptotek in Copenhagen in the early 1970s, and thus immediately after the tomb was violeted (Johansen 1979).

For this reason, we initiated a close collaboration with the curator of the Etruscan Antiquities section of the Ny Carlsberg, which has continued through the years with a very fruitful exchange of ideas aimed at a scientific re-contextualisation of the grave goods. This operation is of fundamental importance for the historical and cultural definition of the Sabina Tiberina during the Orientalising period, because it shows how the *princeps* social model was assimilated by the Sabines settled in the Tiber valley, and the value and importance of the Sabines in this period in relation to the political balance among the various ethnic groups that were in the process of forming in this area. The importance of their role was also suggested by historical sources in the tradition of Tito Tazio and Numa Pompilio.

When the study of the grave goods was ready for publication, the Ny Carlsberg decided to exhibit all the objects from Tomb XI that were in their possession in the renewed Greek, Etruscan and Italic collection. It was therefore suggested that a multimedia product be created for the purpose of virtually reuniting all the objects found in the tomb of the Sabine prince of Eretum, presently exhibited in two different museums: the Ny Carlsberg Glyptotek and the Museo Civico Archeologico of Fara in Sabina.

The proposal for this project, conceived by the CNR Istituto di Studi sulle Civiltà Italiche e del Mediterraneo Antico (ISCIMA), was put forward to the directors of the Ny Carlsberg Glyptotek, the Assessorato alla Cultura of the Rieti Province, the Cultural Management Department of the Museum Section of the Lazio Region and the Municipality of Fara in Sabina. These institutions gave their full approval for the creation of a virtual product aimed at reconstructing an archaeological context of particular interest for the cultural history of an ancient Italic people. The Lazio Region, as well as the Ministero dell'Università e della Ricerca, have assigned special funding for the realisation of this product.

In this way the Institute, which operated under the auspices of the Direzione Generale per i Beni Archeologici of the Ministero per i Beni e le Attività Culturali, adhered to the same agreement protocol which had been made between the Ministry and the CNR, in order to carry out projects in which ICT can be used to enhance the possibility of making cultural information available to a larger public.

2. The excavation of Tomb XI

During the 1972 excavation season it was decided to conduct a topographical survey on the South-East area of the hilltop plateau, on the slightly inclined slope where a pathway cut into the rock and oriented NE-SW had been identified, so as to clarify the link between this latter and the necropolis.

This operation brought to light a broad area, well-defined by dark coloured earth and a noteworthy percentage of archaeological fragments,

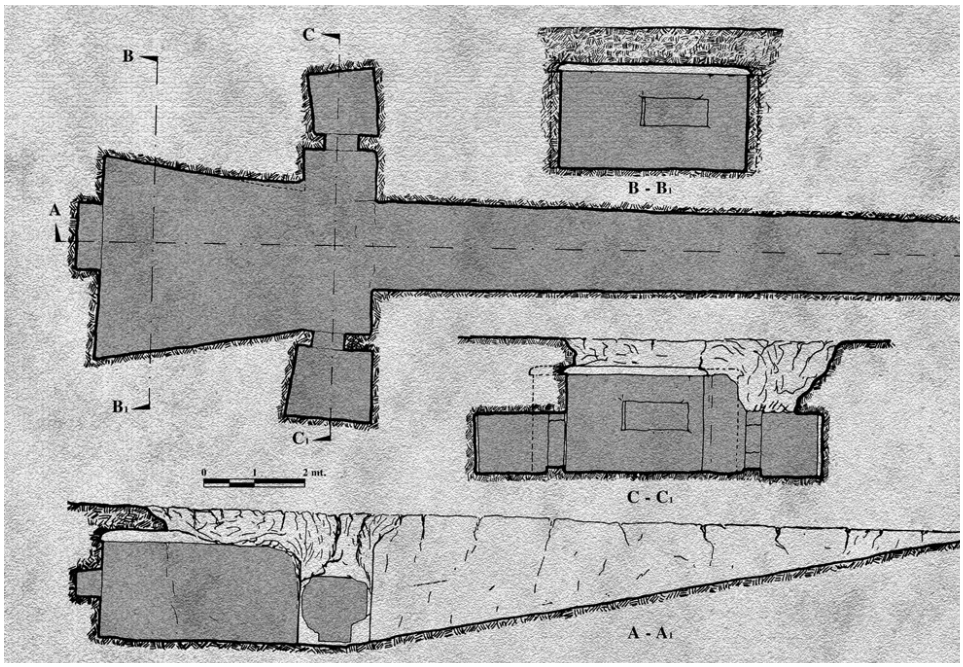

Fig. 2 – Plan and section of Tomb XI.

especially from *impasto* vases with carved and incised decoration, as well as fragments of black-glazed pottery. The excavation was soon begun in this sector and resulted in the discovery of a chamber tomb, preceded by a rectangular vestibule onto which opened two small rooms with carved out benches on the floor, and with an access *dromos* of monumental proportions (Fig. 2).

It was evident that the tomb had been emptied by mechanical means, which had left unmistakable marks in the tufa-rock and had completely removed the ceiling and part of the main chamber; in the side cells the ceiling and the side walls were destroyed, and in the left cell the floor was also damaged. The *dromos* was not involved in the illegal intrusion and the earth filling at the time of the excavation was very compact, with fragments of late-Orientalising and Archaic *impasto* bowls and small jars, as well as fragments of black-glazed pottery, which were associated with the last phases of use of the tomb.

Unlike the *dromos*, the earth filling of the chamber was not very coherent; it was mixed with pieces of tufa of various sizes – probably due to the collapse of the ceiling – and fragments of brown *impasto* vases, which in part could be re-assembled, iron fragments, fragments of bronze sheets and shafts and a small gold pendant.

Emptying of the main chamber brought to light an irregular layer of the original deposit, preserved at the base of the bottom wall, in the corners where it joined the side walls and along the left side wall. In this layer in the right corner researchers found remains of the rims of an iron wheel with one of the wooden spokes, preserved in the concretion formed by the rust; on the left side were numerous fragments of iron rods of various lengths and thicknesses, fragments of bronze and iron sheets, fragments of two circular iron elements with a checkered decoration and amber inlay, as well as remains of wood and leather. Along the bottom wall were found *laminae* of gold with impressed decoration, fragments of decorative elements in silver and bronze, fragments of very corroded sheets of bronze with remains of wood fibre, and fragments of iron swords and daggers, related to the weapons of the deceased.

The two side chambers were permanently damaged. In the left one fragments of black-figured Etruscan pottery and some fragments of black-glazed pottery were found. Fragments of vases from the same period with shards of brown *impasto* pottery were found on the ground around the tomb, where the original earth filling was probably placed when the tomb was looted.

After restoration, the material recovered – *impasto* pottery with carved and incised decoration, bucchero *oinochoai*, gold laminae of different sizes, part of the decoration of the clothing of the deceased, pendants in gold and silver, decorative elements in bronze and iron, parts of the structure of a cart – qualified this tomb as the most important burial of the necropolis, as was also confirmed by its architecture, dimensions and position in the spatial organisation of the necropolis; the tomb, in fact, was built in a prominent position and in connection to the roadway which linked the necropolis to the settlement of Eretum, situated on the outer slopes of the hill of Casacotta, and marked by a pathway for carts which is indicated in old cadastral maps.

As mentioned above, in 1979 in the «Meddelelser fra Ny Carlsberg Glyptotek» (Johansen 1979) mention was made of an acquisition in the early 1970s of a group of bronze sheets with relief decoration, along with other material such as *impasto* and bronze vases, fragments of parts of a cart structure and gold *laminae*. The note also pointed out the fact that the presence of these materials in the antique market as a single lot suggested that they came from the same burial.

Obviously the burial site was not known, but the decoration of the bronze sheets – which was very similar to that of a group of sheets already in the possession of the Foundation, studied by Johansen (1971) and attributed to the production of a city in southern Etruria – suggested that the area of origin was a necropolis in one of the most important coastal towns. Based in part on the year of acquisition and in part on various pieces of information provided by J. Szilagyi – who had examined the lot of materials acquired by the Foundation while he was studying an Etrusco-Corinthian amphora (Szilagyi 1982)

– contact was made with F. Johansen, Director of the Glyptotek, who gave us permission to examine the objects which had been purchased.

From the autoptic examination of all the objects which were part of the acquisition it became evident that they were part of the grave goods from the princely burial of Colle del Forno. Among the objects in Copenhagen, the focus of major interest consisted of a group of bronze sheets, decorated with real and imaginary animals from the Orientalising repertory, which were accompanied by bronze vases and complete banquet paraphernalia, *impasto* vases and the above-mentioned Etrusco-Corinthian amphora, bronze shields (Plate VII, a) and iron spear points, parts of the rims of wheels and structural parts of a cart. These latter, along with those found in the excavation, suggested the presence of two different vehicles with wheels.

At this point, the grave goods of the princely tomb were finally recomposed in their substantial unity, even though various materials, like the goods from the two depositions in the side chambers, were still missing from the original complex as a whole

The grave goods which accompanied the deposition in the main chamber can be qualified as those of a prince, whose role as leader is demonstrated by the display of luxury evident in the rich decoration of his apparel, the complex set of vases destined for use in banquet ceremonies, and, above all, by the presence of a chariot and a cart covered with embossed and engraved bronze sheets, and by the harness of the horses, decorated with similar bronze sheets, that represents a unique find among archaeological artefacts in ancient Italy (Plate VII, b). That the deceased was a warrior can be inferred from the presence of the chariot and the bronze shields dating back to at least one generation earlier and from the complete set of iron arms and armour, which almost certainly included a bronze helmet.

The study of the material in its entirety – that from the excavation, exhibited in the Museum of Fara in Sabina and that removed illegally, exhibited in the Ny Carlsberg Glyptotek – made it possible to focus attention on the grave goods of a prince who lived in Eretum in the lower Sabina between the end of the 7th and the 6th century BC, while the dynasty of the *Tarquinii* reigned in Rome. The composition of the grave goods consists of the possessions of the prince and the goods for the prince. Bronze and metal vases represented goods of particular value; among these, as well as local products, there are also objects imported from the Orient and pieces accurately reproduced from Near Eastern typologies. Besides the metal vessels, there are bucchero *oinonchoai* and brown *impasto* vases, decorated with incisions, that demonstrate the existence of workshops operating in the Tiber valley, as well as Etrusco-Corinthian vases.

However, it is above all the presence of the chariot and the cart that qualifies the deceased as a leader. In the Orientalising period, the cart is linked to the armaments of the caste of leaders and only the burials of distinguished

Fig. 3 – The sequence of the bronze sheets that covered the right side of the cart.

persons had a rich array including a two-wheeled cart. These tombs testify to a heroic concept of war, according to which the warrior reached the battlefield on a chariot. Etruscan iconographic sources also show the ceremonial use of this vehicle, with the leader, fully armed, getting into it with his charioteer. The presence of a cart besides the chariot seems to indicate another aspect of the power of the deceased. He is not only the leading warrior, but also the religious leader of the community. A similar case should be recalled in the profile which, according to the textual sources, is attributed to Numa Pompilio, the second king of Rome and native of the Sabine.

The decoration with real and imaginary animals on the bronze sheets that cover the sides of the cart calls attention to the concept that the prince, owner of the cart, dominated the forces of nature and those of the hidden powers that are a constant threat to human life (Fig. 3). From a stylistic point of view, the decorations represent the work of a metalsmith, a master in the art of embossing and chiselling, who was active in a workshop at the court of princes of the Tiber (Santoro 2001). The cart also represents an interesting example of the construction technique used for vehicles of this type, as was shown by the study conducted on the fragments from both the museums, Fara in Sabina and Ny Carlsberg Glyptotek.

The reconstruction, which was exemplary from a methodological point of view, showed how the complete vehicle must have looked and the features of its single structural components; it produced an analogical graphical result which constituted the basis for the scientific virtual reconstruction of the cart.

3. The cart in 3D

Attempts to reconstruct the vehicles used by the princes of ancient Italy, found disassembled in Orientalising and Archaic tombs, go back to the end of the 18th century (Camerin 1997-2000). However, with the one exception of the fortunate case of the Chariot of Castro (Boitani 1997-2000), the old antiquarian method was replaced by a philological procedure only in the last decade of the 20th century (Emiliozzi 1997-2000, 95-103), the first results of which were presented in the three editions of the exhibition *Carri da guerra e principi etruschi* (Viterbo 1997, Roma 1999, and Ancona 2000). Since the 18th century, the desire to see a vehicle rebuilt with its real dimensions and features has never ceased to tempt antique experts and archaeologists, who have placed chariots in museums with their wooden structure entirely re-made. Fragments from both the functional as well as the decorative metal parts, were applied to it. Because of the perishable nature of wood, and the destruction caused by lying buried for centuries in the ground, these were the only parts that remained.

In the last ten years, before the case study described in this section, modern research had experimented the following criteria in presenting a reconstruction based on detailed philological and comparative studies:

1) Traditional reconstruction mounting the remains onto a modern supporting structure. This solution has been adopted in the rare cases where the original elements were not deformed and were of sufficient quantity and quality to guarantee that the volume of lost forms could be inferred with a negligible margin of error. In this case, however, the actual reconstruction was shaped according to manually executed graphic representations which were printed for the purpose of explaining the object to be displayed in a museum or an exhibition. Some outstanding examples are the chariot from the Tumulo dei Carri in Populonia (Emiliozzi 1997-2000, 163-168, fig. 2-5, plate VI) and that from Monteleone di Spoleto (Emiliozzi 1997-2000, 181-183, fig. 2-6), restoration and reconstruction of which was finished in 2006, in time for the exhibition in the new halls of the Metropolitan Museum in New York, in the Spring of 2007.

2) Models in a scale of 1:1 or reduced. These cases depend on the same conditions as those in point no.1, but have been adopted when the original remains – generally made of metal but occasionally even wood – could not be applied directly onto a modern structure. Therefore, a copy was made, on a 1:1 scale as well as reduced, to be used in the reconstruction. Examples are the chariot from the Tomba del Carro in Vulci, with a modern wooden structure, 1:1 scale (Emiliozzi 1997-2000, 145-151, fig. 10-16, plate III) and the cart from the Tomba "della Principessa" in Sirolo, with a structure in synthetic material, 1:4

scale (Emiliozzi 1997-2000, 249-253, fig. 19-22, plate XXV, 2). The cart from Castel San Mariano near Perugia is also included among these cases, although some errors can be observed in the 1:1 wooden reconstruction (Bruni 2002), especially in the type of wheels.

3) Manual graphic illustrations, in scale. The same criteria for point no.1 is required for this solution (for example, the chariot from the Tomba del Tridente in Vetulonia: Cygielman, Pagnini 2006, 31-51, fig. 9-10). This option must be chosen in cases where the original remains could not be directly applied (because deformed or dispersed in other museums) or could not be copied in their exact form due to a particularly elaborate decoration. An example is one of the two chariots from Castel San Mariano near Perugia (Emiliozzi 1997-2000, 210-213, fig. 2-5). For this vehicle, a bare wooden structure was made on a 1:1 scale in 1997, shown for didactic purposes in the exhibition *Carri da guerra e principi etruschi* (Emiliozzi 1997-2000, 210, fig. 1).

4) Sketches on a scale. When the original elements are scarce but intelligible enough to be referred to known types of vehicles, the best means of reconstruction is a simplified sketch: a non invasive graphic outlines the lost supporting structure, onto which the original elements are traced (Cygielman 1997-2000 for the cart from the Tomba del Littore in Vetulonia; Emiliozzi 2006a for the chariot in the Dutuit collection from Capua). Mixed criteria from points nos. 2 and 4 have recently been adopted for the cart from Tomb 928 in Pontecagnano (Emiliozzi 2006b).

5) Original pieces on a simplified structure for museum exhibition, made of appropriate materials according to the individual case, with a design or photo of the type of vehicle. Juxtaposing original pieces without remaking the supporting structure is the most common and most highly recommended solution. It is more frequent because in most cases the metal remains which have been collected can only be useful in identifying the vehicle as a chariot, cart or wagon. It is the most recommended because it avoids exchanging a deduced hypothesis for an archaeological fact and as such use it in the specific literature. This criterion has been applied to the chariot of Tomb 8 (formerly LVI) of the Contrada Morgi in Narce, exhibited in the Museo di Villa Giulia in Roma, to the cart of the Tomba dei Flabelli in Trevignano Romano exhibited in the local Museo Civico, and to the cart of Tomb 15 of Pitino di San Severino Marche, exhibited at the local Museo Civico.

In January 2005, during the renovation of the Ny Carlsberg Glyptotek of Copenhagen, appropriate criteria were chosen to exhibit the splendid remains of the cart from Tomb XI of Colle del Forno. Contrary to the original proposal to place the finished sheets of the lost wooden structure on a reconstruction made of synthetic transparent material in 1:1 scale, it was decided to use the

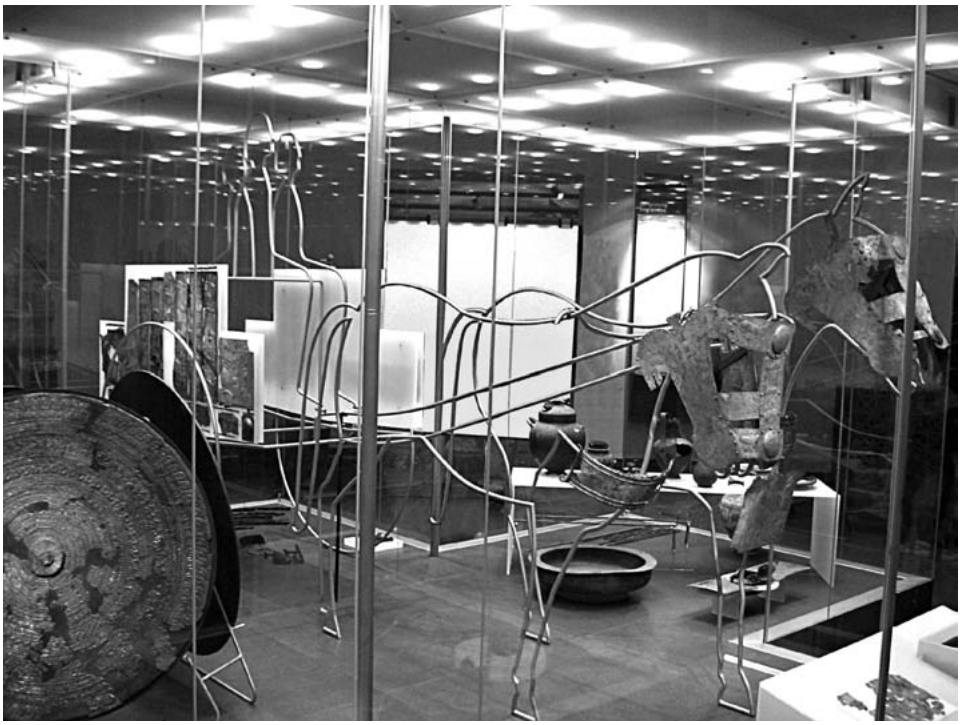

Fig. 4 – The showcase dedicated to the display of Tomb XI in the Ny Carlsberg Glyptotek.

same approach as described in point no. 5, even though there were abundant metal pieces preserved. In fact, a wire silhouette on a 1:1 scale outlines the horses and the passengers sitting on the cart, and panels of synthetic material support the metal covering on the two sides, as well as the naves of the wheels with the original cylinder shape coverings of the external segments. Analogously, the bronze elements belonging to the harness hang from the front part of the two horses, i.e. the headgears, neckstraps and one of two remaining breast plates (Fig. 4, Plate VII, b).

The observer can thus see the space occupied by the vehicle and the horses, without the invasive presence of the supporting structure. Some of the metal pieces, which were once beneath the substructure, have been placed in the showcase, in correspondence to their original positions. However, as we now know, not all elements of the vehicle are in the Danish museum. When the tomb was professionally excavated after being looted, many fragments of iron belonging to the vehicle remained in Italy, as well as the second small lion made of cast bronze.

It was also decided that a video showing a 3D virtual reconstruction should be produced as an explanatory aid of the vehicle. The DVD can be seen at the Ny Carlsberg Glyptotek in the same room containing the cart and the other objects from Tomb XI of Colle del Forno, as well as on the website http://www.principisabini.it/ (cfr. *infra* § 4).

It is worth mentioning that before the decision to create a virtual 3D reconstruction was made, a draft of an in-scale graphic reproduction had already been manually prepared, which included an exploded axonometric view, based on the study of the volumes of the lost wooden structure, according to the criteria in point no. 3. The architect Federico Cavalli acquired and elaborated this draft as the first phase of his work in a virtual laboratory, together with all the necessary information for each component of the vehicle, that basically coincides with the texts that the user can find in the website under the title "Il calesse in 3D/Tutti gli elementi del calesse" (The cart in 3D/All the elements of the cart).

Computer elaboration of the cart elements was also supported by photographs of the surviving metal parts, which represented both functional and decorative elements in the supporting structure. These latter, in particular, were shown already in place according to the instructions given to the Ny Carlsberg Glyptotek operators for setting up the structure created for the exhibition.

The first result was an exploded axonometric view of the virtual reconstruction (Fig. 5), which had the advantage, as compared to the traditional graphic representation, of immediate verification of the progressive re-composition of the parts for the completed assembly of the vehicle. Any correction could be easily and quickly made telematically. Use of different colours for the various components was a great help for the perception of the volumes and the mechanisms of assembly, as if it were being done by a wheelwright.

Once the components were determined to be accurate, each one was assigned a texture (wood, metal, etc.) so that every element was shown with its original chromatic and surface characteristics.

Upon completion of this phase we obtained the essential assembled structure of the vehicle. We then decided against a virtual re-elaboration of the ornamental coverings, but in favour of the direct use of colour photographs of the pieces as shown in the museum (Plate VIII, a). Once these were obtained from a right-angle view, they were applied without the leather layer that originally was inserted between the metal and the wood, leaving the observer the impression that the elements were not completely integrated but "hanging" from the supporting structure of the vehicle. This approach was chosen so as to avoid "inventing" details of ancient methods of construction that cannot be known from the evidence we have. This phase fully demonstrated the usefulness of a virtual laboratory, since the right-angle view could be moved to any other position without making new photographs of the decorative sheets in partial perspective.

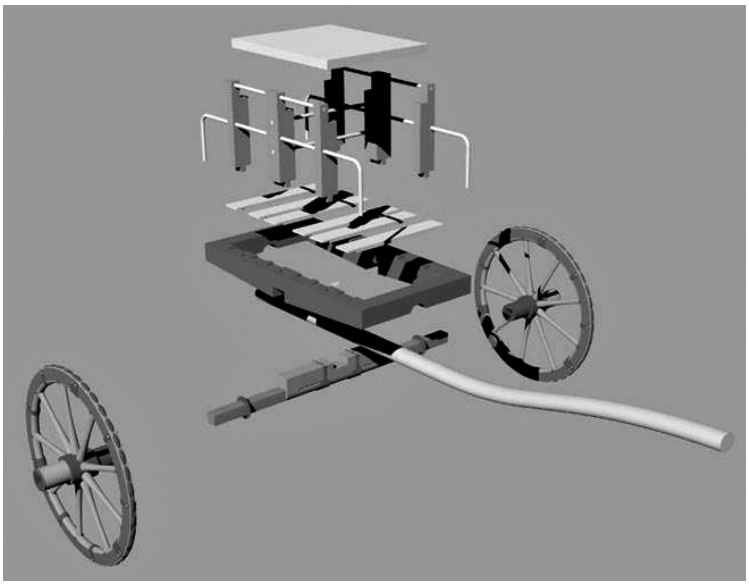

Fig. 5 – Exploded axonometric view of the cart.

The virtual dimension was finally completed in space and time with movement, so that one could see the cart rise from a stationary position and move on two wheels that turned with the axle (Fig. 6).

Virtual Reality was applied here for the first time in reconstructing an Etrusco-Italic vehicle. In any case, a preliminary line drawing is required for study and research. It should be noted that the virtual dimension exponentially increases the comprehension of the mechanisms of reconstruction. However, the fact remains that scientific publication requires a written description of the work performed, with a comment on the entire sequence of static images. Our hope for the future is that in such cases, paper publications can be completed with a DVD included.

4. The virtual project

The project promoted by ISCIMA of the virtual reconstruction of Tomb XI and the princely grave goods found in its interior was based on the twenty-years of experience that the Institute has in the sector of archaeological computing. In accordance with the three key concepts of digital culture – interactivity, hypermediality and connectivity – the project plan included integration of different methods of digital acquisition, processing of data and the implementation of a multimedia system for sharing information online (Moscati 2006).

Fig. 6 – A view of the cart from below.

In pursuing the aims outlined in the protocol agreement among the various institutions involved in this initiative, the project was brought to completion and presented at the inauguration of the new museum exhibit in the Ny Carlsberg Glyptotek in Copenhagen, which was presented to the public on 27 June 2006, in the presence of the members of the Danish Royal Family.

The architecture of the project proposes two separate sections which are distinct but complementary to each other:

1) The phase of visual "perception". This phase involves, in particular, the problems connected to the renovation of the Ny Carlsberg Glyptotek and the virtual visit, by exploiting computer methodology as a support which will allow the visitor to navigate inside the necropolis and the burial chamber as well as enjoying being "immerged" in the habits and customs of an ancient Italic people, located in the middle Tiber valley, characterised by the grave goods of one of its "warrior princes".

2) The phase of "knowledge". This phase permits analysis, with scientific rigour and increased learning opportunities, of the different phases that produced the virtual 3D reconstruction proposed. Within the framework of a single information container, it is, in fact, possible to retrace the complex phases of this archaeological research in each of its aspects: from fieldwork to laboratory analysis, comparative studies, hypothesis for restoration, planning of the best solutions for safeguarding and fruition of the archaeological finds.

4.1 *Exhibition purposes*

The programme of renovation and improvement of the Ny Carlsberg Glyptotek gave major importance to the exhibition room dedicated to the precious collection of grave goods from Tomb XI of Colle del Forno and in particular to the bronze sheets which decorated the cart, displayed according to the modalities indicated in the preceding paragraph.

As an addition to the traditional type of visit to the room discussed here, a video was produced which allows the public to re-contextualise the finds from both a temporal and a spatial point of view. The video, in fact, accompanies the visitor to the hill occupied by the necropolis of Colle del Forno and lets him move along the slight slope that leads to the tomb – which has been covered over again and therefore can no longer be visited – to walk along the long *dromos* and immerse himself in the interior, through a virtual architectural reconstruction of the burial chamber cut out of the tufa, up to seeing the cart, complete with the original decoration, located in the position in which, according to excavation data, it must have been buried (Fig. 7). For the other grave goods in the museum in Copenhagen, the original position is not shown since we have no objective data concerning their original location, and any attempt to place them in the tomb would have been completely arbitrary.

After observing the cart in its entirety, the visitor goes on to the virtual model of the vehicle and, through the assembly of the single components and the description of the materials used in their construction, the structural and functional mechanisms in action can be reconstructed[1]. As said before, reconstruction of the cart implied operating within a virtual laboratory equipped with sophisticated tools, that allowed us to "work" the structural parts of the vehicle as a craftsman would do, by cutting, indenting and making holes in each element, just as if they were real. In the virtual world, however, one works in space and the objects that are modelled are only pure geometric entities, without material, which is then assigned to them by sampling textures of wood, metal, etc. At the end of this process, in order to complete the virtual reconstruction, we need to give movement to the vehicle. In the time span of about a minute, the cart is raised, it moves, the wheels and the axle rotate: the virtual dimension can be considered completed in the two conceptual axes of space and time.

For the decoration, the excellent photographic documentation of each bronze sheet allowed for the use of digital techniques perfected in the

[1] For a recent BBC virtual reconstruction of an Iron Age chariot discovered in Wetwang (East Yorkshire) see http://www.bbc.co.uk/history/ancient/british_prehistory/launch_ani_wetwang.shtml. Very interesting from a scientific point of view, even if in reference to a Renaissance vehicle, is the interactive functioning virtual model of the so-called Leonardo's "Automobile", created, thanks to the rigorous analysis of ancient manuscripts and drawings, through the digital reconstruction of single mechanisms and their progressive assemblage: http://brunelleschi.imss.fi.it/automobile/.

Fig. 7 – A sequence of the video, showing the cart in its original location in the tomb.

Laboratory of computer graphics in ISCIMA, particularly specialised in the documentation of ancient artefacts which – due to the minute dimensions of the decoration, the poor state of preservation, or their being available only in photographs – are not suitable for traditional drawing methods (Santoro, Bellisario 2003). The tools used made it possible to appreciate details which were useful in the study of the iconographical motifs and for identifying the various decorative techniques used by the craftsman during his work (Fig. 8).

4.2 *Scientific and educational purposes*

The project is enriched and completed by a web site (http://www.principisabini.it/), which will soon be available also in English and Danish. The purpose of the web site, which retraces the history of the research, is to spread archaeological knowledge on the Sabine culture and to describe the innovative methodological procedures adopted to expand and share this knowledge.

The web site (Fig. 9) is divided into four sections, which are integrated by information files, a glossary and bibliographic references. The first three sections are dedicated to the illustration of the antique Sabine settlement of Eretum, the nearby necropolis of Colle del Forno (where the excavations began again in 2000 and are still in progress) and the discovery of Tomb XI. The documentation is augmented by the digital acquisition of Latin and

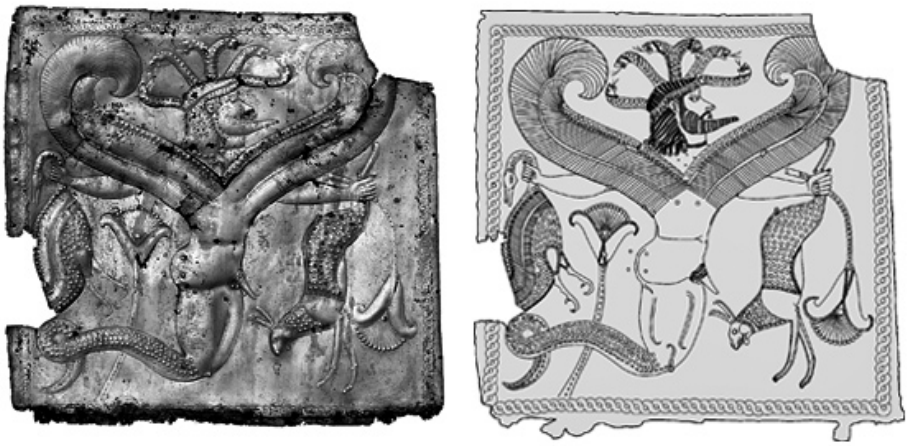

Fig. 8 – Photograph and graphical digital design of one of the bronze sheets.

Greek textual sources, providing information for the historical background; published and unpublished excavation reports and the relative graphic and photographic documentation; present maps, with overlay of historical maps, and those produced during the excavation; images (even overhead images taken from a helium balloon) relative to the site in its present state.

In the description of the excavation of Tomb XI, particular attention is given to the problems connected to the reconstruction of the original nucleus of the grave goods, which, as was said, is divided between the Ny Carlsberg Glyptotek in Copenhagen and the Museum of Fara in Sabina. For the first time, in the long history of the artefacts, it is possible to observe the complete assemblage of the grave goods together, divided into two categories "The personal goods of the prince" and "The grave goods of the prince". Each object is accompanied by a brief explanatory outline and illustrated with reduced size images that can be enlarged upon request. The background colour of the images, black for objects kept in Copenhagen and light blue for those kept in Fara in Sabina, gives one the opportunity to immediately evaluate the entity of the two collections.

The fourth and final section is focused on the cart and on its virtual 3D reconstruction. In respect to the video, however, the graphic documentation is integrated and enriched by information of a technical and structural nature, with particular reference to the description of the methodology followed to obtain the complete reconstruction of the vehicle and its decoration from the minute metal fragments found during the dig. Chronological and cultural aspects are also emphasised, through various comparisons relevant to the Orientalising period that illustrate the practice among the populations of ancient

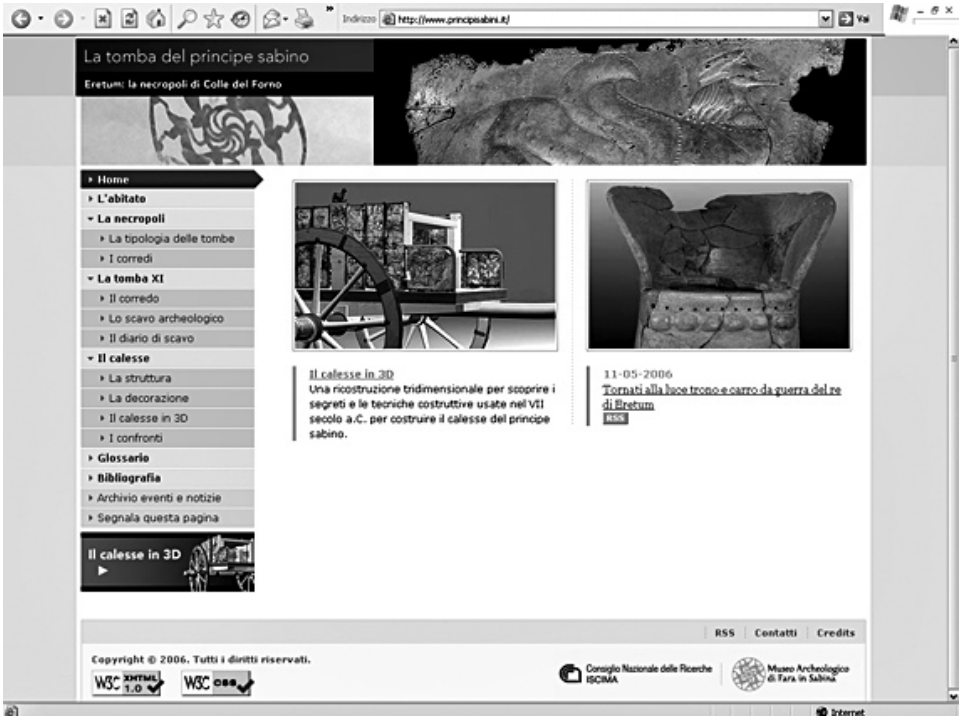

Fig. 9 – Home page of the web site http://www.principisabini.it/.

Italy (Etruscans, Latins, Sabines and Picenes) of depositing a cart in the tomb with the deceased, a practice that comes from the island of Cyprus.

From the home page of the web site, where there is also a section dedicated to news, direct vision of the video with the reconstruction of the cart can be accessed, and at the same time an interactive application allows users to experiment with a dynamic representation and communication tool. This latter offers the possibility of seeing the image and reading the description of each component of the cart, accompanied by the indication of the original material used to make it and the relative measures. The user, moreover, can choose the option to see the single components mounted in the original position on the structure shown on a transparent image of the cart (Plate VIII, b).

4.3 *The enjoyment of archaeological data*

The completion of the project has made it possible to enjoy precious Sabine archaeological evidence, which have been differentiated according to the dimensions of space and time and the typology of users. The web site constitutes

the true fulcrum of the project, as it contains and explains all of the procedures used for study and data elaboration. According to a scheme for presenting information which proceeds from the general to the particular, attention has been given to the relationship between facts and details: the description of the archaeological site and the history of the discovery, the recovery and the study of the precious grave goods, and the reconstruction of the cart and its decoration, which is the result of a series of in-depth analyses of each detail, which opens interesting prospects for future research on ancient techniques.

The home page constitutes the basic feature that gives a general idea of the content and at the same time encourages the virtual visitors to plug-in to the history of an ancient Italic people. For this purpose, an effort was made to use attractive graphics, as well as applications which can be quickly downloaded, with a clear and comprehensible view of available tools that encourage interaction (navigational paths, captions, didactic support). Specific terminology is not lacking, but aims to take into account and share the prior knowledge of the user; the result should therefore enhance interest in learning more according to the personal queries and needs of various audiences. The contents are addressed to different levels of knowledge and to different age groups and can be used by a wide range of public as well as specialised scholars. A multimedia system, in fact, offers various reading pathways, giving the user the possibility of choosing from a series of alternatives, that lead from general information to detailed data on particular aspects.

The aim pursued, therefore, was to diffuse scientific knowledge that would stimulate rather than limit the curiosity of visitors. Through technology-based installations, we also plan, as work progresses, to make the applications usable not only online, but also in three different locations: first, in the Ny Carlsberg Glyptotek, where a multimedia educational hall is planned and in which contemporary means of communication will be introduced to consolidate and enhance the museum's position as a cultural venue in Denmark and the rest of Europe; secondly, in the Museo Civico of Fara in Sabina, which will be the central location for the diffusion of the results of this archaeological research, and for stimulating interest towards the field of IT applied to archaeology, with training activities for schools through educational laboratories; and thirdly, at the Area della Ricerca di Roma 1-Montelibretti of the CNR, where, in the 1970s, construction gave rise to the excavation activities in the necropolis of Colle del Forno.

5. Concluding remarks

This project opens new prospects for research that go beyond national boundaries, thanks to its reiterability in different archaeological and exhibit situations. In fact, this initiative constitutes a scientific example of an ideal

re-unification and re-contextualisation of archaeological artefacts, which, due to illegal excavation activities and the consequent illicit trade in art objects, are dispersed in various museums in different parts of the world. The main focus of the project is the use of the potential of the virtual, that is to say, the capacity of the virtual to become actual (Gregory 1997), thus putting in direct connection with each other the locations where moveable artefacts are kept and those where the archaeological discoveries were made, and guaranteeing, even to a small museum such as the one in Fara in Sabina, the opportunities generally reserved only for larger institutions.

The objective pursued is to use innovative communication and exhibition methods to impart alternative information and communication pathways, for the purpose of creating an appropriate balance in the relationship between artworks, history, culture, society, and the museum itself. Commencing from the excavation data and from the scientifically re-composed archaeological context, the virtual "musealisation" of Tomb XI has allowed researchers to re-create the burial moment as well as the prince's grave goods with a visual immediacy, which we would not have been able to appreciate otherwise. In fact, although in the two museums where the objects are located there are correlated cross-references, and a scientific study of the complex is in the process of publication, the contingent situation does not fully reveal the importance of the monument and of the grave goods in relation to the civilisation that the Sabines developed in the Tiber valley in the Orientalising and Archaic period.

As noted by P. Galluzzi at the end of the 1980s (Galluzzi 1989), the new multimedia technologies develop efficient communication strategies that permit the integration of knowledge coming from a museum exhibit, by presenting each artwork inside a grid of factual and logical relations capable of illuminating its meaning. Virtual "musealisation" has therefore allowed us to go beyond what is kept in the building of the real museum; to acquire a different kind of knowledge from that offered by direct inspection of artefacts separated from the historical context in which they originated; to gather together objects and information that in reality exist scattered in various locations and which are not directly perceivable; to reconstruct and present in an innovative way a precious artwork as it was produced and used in its social and cultural environment; and finally, to enhance the relationship between scientific research and the public understanding of the mechanism of archaeological interpretation.

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REFERENCES

Boitani F. 1997-2000, *Il Carro di Castro dalla tomba della Biga,* in Emiliozzi 1997-2000, 203-206.

Bruni S. 2002, *I carri perugini: nuove proposte di ricostruzione*, «Annali della Fondazione per il Museo Claudio Faina», 9, 21-47.

Camerin N. 1997-2000, *La ricostruzione dei carri nella storia dei ritrovamenti*, in Emiliozzi 1997-2000, 88-93.

Cygielman M. 1997-2000, *La Tomba del Littore di Vetulonia ed i suoi carri*, in Emiliozzi 1997-2000, 264-273.

Cygielman M., Pagnini L. 2006, *La tomba del Tridente a Vetulonia*, Monumenti Etruschi, 9, Pisa-Roma, Istituti Editoriali e Poligrafici Internazionali.

Emiliozzi A. (ed.) 1997-2000, *Carri da guerra e principi etruschi. Catalogo della Mostra (Viterbo 1997, Ancona 1999, Roma 2000)*, Roma, L'Erma di Bretschneider.

Emiliozzi A. 2006a, *Ipotesi di ricostruzione del Carro Dutuit*, in V. Bellelli, *La tomba "principesca" dei Quattordici Ponti nel contesto di Capua arcaica*, Roma, L'Erma di Bretschneider, 131-148.

Emiliozzi A. 2006b, *Nuovi spunti per una lettura del calesse dalla Tomba 928 di Pontecagnano*, «AION Archeologia e Storia Antica», N.S. 11-12, 139-144.

Galluzzi P. 1999, *Musei virtuali: istruzioni per l'uso*, «If. Rivista della Fondazione IBM Italia», 1992, 2, 8-13.

Gregory T. 1997, *Nel mondo semantico del virtuale*, «If. Rivista della Fondazione IBM Italia», 1997, 1, 14-17.

Johansen F. 1971, *Reliefs en Bronze d'Etrurie*, Copenhague.

Johansen F. 1979, *Etruskiske Bronzerelieffer i Glyptoteket*, «Meddelelser fra Ny Carlsberg Glyptotek», 80-87.

Moscati P. in print, *A virtual visit to the ancient Sabine princes*, in *Proceedings of the XV UISPP Congress (Lisbon 2006)*, BAR International Series, Oxford, Archaeopress.

Qulici Gigli S., Santoro P. 1995, *Eretum: ricerca topografica sull'abitato in epoca arcaica*, Archeologia Laziale, 12, 2, 641-663.

Santoro P. 1977, *Scavi nella necropoli sabina di Colle del Forno*, «Notizie degli Scavi», 211-298.

Santoro P. 1983, *Scavi nella necropoli sabina di Colle del Forno*, «Notizie degli Scavi», 100-140.

Santoro P., Bellisario M. 2001, *Elaborazioni grafiche computerizzate nello studio della decorazione di un gruppo di lamine in bronzo da Eretum*, «Archeologia e Calcolatori», 12, 307-321.

Szilagyi J.G. 1982, *An Etruscan late-Orientalizing amphora*, «Studi Etruschi», 50, 3-22.

ABSTRACT

The Authors present a detailed description of the project of virtual reunification and recontextualisation of the grave goods found in a tomb of the Sabine necropolis of Colle del Forno, which held a princely burial: archaeological research, technical analyses, restoration, 3D reconstruction of the cart found inside the tomb and of its bronze decoration, and virtual reconstitution of the grave goods – constituted both by local products and objects imported from the Orient, as well as by two wheeled vehicles: a cart and a chariot) – in the framework of their original archaeological and cultural context. Besides a DVD, which shows a video at the Ny Carlsberg Glyptotek in the room containing the exhibition of the cart and other objects from the tomb, a web site has been created (http://www.principisabini.it/): the web visitors can reconstruct the history of the discovery, walk through this 7th-6th century BC tomb, see the structural and functional mechanisms of the cart in action, and enjoy this Italic masterpiece.