Hypogea2023

Proceedings of IV International Congress of Speleology in Artificial Cavities
Italy, Genoa, September 29th / October 1st

EDITORS

Stefano Saj, Carla Galeazzi

Michele Betti, Francesco Faccini, Paolo Madonia

Union Internationale de Spéléologie

Società Speleologica Italiana ETS

Regione Liguria

Comune di Genova

Università di Genova

UNESCO Chair

Istituto Nazionale di Geofisica e Vulcanologia

Istituto di Ricerca per la Protezione Idrogeologica

Ordine degli Architetti Pianificatori Paesaggisti e Conservatori Genova

Ordine Ingegneri Genova

Ordine Regionale dei Geologi della Liguria

Federazione delle associazioni dell'Antico Acquedotto Storico Genova

Opera Ipogea

Opera Ipogea
Journal of Speleology in Artificial Cavities

Organized by

© CENTRO STUDI SOTTERRANEI
PER LA RICERCA E VALORIZZAZIONE DELL'AMBIENTE IPOGEO NATURALE ED ARTIFICIALE

PROCEEDINGS OF IV INTERNATIONAL CONGRESS OF SPELEOLOGY IN ARTIFICIAL CAVITIES

HYPOGEA2023

SEPTEMBER 29th / OCTOBER 1st
GENOA, ITALY

PALAZZO DUCALE, SALA MINOR CONSIGLIO
Piazza Matteotti 9, Genova

GENOVA ypogea 2023

Proceedings of IV International Congress of Speleology in Artificial Cavities

HYPOGEA2023

PALAZZO DUCALE, SALA MINOR CONSIGLIO
Piazza Matteotti 9, Genova

Edited by
CENTRO STUDI SOTTERRANEI

Supplement to issue 1-2 / 2023
Opera Ipogea - *Journal of Speleology in Artificial Cavities*
Memorie della Commissione Nazionale Cavità Artificiali
www.operaipogea.it
Semestrale della Società Speleologica Italiana ETS
Autorizzazione del Tribunale di Bologna n. 7702 dell'11 Ottobre 2006

Composition and layout
Luca Paternoster, Stefano Saj

Graphic project
Carla Galeazzi, Stefano Saj

Cover photo
Martina Gogioso

Back cover photos
Ivan Greco, Fernando Naldoni, Danilo Repetto,
Stefano Saj, Luca Torti, Mauro Traverso

Typography
Corigraf Srl – Viserba, Rimini, Italy

With the financial support of
Società Speleologica Italiana ETS

€ 200,00

ISBN 978-88-32241-32-7

CONTENTS

ANCIENT UNDERGROUND HYDRAULIC WORKS

ROCK-CUT SETTLEMENT WORKS

UNDERGROUND RELIGIOUS AND CULT STRUCTURES

The water storage system of Marcigliana (Rome, Italy): an unusual representative of a Roman cistern

Andreas Schatzmann[1,], Mara Abbate[1], Andrea Peresso[1]*

Abstract

The aim of this contribution is to present a multi-part hydraulic system located in the *Parco della Marcigliana*, a still completely undeveloped agricultural zone east of Rome. Among the elements of this hydraulic system is a still active water conduit lying under a plateau, the course of which is evident in the landscape from well shafts lined up at regular intervals. Where the plateau drops off steeply towards one of the side valleys, this conduit was intercepted from a lower level, thus diverting the water into a system of galleries lined with hydraulic cement (*opus signinum*) up to a considerable height. Structural features indicate these plastered galleries as a typical example of a cistern consisting of a network of impermeable galleries, a typical pattern of the 1st century BC in the Roman countryside. As a rule, such systems were fed by rainwater. In contrast, this is a rare case in which the cistern takes its water supply by secondary docking to an already existing water conduit, which in turn means that the latter remains profoundly impaired in its original function. In our contribution we will discuss different functional hypotheses and contextualization of the hydraulic system using a diachronic perspective.

Keywords: water conduits, irrigation, water storage systems, cisterns, villae rusticae, defunctionalization of preceding structures.

Introduction

Southern Etruria, as well as the hilly countryside around Rome, is an 'eldorado' for cuniculus researchers. It is not surprising that, already during the 60's, a systematic study was completed under the aegis of the British School at Rome, focused on the typologies and presumed functions of these water conduits. A distinction was made between channels leading a stream underground, parallel to the valley axis, and those diverting a stream from one valley to another (Judson & Kahane, 1963: 84). In a nutshell, one can say as a rule that a certain area was drained while another was irrigated, which means that the most frequent purpose was to create new agricultural land.

A series of wells has been recognized, already at the beginning of the 1900s, on the plateau of the Casaletti farm house, at the outskirts northeast of Rome and within today's *Parco della Marcigliana* (Ashby, 1906: 50) as a typical indicator of an underground water course (Quilici & Quilici Gigli, 1993: 109-110; site 22). These wells were visible also on aerial photographs (fig. 1; see on these photos Quilici & Quilici Gigli, 1993: 110, nota 32). Furthermore, at a lower level, at the edge of a side valley (41°59'33.9"N/12°34'39.6"E), the outlet of a tunnel can be seen, with an active water flow feeding a cattle trough by means of a metal pipe (fig. 2). The terminal part of this system was the object of a quick survey, in the context of a thesis in 2000, when an approximate plan was drawn (Dell'Era, 2000: 257-258). The dry areas, filled by soil, had not been accessed at that time, nor had the entire inner part of the system been analysed, with the consequence that the most revealing details of the structure had remained unobserved, and the structure as a whole had been erroneously regarded as a water draining system dating at Roman times.

Fig. 1 – Aerial photograph of the area (1943): the chain of wells is clearly recognizable (from Quilici & Quilici Gigli, 1980: tav. LXXXIX).

This hypothesis seemed confirmed, at a first sight, by the significant water flow encountered in 2011, when we began to inspect the corridors.

[1] Associazione Roma Sotterranea, Viale dell'Esperanto 71, 00144 Roma, Italy

* Reference author: andreas.schatzmann72@gmail.com

Fig. 2 – Site entrance and location on the *Istituto Geografico Militare* (IGM) map.

A new functional explanation

As it is shown below, this explanation is too simple. The case, like many others, underlines the importance of a complete inspection of the entire structure, using speleological techniques, for a correct functional determination.

Corridor B (see plan in fig. 3) starts more or less at a right angle from the refurbished entrance (corridor A). It is completely dry and filled by soil, especially in its central part; it is necessary to crawl directly under the vault to reach its end. Despite being detached in various parts, the omnipresence of *cocciopesto* (hydraulic cement) strikes the eye in this zone. It covers not only the side walls, up to the start of the vault, but also part of the vault itself, which means that the water must have reached a considerable height here. Corridor B ends with a reasonably well-preserved plastered wall, on the sides of which two vertical quarter rounds reaching up the arch are clearly visible (fig. 4).

About halfway along corridor B, a short passage C opens up on the left, probably connecting to a further corridor, parallel to B, but impossible to explore due to the fill which almost reaches the vault. However, at the end of the branch, a widening is visible, with a wall at the end, which could indicate the presence of an intersection with a new branch.

The *cocciopesto*, together with the quarter rounds and with the apparently net-like structure of the branches, showing a dead end in corridor B, leads to the inevitable conclusion that the interpretation of a water catchment system cannot be correct[1]. Instead, these elements suggest the interpretation of the structure as a particular type of water reservoir, with several intersecting passages. Indeed, this type of cistern is very frequent in the countryside around Rome (cf. below). It is designed for distributing the wall pressure, caused by the accumulated water over several arms. The construction of vaulted cisterns with large chambers became possible only later, when the development of technology led to an improved stability of huge vaults in the I century AD.

Turning back to the intersection of branches A and B, and going further ahead in the direction where the water comes from, we have to pass under a small road (*via di Tor San Giovanni*). In this section, on the original plastered corridor, a vaulted brick cladding was applied, which is very reminiscent of some hydraulic conduits built in Latium, in the realm of reclaim works

[1] Dell'Era, 2000: 258 had assumed that the waters coming from two different sources would meet shortly before the outlet.

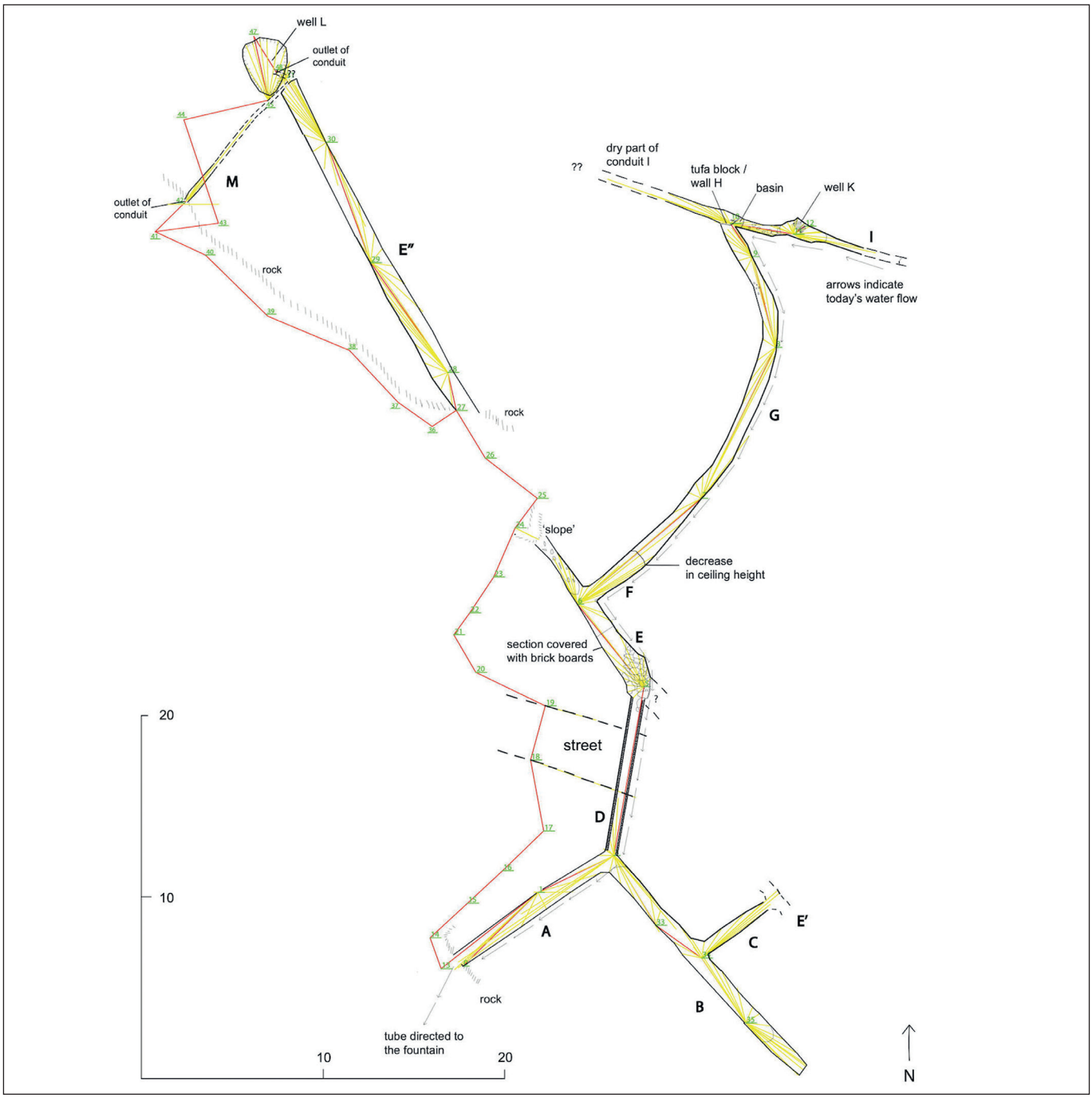

Fig. 3 – General plan of the structure (M. Abbate, A. Schatzmann; graphic restitution A. Schatzmann).

of the first decades of the 1900s. The reinforcement of the corridor is directly related to the road running above it, which means that, whenever it was decided to enhance the stability of the water conduit, it was considered important not to interrupt it.

After crossing the reinforced section, at the beginning of branch E, signs of a major collapse are visible almost in the entire stretch (fig. 5). In addition to the presence of large stones, the course is rather irregular, part of the ceiling is replaced with large brick boards, and another consolidation in form of an arched vault can be seen. However the most evident sign of a collapse is an irregular wall, erected with stone blocks that, at the arrival point of the reinforced corridor D, closes corridor E towards east. In other words, corridor E almost certainly once continued in this direction (marked as E' and with dashed lines in the plan). If this assumption proved to be correct, E' would come to join corridor C, therefore the open space mentioned above, visible from corridor B, could actually be nothing else than the point of intersection with E'.

Only a few meters to the north-west, another intersection is encountered, after which the ceiling of corridor E has collapsed, leading to daylight over a cone of rubble. Continuing outside in the same direction, after a few meters there is another section of the corridor (about 30 m long), with exactly the same direction (E"), which without any doubt represents the continuation of E.

Fig. 4 – The vertical quarter rounds at the end of corridor B (photo A. Schatzmann).

Fig. 5 – The collapsed part of corridor E with the refurbished ceiling (photo A. Schatzmann).

This "detached branch" is plastered with the same type of *cocciopesto*, covered in some places by considerable calcite deposits (fig. 6). It is heavily filled by soil, whose thickness increases towards the end of the branch. Here, through a tiny opening, a small water conduit (M) is visible, running at a lower level and leading out of the tuffaceous ridge. There is a further shaft (L), too, with which it seems to be indirectly connected.

The deeper parts of the system

At the last intersection of corridor E, in the main part of the system, another corridor branches off at a right angle, characterized by a first straight section of about 3 meters (F), followed by a curvilinear course (marked with the letter G). While the original height can no longer be determined, due to the filling, the transition between the two sections is marked by a striking step in the ceiling height. Because of the low ceiling and the presence of water, section G is difficult to cross. The presence of well-preserved hydraulic *cocciopesto* suggests that the entire corridor G was still a part of the cistern up to its end.

It is surprising to see that corridor G, at its end, seems to be walled up, intersecting a water conduit, indicated with I on the plan (fig. 3), whose floor is presently about 1.20 m higher than the current level of G. Originally, the height difference was probably more than 2 m, but this is impossible to establish due to the filling in corridor G.

At a closer sight, it appears that the rock on which conduit I was running was undermined in an obviously purposeful act, creating a small and irregularly shaped basin in the middle of its former course. Its back wall was certainly cut at an oblique angle, to prevent the water from hitting the baffle with full force, and thereby releasing erosive energy. The effect of this, however, is that all the water arriving from the conduit falls down into the basin, and is diverted towards the cistern. The bottom of the basin has been deeply dug over time by the erosion of the falling water.

Another effect of this drastic measure was that the original continuation of conduit I became a dry branch. As to block even more definitely the original water course towards west, a brick wall (referred to as H in the plan), reinforced with *opus caementicium* and plastered with *cocciopesto* (fig. 7), was raised on the part not cut out, and on the original floor level of the water conduit, further increasing the capacity of the cistern. The wall H, together with the back wall of the basin under the original course of the conduit, is therefore to be considered the limiting element of the cistern. As a confirmation of this, there are further vertical quarter rounds in two of the corners created through this water diversion system: one on the southwest side between wall H and the west wall of corridor G (the opening, visible today between this corner and the plastered wall of the cistern, is probably caused by subsequent erosion), and the second one on the inner edge of the basin (fig. 8). It seems that, in a second moment, the effectiveness of the block was affected when

Fig. 6 – The detached branch E'', and detail of its plastered wall, with lime deposit above it and digging traces below the plaster (photo A. Schatzmann).

Fig. 7 – Intersection between conduit I and corridor G (from where the photograph is taken). The vertical quarter round is well visible in the left angle of wall H (photo A. Schatzmann).

a small channel was dug on its surface. It may have served as an overflow, probably in order to prevent water from stagnating in the conduit I when the cistern was completely full. In that case the continuation of I towards west would have at least partly entered into function as a water conduit.

While the dry branch is heavily filled by soil, it is possible to enter in the adductor for a few meters in the direction of the flow origin. From the basin one has to climb onto its floor, on which there are numerous blocks of stone, but also modern rubbish and glass remains, fallen in the well K and then carried by the water towards the cistern (some material is still encountered in the curved corridor G).

After little more than two meters, a rectangular well K (60 x 85cm) opens up. The well, washed out in the lower part, is 10.4 m high and closed on the surface with modern hollow blocks. Under its opening there is the usual accumulation cone, which creates a sort of dam for the water coming from the east.

This well is in perfect line with the chain of inspection shafts mentioned above, around which large craters have formed over time (fig. 1), even though no structures in exact correspondence with well K are visible on the surface.

Continuing eastward from beneath well K, the progression in the conduit I becomes soon impossible, due to a layer of very dense mud about 80 cm thick. In any case, the tunnel is completely sealed off after 10 m, probably in correspondence with the filling of the next shaft.

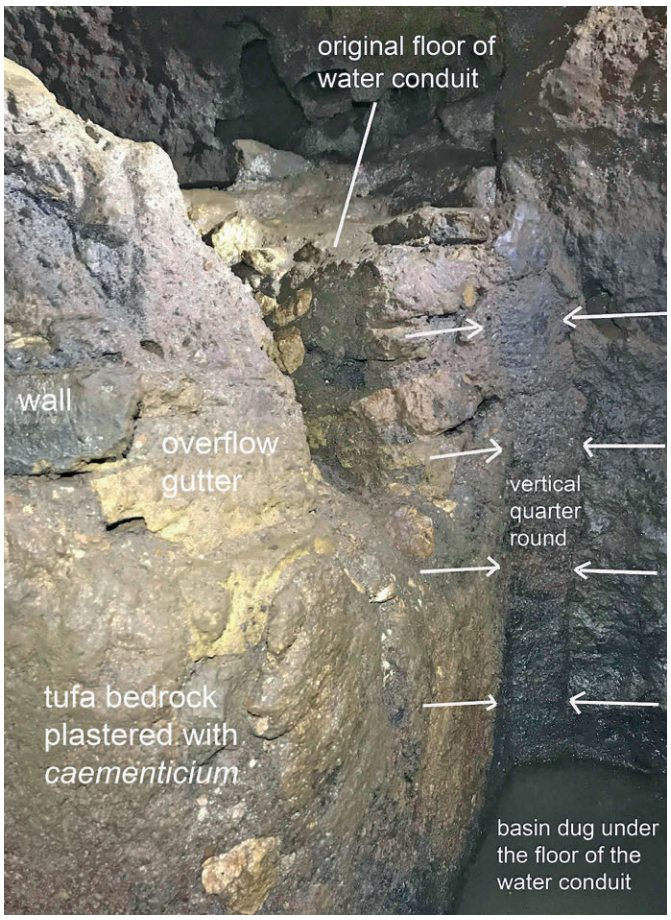

Fig. 8 – The construction that blocked the water flow, seen from east (photo A. Schatzmann).

At the north-west edge of the studied area, in the forest along the foot of the tuffaceous ridge, other remnants belonging to the hydraulic system here described have come to light. A small channel opens from the rocky slope, revealing itself as the same structure (M) we have noticed below the terminal wall of branch E". Although it is impossible to establish by direct survey, M is unlikely to be anything else than a branch of conduit I. Its function could have been that of a nutrition/overflow of branch E", but again this cannot be definitively determined because of the overall soil deposit.
About 5 m higher there are the borders of well L (fig. 3), whose present depth does not exceed 3.80 m, although it was probably deeper. On its south-east wall the vault of another channel is visible, but it cannot be crawled into because of the 20 cm free space remaining between the filling and the ceiling. As it is visible on the plan, this vault is located at a point that seems to correspond with a hypothetical extension of channel I, with which it has a comparable appearance. In this case, well L could be another example of the shafts accompanying at regular intervals the water conduit I.
The interpretation of all these structures, however, leaves open a number of questions. It is not clear, for example, if L was the last of the series of wells, or if conduit I continued in the same direction beyond well L. If such a continuation existed, it would be today deeply buried in the filling of the well.
As already mentioned, also the existence of a connection with conduit M still needs to be checked. The most probable hypothesis is that channel M started as a fork from channel I, in the vicinity of well L.

Discussion

The system we describe is a typical example of a cunicular cistern, a widespread typology in central Italy and in agricultural villas of the I century BC around Rome. These cisterns are normally fed by drainage conduits or, when they are directly integrated into the platform of a villa, by various *impluvia,* and equipped with wells for drawing water (Riera, 1994: 313-330; Schingo, 2004: 53-56; De Franceschini, 2005: 306-307).
From this point of view, it is immediately clear that we are dealing with a particular case. The quantity of water arriving from conduit I suggests that the latter was not dug as a classical water extraction tunnel. Rather, it is highly probable that it took, and still takes, water from an underground flow. It was certainly pre-existing to the water cistern, but at a certain moment, which for the reasons discussed above we believe to be the I century BC, it was intercepted in a very particular way, with the purpose of feeding a (newly dug?) cistern. This reduced its previous function of a water transport conduit to the exclusive function of an adductor tunnel for the storage structure, with its westbound continuation serving as a mere overflow.
As regards the cunicular cistern, we were unable to find a directly comparable structure, but we believe that this is due to the state of research and to the general conservation situation of such systems. As a comparison with other areas in the immediate vicinity of Rome shows, such hydraulic systems are rarely preserved to a major extent, namely if they had not been destroyed by expansive construction activity or from intensive agriculture. For our cistern, a primary question is whether it was, like most of the others, originally designed as a rainwater cistern.
One of the rare examples of a direct contact between a waterproofed cistern structure and a conduit for continuous water transport has recently been documented below the gardens of *Villa Medici* at Rome, where, in antiquity, the *Horti Luculliani* were located. But in this case things seem to have gone differently. In a first phase, a cunicular cistern filled with rainwater and drainage water met all the requirements of the *horti*. Later, this cistern fell out of use when there was the possibility to increase significantly the amount of water, with the help of an off-branch arriving from a nearby aqueduct (Fratini & Moriconi, 2015: 119-121).

Since in the explorable parts of the Marcigliana cistern no remains of *impluvia* are detectable,[2] it might not be entirely unreasonable to assume a very unique and bold project. Its builders must have been inspired by the presence of the ancient water conduit under the plateau, whose shafts had always remained visible. So they decided to dig and divert the watercourse inside the hill, with the help of a cistern of the classical cunicular shape (this might also explain the curved design of corridor G). Once the storage capacity of the cistern was reached, water could continue to flow in the inner conduit.

The conduit which determined the position of the cistern runs under a plateau where, on the base of sparse pottery findings[3], the presence of a Roman villa has been hypothesized. On the other hand, the cistern by itself does not extend under the plateau, but rather under the hillside that, like today, was probably covered by dense vegetation even in ancient times. It can therefore be deduced that, if such a villa existed, the cistern was almost certainly not in direct relation to it. Putting all the clues together, namely the absence of *impluvia* or drawing wells, which would instead attest a direct relation between the two (Mari, 1991: 39; De Franceschini, 2005), and the marginal position of the cistern under the hillside, but not under the plateau, the general impression is that our cistern was rather used to irrigate a structure different from a residential unit, probably an agricultural area that required not only a continuous water flow, but also a large amount of stored water. The small valley where the cattle trough and the entrance to the structure are located, is and was undoubtedly suited to agricultural cultivation. It is easily accessible from both the main valley of the *Fosso di Tor San Giovanni* and from a villa on the other side of the flat valley.[4]

It is evident that the cistern at a certain moment went out of function, and the system was reduced to a mere sequence of conduits (see the arrows on the plan, fig. 3) drawing water from the adductor out to a historical fountain, attested on the *Catasto Alessandrino*. This fountain was located at the same place as today's cattle trough (Dell'Era, 2000: 258). The availability of a perennial source of water seems to have been highly regarded, deserving accurate restorations after any significant threat or disaster, such as the construction of the modern street above it.

In extreme synthesis we can thus distinguish three phases in the history of use of our system:

1) A probably pre-Roman *cuniculus*, which ensured irrigation for agricultural purposes;
2) An apparently purposeful interruption of this *cuniculus* in Roman times and the drainage of its water in order to fill a cunicular cistern that most probably served for agricultural purposes;
3) The flow of running water through the disused remains of this cistern, feeding the fountain in early modern times and, up to today, the cattle trough.

Acknowledgements

This study was commissioned by the former official of the *Soprintendenza Archeologica di Roma* Francesco Di Gennaro, whom we thank for his constant interest in the project. We are also extremely grateful to the current official, Marta Baumgartner, for her interest and permission for this preliminary presentation. Also we would like to thank Gianluca Schingo, a specialist of Roman cisterns, for the extremely useful discussion on functional issues of this typology. Many members of Roma Sotterranea were involved in the exploration and documentation process: Antonella Boccone, Maurizio Massimo Cappa, Gabriele Catoni, Vittorio Colombo, Donatella Ertola, Manuel Gentili, Luciano Meloni, Lorena Nubile, Gianluca Spuntarelli, Ivano Stranieri, Alberto Tancredi and Beatrix Tejero.

Bibliography

Ashby Th., 1906, *The Classical Topography of the Roman Campagna, part II*, Papers of the British School at Rome III: pp. 3-212.

De Franceschini M., 2005, *Ville dell'Agro Romano*, L'Erma di Bretschneider, Roma, 564 pages.

Dell'Era F., 2000, *Villa e paesaggio: gli impianti idraulici*, Bullettino della Commissione Archeologica Comunale di Roma LX: pp. 249-262.

Fratini G., Moriconi F., 2015, *Lo scavo dietro la falegnameria e le ricerche a Villa Medici, le indagini nel convento, nel giardino e nella Casa d'accoglienza della Trinità dei Monti: Una nuova lettura dei resti archeologici*, in: Bollettino di Archeologia online VI: pp. 81-138.

[2] We have to remind however that probably only a small part of its original extension has been preserved and remains explorable to these days.

[3] Fragments of concrete and fragments of tiles, referable to the imperial era, and transported by agricultural work, are mentioned in Quilici & Quilici Gigli (1993: 110) in order to argue for the presence of such a villa on the plateau (see also Dell'Era, 2000: 258). However the observed remains could also be referred to a small secondary building (stable, granary or similar). But as mentioned above, the remains we found during our exploration were all of recent times.

[4] The closest example of a known Roman villa is the 'villa di Marcigliana' close to today's *Casale di Belladonna* (Di Franceschini, 2005: 48-51).

Judson S., Kahane A., 1963, *Underground Drainageways in Southern Etruria and Northern Latium*, Papers of the British School at Rome XXXI: pp. 74-99.

Mari Z., 1991, *Tibur, pars quarta*, Forma Italiae 35, Olschki, Firenze, 324 pages.

Quilici L., Quilici Gigli St., 1980, *Crustumerium,* Latium Vetus III, CNR, Roma, 325 pages.

Quilici L., Quilici Gigli St., 1993, *Ficulea,* Latium Vetus VI, CNR, Roma, 552 pages.

Riera I., 1994, *Le cisterne: Le testimonianze archeologiche*: in AAVV. (eds), *Utilitas necessaria. Sistemi idraulici nell'Italia romana*, Progetto Quarta Dimensione, Milano: pp. 297ss.

Schingo G., 2004, *La cisterna a cunicoli*, in Campitelli A., Cremona A. (eds), *La Casina Valadier. L'edificio e il suo sito*, Electa, Milano 2004: pp. 53-56.