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Mario Parise
Carla Galeazzi, Roberto Bixio, Carlo Germani

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ARTIFICIAL CAVITIES WITHIN THE HILL OF PRIMA PORTA (ROME, ITALY)

Davide Ivan Pellandra
Freelance archaeologist; Contrada Omerelli, 45, Republic of San Marino (RSM); dpellandra@gmail.com
A.S.S.O. - Archeologia, Subacquea, Speleologia e Organizzazione (www.assonet.it)

Abstract
The hill of Prima Porta, located in the northern Roman hinterland, overlooks the village of Prima Porta and the Giustiniana road, which in this section follows the route of the ancient *Via Flaminia*, about 200 meters W of the archaeological site of Villa of Livia. On it still raises the homonymous tower, around which were made some archaeological excavations, the last of which was under the scientific conduction of the author. Recent investigations have allowed to identify and inspect a complex system of tunnels, which in some cases formed part of an articulated system of storage and distribution of water, consisting of tanks, wells, tunnels. The underground structures are interesting not only for the internal organisation but also for the different utilisation stages that span a wide time period: in fact, scientific data have confirmed that the first use dated back to the archaic period and continued until the imperial one. Equally interesting the research hints offered in relation to the techniques used for the implementation of these underground systems, in some cases dug into the tuff and in others constructed with blocks. The materials used, coming either from neighbouring quarries or from adjacent existing building structures, offer further ideas for research and analysis.
Keywords: artificial cavities, cisterns, hydraulic works, Prima Porta, Rome.

Riassunto
La collina di Prima Porta, situata nel settore N dell'hinterland romano, domina il borgo di Prima Porta e la via Giustiniana, che in questo tratto segue il tracciato dell'antica via Flaminia, circa 200 metri a W del complesso archeologico della villa di Livia. Su di essa si eleva ancora l'omonima torre, attorno alla quale sono state realizzate alcune campagne di scavo archeologico, l'ultima delle quali è stata effettuata sotto la conduzione scientifica dell'autore. Le recenti indagini hanno permesso di individuare e ispezionare un complesso sistema di gallerie, che in alcuni casi facevano parte di un articolato impianto di conservazione e distribuzione idrica, costituito da cisterne, pozzi, cunicoli. Le strutture sotterranee risultano interessanti non solo per l'articolazione interna ma anche per le differenti fasi di vita che abbracciano un ampio arco cronologico: infatti i dati scientifici hanno confermato che le prime frequentazioni iniziano dall'età arcaica per proseguire sino a quella imperiale. Altrettanto stimolanti gli spunti di ricerca relativi alle tecniche di realizzazione di questi sistemi sotterranei, in alcuni casi scavati nel tufo e in altri costruiti in blocchi. Proprio i materiali utilizzati, provenienti sia da cave limitrofe ma anche da costruzioni preesistenti offrono ulteriori spunti di ricerca e di analisi.
Parole chiave: *cavità artificiali, cisterne, opere idrauliche, Prima Porta, Roma.*

The hill of Prima Porta, in the town hall of the municipality XV of Rome, is located on the 13th mile of *Via Flaminia*, at the junction between *Via Giustiniana* and *Via della Villa di Livia*, few tens of meters SW of Villa di Livia, near the Tiber River.
The hill emerges, with its 50 meters a.s.l., from the village of Prima Porta, now suburb on the northern outskirts of Rome; it has the church of San Lorenzo to SE, built in the XII century (dedicated in the XVII century also to Sant'Urbano), while on the S and SW it is bordered by an industrial complex for processing and ripening of the cheese; on the other sides it is contained by *Via della Giustiniana* and some houses and shops.
From the geological point of view in that area only croplands of pyroclastic origin crop out, produced by explosive volcanic activity of the mountains Sabatini (Funiciello-Giordano, 2008); they consist of lithoid and inconsistent tuffs, sometimes made of *lapilli* and ash, interspersed with thin layers of slags and fragments of lava, *tuffiti* and thin lenses of alluvial deposits. These soils are locally altered resulting in the formation of clay materials. Thus, to the depths of our interest (between -0.50 and -10 m from the ground surface), we find compact tufa and clays, with interbedded pumice material and lenses of alluvial material consisting of coarse sands.
On the hilltop stands a tower, known as Tower of Prima Porta or Torre d'Orlando (Tomassetti, 1913), already represented on the map of Eufrosino of Volpaia (Ashby, 1914) and in the design of the Catasto Alessandrino (Ashby, 1914); the tower is also clearly visible in the depiction of Cacchiatelli and Cleter (1860-1869), which represents the discovery and excavation of the famous statue of Augustus from the nearby villa of Livia (Fig. 1).
Around the tower, and across the top of the hill, thanks to some archaeological investigations carried out after a series of illegal work (Loretti, 1983), a series of structures, only partially investigated (AA. VV., 1985; Calci-Messineo, 1986, 1987, 1989-90, 1991-92; Messineo, 1987, 1991, 1996), emerged in the early 80s of last century: tanks, wells and tunnels. The excavation was taken up in a systematic way only at the end of 2012, under the leadership of the writer, under the scientific direction of the Superintendence for Archaeological Heritage of Rome, in the person of Dr. Marina Piranomonte and Mr. Andrea Venier.
The excavation of the ancient structures of the

Fig. 1: the Tower of Prima Porta in the famous picture during the excavation of the statue of Augustus.
Fig. 1: la Torre di Prima Porta nello sfondo della famosa immagine dello scavo della statua di Augusto.

Fig. 2: the tower view from the east with the entrance and the staircase added in the second phase.
Fig. 2: la torre vista da est con l'ingresso e le scale aggiunte in seconda fase.

hill would have to be part of a larger project for the regeneration of the hill, overgrown by brambles and creepers, and restoration of the tower, occupied by homeless and subject to vandalism, hoping to make the hill and the tower a pole of cultural attraction for the whole township. This ambitious project was carried out thanks to the generosity of the owners, family Brunelli, for about two years, but is currently interrupted due to lack of funds.

The ancient structures

As mentioned, there are many ancient structures related to the attendance in the past: the most recent building is a tower, mentioned for the first time in a document from 1368 and then in 1513 (Tomassetti, 1913; Calci-Messineo, 1984), of which the first two floors still remain, while the third is partially in ruins. The tower features a side full of materials for reuse, such as tufa blocks, but also fragments of travertine tiles and bricks; very interesting is the presence of parts of the mosaic flooring and earthenware from the Roman period (Fig. 2).

The technical and architectural design analysis of the facility allowed to identify at least two main building phases: the tower was originally designed with a quadrangular shape (6.4 m outside the perimeter, 5.50 m around the inner), to which was added a stem input on the SE side and a step for external access to the upper floors on the NE side, making it more monumental, with a main archly entrance. It is very likely that it was built as a lookout tower, as a defense of the Tiber River and the underlying *Via Flaminia*. It is not clear when it assumed the function of tower "colombaria", function that surely it fulfilled, given the presence of a frame of bricks, typical of this category of towers, at the base of the third floor, and especially the existence of a series of niches within the same floor (likely after the XVIII century). In the 1960-80s it became the residence of two families, whose members worked in the dairy factory below.

Long before the construction of the tower, the hill had aroused interest, and the materials recovered from archaeological excavations show that the site was utilised from the VII century BC (we noted a deposit of ceramic materials of *Veienten* production, a bronze *situla*, a fragment of *loutrophoros* type *apulo;* Messineo, 1987). Most of the materials related to the archaic period come from underground deposits, real *favissae*.

The main structure was built on the summit of the hill, with construction technique in blocks of tufa, probably extracted gouge at the foot of the same hill. Only a few rows of some rooms have resisted to time and abandonment (Fig. 3), in some cases with the remains of the wall covering; some pieces of flooring, in *cocciopesto*, in *scutulatum* (Fig. 4) and in black and white mosaic, are also preserved. It is an extended structure partially obliterated from the tower and much eroded by weathering and modern human activities, whose entire layout is difficult to reconstruct. The current state of research shows a diagram with symmetrical rooms respect to a central corridor.

Belonging to a more recent archaeological phase, as can be deduced from the different building techniques and the archaeological materials associated (as a series of lamps from the III and IV centuries AD), is a long

Fig. 3: one of the main areas in tufa blocks.
Fig. 3: uno degli ambienti principali realizzato in blocchi di tufo.

Fig. 4: scutulatum.
Fig. 4: pavimento in scutulatum.

wall of substructure in uncertain work, oriented NE-SW; this, supporting a vaulted corridor, plastered, lower than 2 m and wide 2,80 m, belonged to a system of *criptoportici* that occupied the E slope of the hill allowing access to its top through a covered walkway (also a 90 cm-wide niche has been detected, realized directly from the tuff, in bad status of preservation, that was likely to host a decorative statue sculpture; Fig. 5).

The underground cavities

The entire hill of Prima Porta is populated by wells, tunnels, caves, underground passages, made in ancient ages, but also more recently. The already mentioned document of 1518, describes the sale of a cave, "*seu pozolanae* " that Messineo (1984) would locate at the foot of the hill, on its E side, near the so-called Arco di Prima Porta, identifying it with an *antrum* that can be seen in a design of 1891 by C. Nispi Landi (see Calci, Messineo, 1984), and in a photo by Parker (see Tomassetti, 1976). Moreover, it does not seem casual the construction at the base of the hill of the ripening plant of *pecorino romano cheese*, whose seasoning initially took place in the pre-existing caves (a photo of the 1960s shows two large caves on the S side of the hill), that later were re-organised as communicating

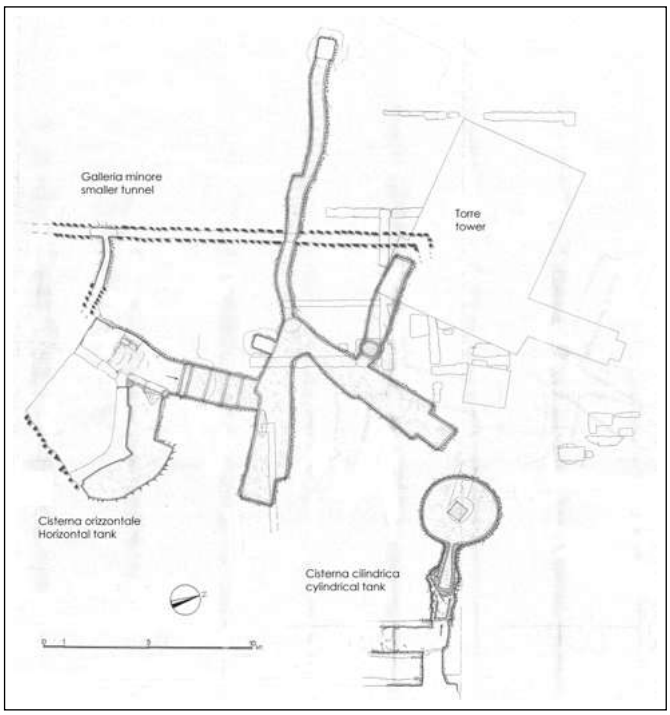

Fig. 6: schematic plan of the tanks and the smaller tunnel (drawing Davide Ivan Pellandra by graphic documentation of the study Sabatini).
Fig. 6: pianta schematica delle cisterne e del tunnel minore (elaborazione Davide Ivan Pellandra da documentazione grafica Studio Sabatini).

tunnels (it is possible that, given the width and regular shape of some areas, over the years even new ones were excavated).
It has to be reminded that during the Second World War some of these tunnels have been used as air-raid shelter all cavities were inspected and documented in collaboration with A.S.S.O. technicials (www.assonet.it).

Tanks

On the SW side of the hill a complex system of horizontal tanks opens up: those are tunnels and rooms dug in the tufa or pozzolana, completely covered with *cocciopesto*, during various phases of construction (Figs. 6 and 7). The main room 'A', of irregular base

Fig. 5: wall substructure in opera incerta.
Fig. 5: muro di sostruzione in opera incerta.

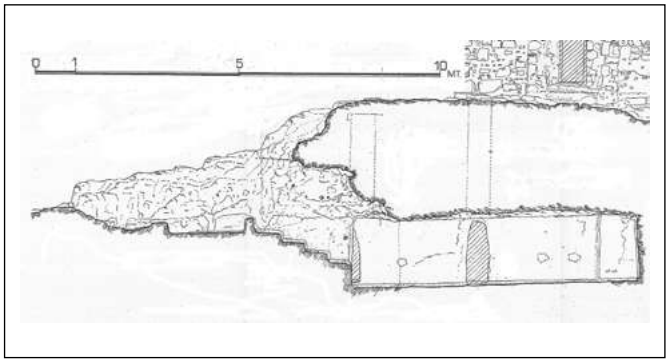

Fig. 7: north-south section of the greater tank (drawing Davide Ivan Pellandra by graphic documentation of the study Sabatini).
Fig. 7: sezione nord-sud della cisterna maggiore (elaborazione Davide Ivan Pellandra da documentazione grafica Studio Sabatini).

Fig. 8: edging of separation by cocciopesto.
Fig. 8: cordolo di separazione in cocciopesto.

Fig. 9: larger tank, south wall with remains of pillars.
Fig. 9: cisterna maggiore, muro sud con pilastri risparmiati.

(7x5 m approximately), partially excavated in the rock, has a perimeter wall on its W side made of tuff blocks, covered with *cocciopesto*. The tuff vault was supported by columns built off the tuff bank, with quadrangular and circular bases (three of the remaining are rectangular, two with elevation and one only the imprint, in addition to three circular, with a diameter of 110 cm, on one of these two rectangular blocks were placed); the tuff level is everywhere coated of waterproofing *cocciopesto* (Fig. 8).
Probably, due to the above vault falling, in a second stage this room was reduced to a little more than half of its original size, by using tuff blocks taken from the housing complex of the top of the hill.
The N side of the environment A, raised compared to the rest of the room in a second phase, leads to a short staircase, preceded by a high curb laterally provided with the housing for a lock which could regulate the flow of water (Fig. 9).
There are four broad steps (90 cm wide and 30 cm high, the last one being 90 cm high), covered with *cocciopesto*, lead to a second room, B, placed about 2 m below, 9 m long and 1.8 m high (Figs. 7, 8 and 10).
In the E corner a first well of adduction, rectangular (90x60 cm), is present (well F), whilst not far a tunnel, about 14 meters long, 60 cm wide in average, which winds not perfectly straight towards the NNE, shows another well (E) at its entrance; it ends in a second well of adduction, little wider than the previous one, provided with decanting tank. This tunnel is crossed, at an altitude of approximately 1 m above the surface, by a perpendicular tunnel, belonging to another archaeological phase (see later). The environment B leads towards the NNE to a third room, C, which is also long and narrow (about 10x1.80 m), directed towards the centre of the hill. At about half of the W side another tunnel opens perpendicularly, 5.5 m long with an average width of 90 cm, with a third adduction well, round, with a diameter of 90 cm, and a decanting tank. All galleries and halls are lined with *cocciopesto* on the floor, the walls and the ceilings; the latter are lowered in the main rooms and ogive in tunnels. In addition, the corners are everywhere bordered by curbs earthenware.

On the E side of the hill a large cistern opens, or better a well-tank, which has a completely different system of maintenance of rainwater: it is a large cylindrical tank, with the oval bottom (diameters from 3.60 to 3.20 m), 3 m high, dug in the tuff and covered with *cocciopesto* (Fig. 11). It has in the centre a quadrangular decantation bowl (60x60 cm), in correspondence of a well of adduction; also a narrow corridor opens to the SW, 2.10 m long and 90 cm wide; on its vertical line a second well opens, which reaches down to the bottom, covered with earthenware and comes with footholds (this element can lead us to assume that this was a well maintenance). This tank is served from a third well, through a secondary tunnel, 5 m long, probably a later stage that comes from the NE.

Wells

The hill of Prima Porta helped to identify many wells, ancient and modern, some connected with the tanks, others that reach to the aquifer, and therefore very deep (Fig. 12). In this section a short description of the wells is provided.
Well A: it is one of the wells of the cylindrical tank, probably used also to access it and make maintenance. It has a diameter of 90 cm, and a depth of 8.50 m; it presents pairs of footholds, and is still partially coated with *cocciopesto*.
Well B: it is one of the water wells supplying the cylindrical tank, with a diameter of 120 cm, depth of some 11 m, with adduction bowl of decantation at the bottom. The waterproof coating is present only in the last 3 meters, inside the cylindrical tank.
Well C: it is the third of the wells in communication with the cylindrical tank, through a tunnel, 5 m long and 120 cm high, which runs 4 m below the current decking. Currently the well reaches the bathrooms and locker rooms of the industrial complex below.
Well D: it is one of the wells of water supply to the bigger tank with bowl of decantation; it is covered and padded already in ancient period.
Well E: it is another of the wells that serve the larger tank with a diameter of 90 cm.
Well F: it is another of the wells in the biggest cistern, rectangular (90x60 cm), 6 m deep, covered with

Fig. 10: tank, entrance to the room B (photo Marco Vitelli, ASSO).
Fig. 10: cisterna, ingresso nell'ambiente B (foto Marco Vitelli, ASSO).

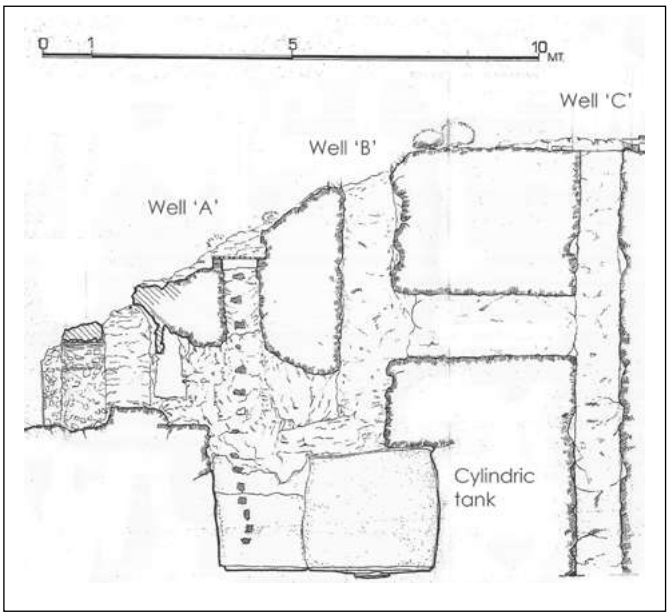

Fig. 11: north-south section of the cylindrical tank (drawing Davide Ivan Pellandra by graphic documentation of the study Sabatini).
Fig. 11: sezione nord-sud della cisterna cilindrica (elaborazione Davide Ivan Pellandra da documentazione grafica Studio Sabatini).

cocciopesto and with a bowl of decantation.
Well G: it has a rectangular shape (90x80 cm), placed on the W front of the hill, and is one of the wells of adduction of the biggest cistern, with a decantation bowl.
Well H: it has a rectangular shape (120x60 cm), placed on the NW corner of room C, probably decommissioned in ancient.
Well I: it has a diameter of about 1 m, placed on top of the hill, on its NW side, and is deep 30 m; it goes down to the aquifer, entirely excavated in the tuff. At the moment of inspection it was closed with a big tufa block (Fig. 13).
Well L: it is a modern ventilation shaft that opens on the NW side of the top of the hill, with diameter of 60 cm, that cuts the E boundary of the wall made of tufa blocks, pertaining to the most ancient phases of settlement on the hill.
Well M: with a diameter of 90 cm, it faces on the N side of the hill, near the top and is deep 8 m; partially excavated in the '80, it has been totally emptied during recent researches.
Well N: on the N side of the hill, with a diameter of 110 cm, it partially intercepts the gallery A.
Wells O, P and Q: they are 3 ventilation and maintenance wells of the main tunnel, rectangular in shape (60x150 cm on the first and third, the central 90x60) with footholds.
Wells R, S, T: they are three wells in the S side of the hill, related to the smaller gallery: the first is 60 cm wide, 90 long, with bottom slope towards the E; the second, with the same dimensions, is 2.30 m deep, until the share of the extrados of the tunnel below; finally the third, 60 wide and 150 cm long is deep 2,50 m, also in this case up to the extrados of the tunnel.

Galleries

Recent archaeological investigations have allowed to empty and shed light on a long tunnel (Fig. 12, 14 and 15), which, starting from the top of the hill runs at about 3 m depth in NE direction; the tunnel, has been emptied for about 80 m, and is 90 cm wide. It is fully excavated in the tuff, which appears, in many places, inconsistent. The tunnel presents a slightly ogival vault, with an average height between 180 and 170 cm. Three wells have been identified and dug for maintenance and ventilation, of rectangular shape, served by footholds. While the SW end has not yet been fully excavated, arriving at the foot of the medieval tower, which is within the Roman structure in blocks of tuff, the NE is a dead end, probably due to the interruption of the works. The floor is not paved or covered with *cocciopesto*, like the walls, which still show signs of the digging of axes and hammers (interesting is the area of intersection of two teams working with opposite inclination of the cut tuff and with different heights of the vault). At the moment, as the emptying activity has not been completed, it is not clear its function, perhaps as service passage or a secret tunnel, which was supposed to bring down the hill, onto the *Via Flaminia*, or even go back over to the *Villa of Livia*. The tunnel was almost completely filled with earth, rich in archaeological material in the far SW side, near the ancient structures: those are mainly materials related to the end of the IV and early III century BC, like Black Glaze pottery (especially open forms) and *genucilia*; it is interesting the presence of many clay loom weights, whole or fragmented. In contrast, the filling of the downstream end was mostly made with barren land, and clay with tuff fragments collapsed from the vault.
During the last campaign of archaeological excavations on the hill of Prima Porta, it was partially brought to light a second tunnel, entirely excavated in the tuff (Figs. 6 and 16). Starting from the W end, the tunnel,

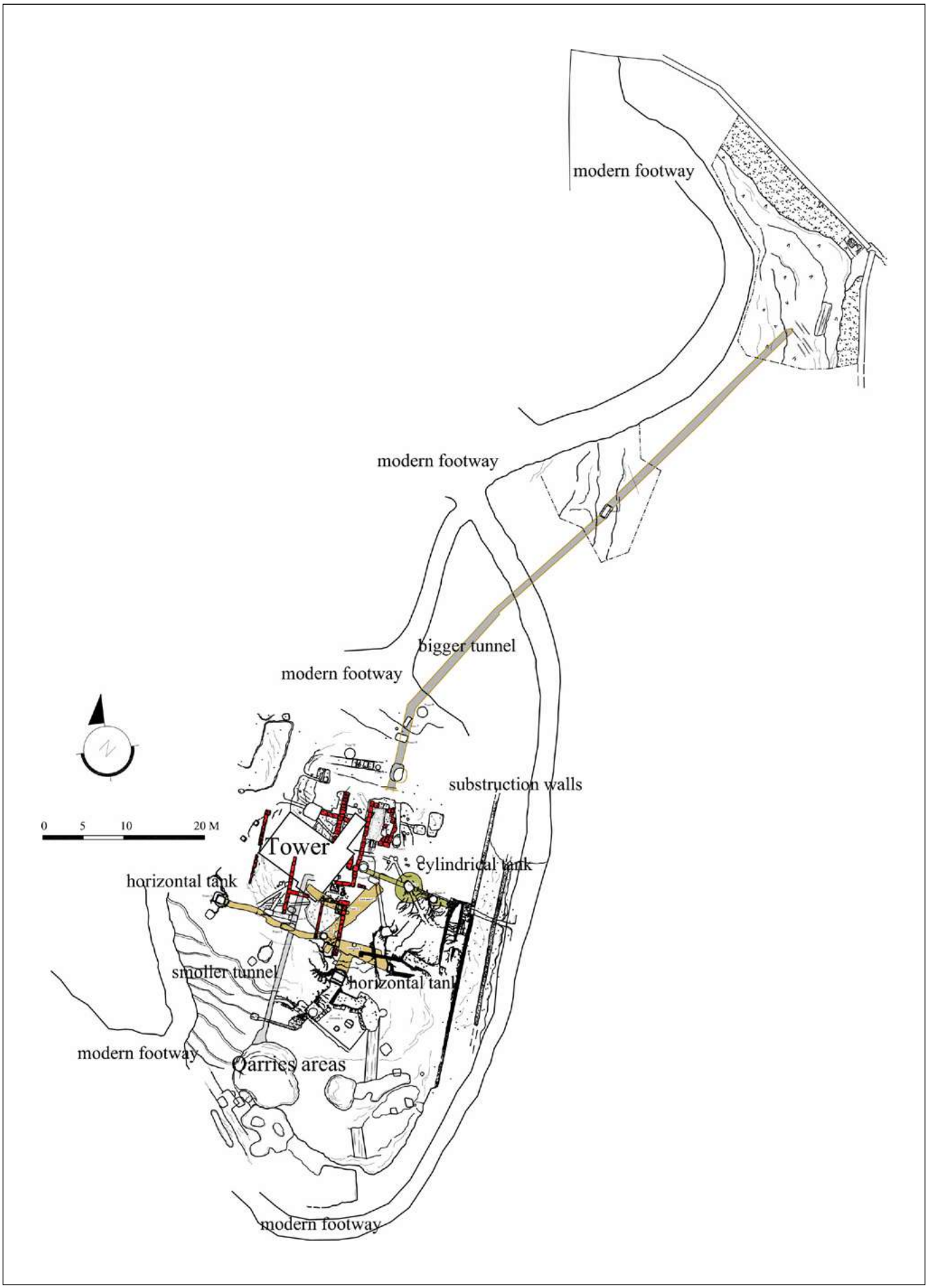

Fig. 12: archaeological remains in Prima Porta hill (drawing Davide Ivan Pellandra).
Fig. 12: resti archeologici sulla collina di Prima Porta (restituzione grafica Davide Ivan Pellandra).

Fig. 13: well I during the inspection (photo Stefano Barbaresi, ASSO).
Fig. 13: pozzo I durante l'ispezione (foto Stefano Barbaresi, ASSO).

21 m long, wide 60 cm, and high 180 cm, intersects the horizontal W gallery of the big tank, and continues in a N direction up to the tower, where it turns sharply to 90 degrees to the E. This gallery, in the present state of research, is more ancient than the big tank, but since it was not fully excavated, it is not yet clear about its function. It is currently pierced by three wells, but, at the present state of research, it is unclear whether they are coeval with each other (wells R, S, T).

Quarries and warehouses

The archaeological survey has also allowed us to identify, on the SW ridge of the hill, a few meters below the big horizontal tank, an area of the quarry. In particular, a large pit was excavated, with a diameter of about 7 m, flanked by a smaller one, about 3.5 m in diameter. Both were filled with debris materials, large blocks of tuff deriving from the collapse of the buildings above (the chronological data of the abandonment deriving from ceramic materials are being studied). Since there are no signs of blocks, it is possible that the two large holes were initially of the pozzolana quarries, then used as warehouses.

Just below the main hole a quarry of lapilli has been dug, with irregular plan (6x5 m), entirely underground at the time of discovery, with the vaults supported by pillars spared from the excavation (180 cm high). For safety reasons, the excavation had to take down the vault, as it is easily understandable by photographic documentation (Fig. 17).

A few meters to the W an open tuff quarry is visible, where the shapes of the blocks extracted remain evident.

Another big area dug under the floor of tuff has been highlighted on the W side of the hill, mainly rectangular in plan (9,40 x 3,80 m); it does not have waterproof coatings, and could be interpreted as a warehouse for dry materials or animal enclosure.

To conclude the descripion of the main cavities of the hill of Prima Porta we must remember a cylindrical hole, located on the N side of the top of the hill; it may be interpreted as a *favissa*, that is the storage place of votive objects near a shrine, or as a warehouse, of oval plan (150x180 cm) terminating in a bell shape, which partially intercepts the bigger tunnel, of a depth of 6 m. Also in this case the filling materials, still being examined, tend to indicate interrupted works in the middle Republican era and perhaps used from the Archaic age.

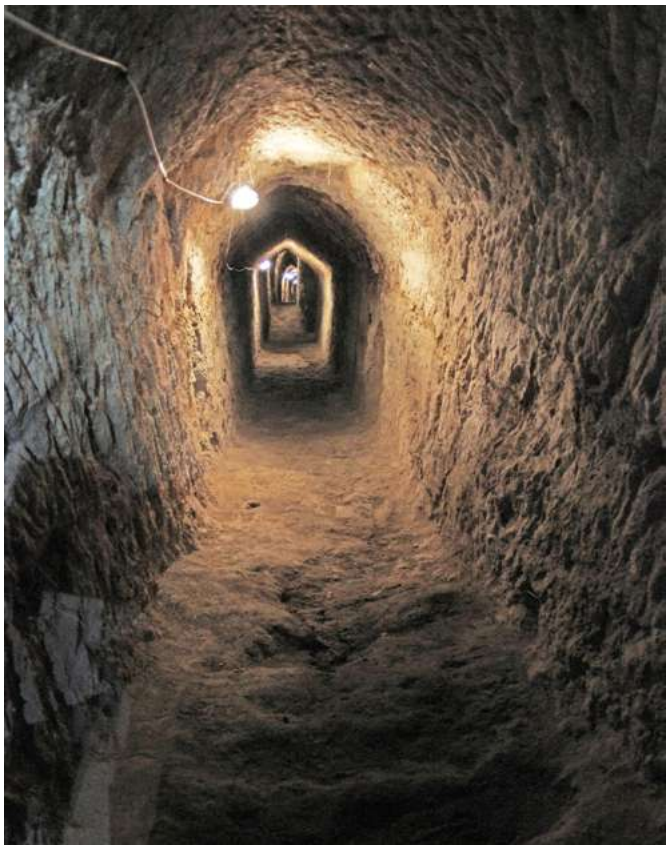

Fig. 14: tunnel A.
Fig. 14: galleria A.

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Fig. 15: tunnel A's inspection (photo Stefano Barbaresi, ASSO).
Fig. 15: l'ispezione della galleria A (foto Stefano Barbaresi, ASSO).

Fig. 16: south end of the smaller tunnel.
Fig. 16: estremità sud della galleria minore.

Fig. 17: quarry of lapilli.
Fig. 17: cava di lapillo.

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