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EDITORS

Mario Parise

Carla Galeazzi, Roberto Bixio, Carlo Germani



## AN ANCIENT HIGHWAY TO THE TUFFA QUARRIES. NEW CONSIDERATIONS ON A FORGOTTEN MONUMENT NORTH OF ROME

Andreas Schatzmann

Roma Sotterranea - andreas.schatzmann@libero.it

### Abstract

This study presents an analysis of an ancient street tunnel in the N part of the territory of Rome (via Flaminia km 18). It is directed W-E and passes beneath the via Flaminia ridge. It has a general width of 2.1 m and a length of at least 350 m. Although it is still accessible in almost its entire length, it has completely passed into oblivion during the last decennies. The E mouth has been spilled in a moment hard to determine, but probably in rather recent times. As the W part of the tunnel has been used for mushroom cultivation during some decades, today it presents itself heavily filled up with earth, with a ceiling height of 1.50 m or lower, and traces of recent interventions can be seen at a lot of places. On the contrary, a series of small cuniculi running parallel to the tunnel seems to have preceded the construction of the tunnel, but then surely was adapted and linked with the tunnel in order to serve as a drainage system. Of much interest, finally, is an enlarged space in the E part of the tunnel with a rock pilaster left in place for reasons of stability, and with five worked tuffa blocks lying on the floor. The tunnel can be called a bold element of an transversal road linking Veii with the tuffa quarries of Grotta Oscura and with the Tiber valley, other parts of which have been documented during the fieldwork carried out in the '60s by the British School. The construction of the tunnel helped to avoid a steep slope which must have been a serious problem for the carriages loaded up with excavation material but also with agricultural products and other building material. Looking at the rather unusual typology of the tunnel – with an absolutely rectangular section and no vault –, it may not be completely out of the mark to hypothesise that the engineers who planned the tunnel were the same persons who worked also in the quarries. It is likely that the road continued to be used up to a few centuries ago.

**Keywords:** Veii, Flaminia road, Tiber valley, ancient street tunnels, communication and transport roads, hydraulic works, drainage systems, natural erosion, tuffa quarries, ancient topography.

### Riassunto

*In questo studio viene presentata una galleria stradale antica larga 2.1 m e lunga almeno 350 m, situata nel territorio settentrionale del Comune di Roma e che sottopassa in direzione O-E la collina della via Flaminia (altezza km 18). La sua memoria è andata completamente persa negli ultimi decenni, nonostante sia ancora percorribile per quasi tutta la sua lunghezza entrando dallo sbocco O, mentre lo sbocco E è stato interrato e ostruito in un momento difficile da determinare con precisione, ma probabilmente in un periodo abbastanza recente. La parte O della galleria è stata adibita a fungaia fino a tempi recenti e per questo motivo la galleria oggi si presenta molto interrata, con il soffitto alto 1.50 m o anche meno e con evidenze di interventi recenti. Un sistema di stretti cunicoli paralleli alla galleria, scavati dall'esterno verso l'interno, sembra invece avere un'origine più antica rispetto alla galleria, ma al momento della costruzione di quest'ultima sicuramente è stato adattato e collegato alla galleria come sistema di drenaggio. Molto interessante, infine, è un ambiente ampio con un pilastro risparmiato in fase di scavo per garantirne la stabilità e cinque blocchi lavorati di tufo diverso di quello in cui è scavata la galleria, poggiati a terra. La galleria costituisce la realizzazione audace di una strada trasversale O-E che collegava Veio (che dista soltanto 6 km in linea d'aria dal sito oggetto dello studio) con la zona delle cave di Grotta Oscura e con la valle del Tevere; altri elementi di questo asse viario trasversale sono stati identificati grazie ai sopralluoghi della British School negli anni '60. Lo scopo della galleria era dunque quello di evitare un saliscendi assai ripido ai carri che portavano il materiale estratto nelle vicine cave di tufo (Grotta Oscura), ma anche prodotti agricoli e altro materiale edile. Considerando la tipologia inconsueta della galleria, che presenta una sezione assolutamente rettangolare e non voltata come tante altre gallerie stradali antiche, si potrebbe ipotizzare che le maestranze siano state le stesse che operavano anche nelle cave. È probabile che la galleria sia poi rimasta in uso fino a pochi secoli fa.*

**Parole chiave:** Veio, via Flaminia, valle del Tevere, strade antiche in galleria, vie di comunicazione, assi di trasporto, opere idrauliche, sistemi di drenaggio, erosione naturale, cave di estrazione di tufo, topografia antica.

### Introduction

In April 2014 a small group of the survey team of the Roma Sotterranea association ('Explora') headed to the rock of Pietra Pertusa N of Prima Porta (Rome) which is a promontory projecting towards the Fosso della Torraccia valley on the W side of the via Flaminia ridge at the height of km 18. The territory belongs today to the municipal area of Rome but in ancient times it was part of the Ager Veientanus. The purpose of the visit was to check the state of conservation of the short

road tunnel (60 m) of probable Etruscan origin which had enjoyed some familiarity through a photograph of RODOLFO LANCIANI posing at the tunnel's entrance during one of his surveys in March 1898, but that today has fallen into almost complete oblivion, even if it is included in the National Register of Artificial Cavities as CA 159 LaRM, with a planimetry by G. CAPPA (see also KAHANE et al., 1968; MESSINEO, 1991; BUSANA 1997). The S entrance of the tunnel turned out to be in an alarming state indeed: Tree roots have opened two enormous

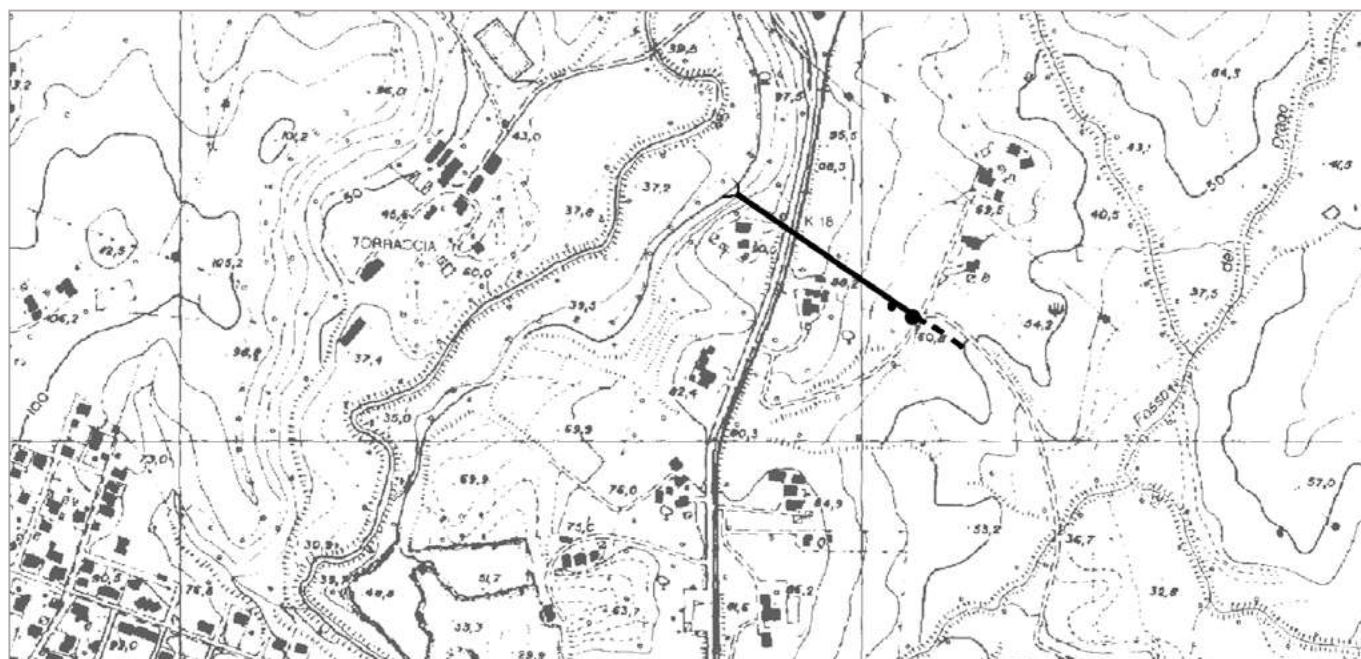


Fig. 1: superimposition of the tunnel track on the Carta Tecnica Regionale.

Fig. 1: sovrapposizione del tracciato del tunnel sulla Carta Tecnica Regionale.

crevices in the rock, and this will sooner or later lead to the collapse not only of several metres of the side wall but also of part of the ceiling if no intervention is provided.

The subject of this paper, however, is another tunnel situated some 350 m NE of the first one, more than 300 metres long plunging entirely through the ridge towards SE, in direction of the Tiber valley (Figs. 1&2). During the BSR Ager Veientanus field survey project in the early '60s (see JUDSON & KAHANE, 1963; KAHANE et al., 1968), this latter was recognized as an important element of a transversal road system. But judging from the short remark in the monograph on the monuments of the Via Flaminia territory by G. MESSINEO, its exact position had gone lost in the decades that followed and seemed no longer determinable in the early '90s (MESSINEO, 1991; MESSINEO & CARBONARA, 1993). Today, again more than 20 years later, its entrance turned out to be surprisingly visible (Fig. 3) and, more than that, for the most part of its total length, it presents itself in a very good, if not excellent, state.

The Fosso della Torraccia valley had a frequentation history which goes back at least to the Etruscan period. The omnipresence of cuniculi reveals the intensity of early landscape regulation and land reclamation for agricultural purpose (KAHANE et al., 1968; ROSICA et al., 1997). In Roman times the western banks of the valley have been occupied by a 'wealthy villa and its accessory buildings', the best preserved part of which are today two nymphaea in discrete state of conservation (they are classified as site 320 in KAHANE et al., 1968; cf. MESSINEO, 1991). At the same place a fortified village (castrum) was built in medieval times. It has left as a visible landmark a tower with white and black stone rows to which the Fosso owes its name (MESSINEO & CARBONARA, 1993). All these realities we have to bear in mind as a background for the road tunnel we are going to discuss now.

## Description of the site

### The Road Tunnel: Generalities

The complete lack of documentation, in the case of the longer tunnel below the Flaminia ridge, seemed to be reason enough to carry out an in depth analysis on the function of the structures. A detailed map of the site was produced by Roma Sotterranea. Parallel to the field work, some archival research of additional sources was made together with ANDREA VENIER in order to find more information about how the situation would have presented itself to the surveyor's eye some decades ago. The result of these investigations cannot be included in this paper for lack of space and will be presented elsewhere.

Even if they did not enter, it was already clear to JUDSON & KAHANE (1963) that the tunnel must have been part

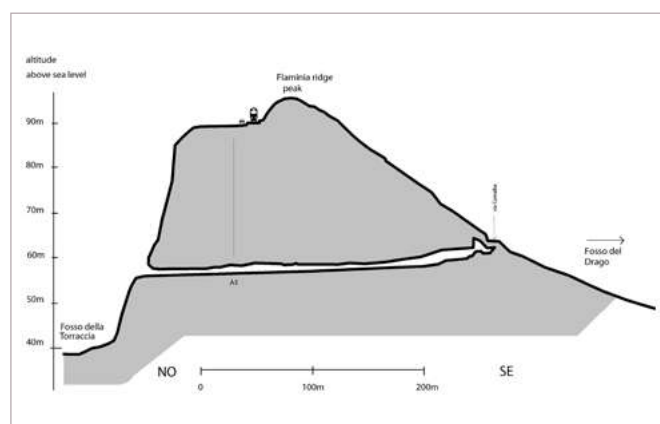


Fig. 2: profile of the Flaminia ridge, in correspondence with the longitudinal section of the tunnel. The vertical magnification factor is 4 (drawing A. Schatzmann and C. Germani).

Fig. 2: profilo del crinale della Via Flaminia, in corrispondenza con la sezione longitudinale della galleria. Il fattore di ingrandimento verticale è 4 (elaborazione grafica A. Schatzmann and C. Germani).

of an original transversal road running E-W below the Flaminia ridge (for a discussion on the archaeological context see below). It is still accessible from the W side. The entrance is situated at  $42^{\circ}2'27''$  N /  $12^{\circ}29'5''$  E and lies today about 8.5 m above the bottom of the Fosso della Torraccia valley (57 m a.s.l.), at the foot of the eastern rock face of the Fosso, at this point creating a sharp delimitation between the Flaminia ridge and the valley (Fig. 3).<sup>1</sup> JUDSON AND KAHANE describe it as 'clogged with silt in March 1962, and not entered'. Nonetheless it is indicated with precision on the *Carta storica archeologica monumentale e paesaggistica del Suburbio e dell'Agro Romano* (henceforth: *Carta dell'Agro Romano*) elaborated in the early '70s. In the late '90s the site was visited by A. FELICI, G. CAPPA, and T. DOBOSZ, who included it in the National Register of Artificial Cavities as CA 160 LaRM, but without mapping it,<sup>2</sup> whereas some ten years before a joint group of geologists and archeologists of the Archeoclub Roma limited themselves to an inspection of the western entrance part (ROSICA et al., 1987).

The eastern mouth of the tunnel, on the contrary, was very difficult to locate, even in 1962, and, even more, its position has become completely lost over the following decades. However, thanks to the detailed mapping, it is again possible to track it with precision, as will be discussed further on.

The tunnel has an orientation of  $119^{\circ}$  SE, and it runs absolutely straight through the mountain. From the W entrance to the furthest observable point it has a total length of 343 metres. This must be very close to its original length indeed – in other words what today is filled up with earth and sealed is only a very short track on the E side. For its total length the tunnel is inclined. The last accessible point of the ceiling in the E is 4.7m higher than the ceiling at the W entrance. Where the walls of the tunnel are still well preserved, and this is true for the major part of it, it has a general width of 2.1m. Apart from this, the most interesting features of the tunnel (see Fig. 4) are: an enlarged space excavated from the rock starting at 282 metres from the W entrance from where several short cuniculi start (B) and which has a pillar left for stability reasons in its center, as well as a natural, arenaceous cavern some 30 m further on to the E, a geological instability which seems to have interacted considerably with the original tunnel construction (C). Parallel with the S wall of the tunnel, but only for a part of its length, and sometimes at a very small distance to it, runs an interesting system of



Fig. 3: W entrance of the tunnel seen from the Fosso della Torraccia (photo V. Puggini).

Fig. 3: ingresso ovest del tunnel visto dal Fosso della Torraccia (foto V. Puggini).

low-ceilinged cuniculi.

If today's general impression of the tunnel is substantially different from how it must have been in antiquity, this is due to the fact that the floor level of its W part has risen considerably. During the second half of the XX century (and, more exactly, probably during some period between the survey by JUDSON & KAHANE and that by G. CAPPA) this area was used for mushroom cultivation, and it seems that the tunnel was made accessible also for small lorries. Consolidation work has been carried out not only in front of the W entrance, but also inside the tunnel. The ground has obviously been filled up with substantial quantities of earth which created a layer probably more than 1 metre thick. Water infiltrations must have posed a constant problem in various sectors of the tunnel which they tried to resolve by cutting drainage channels on the side walls (Fig. 5). It looks as if there was a need to consolidate the ground, too, with large stone slabs, probably in order to prevent the bed of the tunnel from being washed away too quickly or becoming a muddy basin. But this is exactly what happened during these last decades of the tunnel's history. Indeed, the tufa bedrock into which the tunnel is dug (the Tufo giallo della via Tiberina = TGVF for the lower part of its section and the Tufo stratificato di Sacrofano for its upper layers; see Fig. 6; cf. BOCCALARO et al., 1991; ROSICA et al., 1997; DE RITA, 1999; VENTRIGLIA, 2002) lies on an impermeable ground as is also shown by the presence of numerous springs. In other words, the water, while easily permeating the different layers of the tufa formation from above, is trapped on the ground. It can find its way out of the tunnel only through the entrance portal. Inside the tunnel, some metres away from the entrance, a more substantial water infiltration was caught up in a tank and led through a tube to a small pond at the bottom of the valley while the overflow of the stagnant water on the infill at the W end of the tunnel feeds a small basin immediately in front of the entrance. The high concentration of water makes it impossible to investigate the thickness of these sedimentary layers. It can at best be calculated indirectly, as we shall see later.

The mushroom cultivation has left other traces such as

1) From the Fosso, the ancient road probably rose to the tunnel entrance in a gentle curve.

2) A very short note written by G. CAPPA on its interior characteristics in complete agreement with what we were able to observe and what is the object of this paper is preserved in the documentation of the Register. At that time, the interior part was inhabited by a number of small mammals whose excrements created an almost unbreathable air which, together with a lack of natural ventilation, made further investigations impossible (DOBOSZ, pers. communication). Today the only mammals we found living in the tunnel was a colony of bats. The tunnel therefore should not be visited during the period of their winter lethargy.

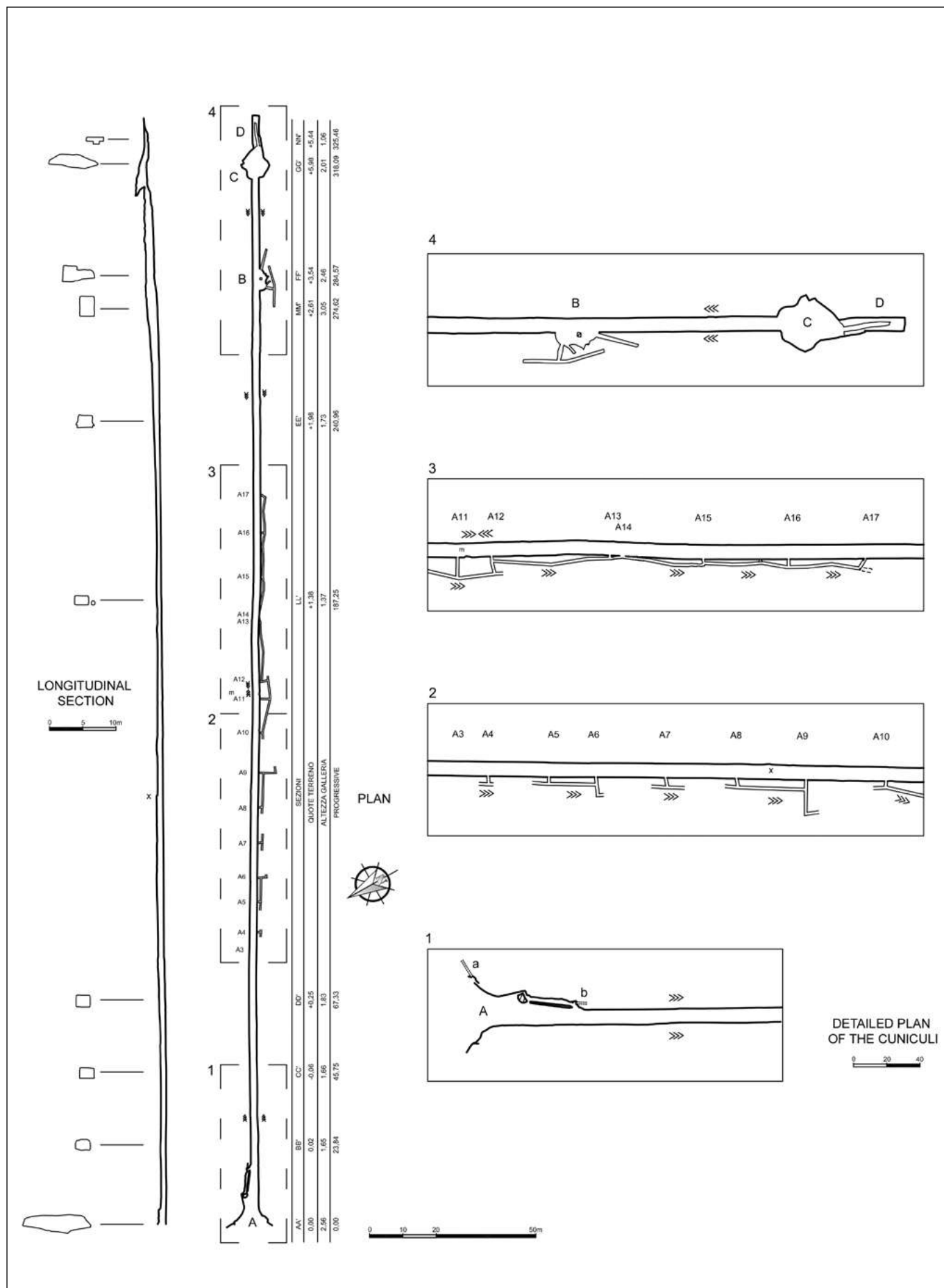


Fig. 4: plan and longitudinal section of the road tunnel (drawing C. Quaranta and C. Germani).

Fig. 4: pianta e sezione longitudinale della galleria stradale (elaborazione grafica C. Quaranta e C. Germani).



Fig. 5: draining rims cut into the side walls (photo V. Puggini).  
Fig. 5: *canaline di drenaggio scavate nelle pareti laterali (foto V. Puggini).*

remnants of plastic curtains and nails with which they were fixed, and along the S wall a series of plastic strips that closed the tunnel section off from the drainage system on its side. Further inside, in several cases, the infiltrating water must have been caught by an open tube that was fixed directly below the crevice in the ceiling and then led to the side wall (Fig. 5). From here it was led diagonally downwards through a descending rim cut directly into the side wall and ended up only a few centimetres above today's ground level. This type of drainage rim (normally not very ancient) is a well-known feature from many underground places. It can, for example, be found in the cuniculus system below the medieval centre of Orte (PASTURA, 2013).

As for the side walls, they show a high concentration of niches of various sizes, most likely used for placing small lamps, at least for the most part of them (cf. Figs. 5&11). What is remarkable is that they are normally concentrated at two different levels of height: one is at 1.5 m above the actual ground level, whilst the second is only a few centimetres above it. One possible explanation would be that this reflects two different periods of use of the gallery. The higher niches would then correspond to the mushroom cultivation (traces of ash are sometimes still visible) whereas the lower group, for which it is hard to find another explanation, could be linked with a much earlier period of use, at a time when the sedimentary layer was not yet present.

But let us turn back to the original tunnel construction. No doubt one of its remarkable characteristics is its rectangular section (cf. Figs. 6-8; see also the sections in Fig. 4), which is only compromised in some few cases in favour of a slightly M-shaped section. As far as the digging of the tunnel is concerned, it is remarkable that not a single shaft was used, with the consequence that only two small teams could advance from the two opposite sides, with the disadvantage that there was no alternative way to remove the excavated material other than through the tunnel itself. The meeting point of the two teams can still be determined, thanks to the cutting marks on the side walls (cf. RIERA, 1994). It is at a distance of 145 m from the W entrance, shortly after the fixed point A11 (Fig. 4,m), in a zone characterized



Fig. 6: situation close to the W entrance, with the stratified tufa layers (photo S. Juran).

Fig. 6: *situazione vicino all'ingresso ovest, con le stratificazioni di tufo (foto S. Juran).*

today by two massive sinter pegs.

However, the only example of an abrupt difference in the ceiling's height that has not been adjusted is not here, as one would expect, but further to the W, at m 125.<sup>3</sup> Here, a step of 35 cm has remained that reduces the ceiling height to 1.65 m from the actual ground level (Figs. 4,x; 8). Consequently, from that point walking further to the E is not really comfortable (cf. again Fig. 7): In the lowest part the ceiling is today only 1.25 m above the ground. The situation only changes shortly before zone B, where the ceiling is again considerably raised but without a step, and at the same time the sedimentary layer starts to diminish. Here, and further on in sector B, it has been possible to identify the original floor level and thus to establish the original ceiling height (between 2.9 and 3.0 m). We assume therefore that the original height all through the tunnel must have been between 2.5 m and 3.0 m. If this is true, we might deduce also the depth of the sedimentary layer in the first sector which must be considerable. Subtracting 1.25-2 m of clearance from the assumed total of 2.5-3.0 m one arrives at a sedimentary layer between 0.5 and 1.75 m.

The side walls, on the other hand, do not reveal any obvious irregularity that could be linked to the construction history of the tunnel. While smoothing works have not completely concealed the original direction in which the tunnel was dug, the ceiling and the tunnel walls have probably been standardized in a last phase of the work, and the step in the ceiling may be considered the last trace of construction works left visible. In the region west of B (see plan Fig. 4) the side walls have obviously been worked and reworked in both directions.

Speaking of the side walls, the numerous horizontal scratch marks should also be mentioned. It is probable that they mostly originate from small lorries which entered the W part of the tunnel during the mushroom cultivation activity. But there are also deep scratches spread all over the ceiling in the zone close to the east-

3) In the following, indications 'at m xy' always mean the distance from the W entrance.



Fig. 7: survey activity in the zone with low ceiling height (photo L. Mangani).

Fig. 7: attività di rilievo nella zona con il soffitto basso (foto L. Mangani).

ern entrance which at least partly has been filled with earth for centuries (D). These marks therefore must have a much older origin.

### ***The system of cuniculi***

From the S wall of the tunnel, and for the most part only there, a series of short conduits (connecting conduits) start more or less at right angles and at quite a regular distance between each other (every 10-12 m; cf. Fig. 4, A4 to 17). They link the main tunnel passage with a system of water conduits which run sometimes at a distance of some metres from the tunnel, while in other cases they are visible at minimal distance and immediately behind its side wall (Figs. 4, detailed plan; 9). The water conduits have the typical shape of the well-known archaic drainage or water collecting cuniculi omnipresent in this region (cf. RIERA, 1994). In our case they are often buried deeply, sometimes also with stagnant water which goes from a few centimetres up to complete immersion, and therefore they are not easy to explore. Where it was possible to enter them, that is mainly the case from A12 eastward, the system has been measured and documented. The infill normally leaves a space of 0.55-0.7 m up to the top; the width varies between 0.4-0.55 m. In general these conduits run more or less parallel to the tunnel, but as closer inspection has shown, they follow a more zig-zagged course than one might deduce from seeing them only from the connecting conduits. Sometimes the system turns at right angles away from the tunnel, as for example with the connecting conduit A6, in order to continue its course at a much greater distance from the tunnel. A similarly sharp twist, together with a very short notch, can be observed in A12 (see detailed plan in Fig. 4). Unfortunately it is impossible to establish the reasons for this strange course since all channels involved are buried almost up to the top and therefore inexorable.

What is obvious from the explorable parts, however, is that the conduits are dug without any exception from outside (i.e. the Fosso della Torraccia valley) towards the inside of the rock. Due to the zig-zagged course



Fig. 8: not standardized step in the ceiling (photo V. Puggini).

Fig. 8: gradino non standardizzato sul soffitto (foto V. Puggini).

sometimes only a very thin portion of the dividing wall has remained between tunnel and water conduit, and in several instances, typically where the water conduit makes an obtuse angle at minimal distance from the tunnel, small leaks are visible (or also a big hole like A14, seen in Fig. 9). If the wall had been broken accidentally here in ancient times, this would mean that the damage in the side wall had never been repaired; however, this is rather unlikely, so it must have happened later. At least in one case, at A3 where the conduit is completely inundated with water, the breach is certainly of very recent origin. Some years ago an electric grounding for a new transformer station was sunk from more than 30 metres above this place, only a few metres away from the modern Via Flaminia road and the Roma Nord railway line. The two metallic tubes drilled into the ground are visible through the small hole A3 and through the water. Even if this interference has had a negative effect on the side wall of the tunnel, at least it gives a reliable topographical reference point for its course.

But at this point the question arises whether there was a functional relationship between the tunnel and this hydraulic system and, if so, what this does mean for their relative chronology. The cuniculi immediately give the impression of having fulfilled the task of draining the road tunnel (as in part they still do today). And indeed, the short right angle conduits create an undeniable functional link between the two structures. As to chronology, however, two scenarios are possible which need to be briefly discussed here:

- a) The lateral conduits were excavated explicitly as draining conduits of the tunnel and are therefore coeval or posterior to the road tunnel.
  - b) The water conduit system originally did not have any functional relationship with the road tunnel, which means that it is pre-existent to it and was linked with the tunnel only when or after the latter had been dug.
- Out of these possibilities we clearly favour the second one, i.e. an origin of the water conduits independent from the tunnel, and this for several reasons:

- 1) As already mentioned, the direction of the excava-



Fig. 9: the cuniculus system seen from the tunnel through the breach A14 (photo V. Puggini).

*Fig. 9: il cunicolo visto dal tunnel attraverso la breccia A14 (foto V. Puggini).*

tion of the cuniculi is from outside (i.e. from the W slope) towards the inside of the rock. Had the conduits been hewn from the tunnel starting from the connecting cuniculi, no doubt, in every intermediate sector, both directions would be visible.

2) The connecting channels in general give the impression of having been dug into an already existing system. Their peak is always 30-50 cm higher than that of the cuniculi inside. In some cases the arrival of the connecting channel also provoked a higher peak of the latter as well as irregularities in the walls of the conduit itself, all of which clearly shows that the connecting channel is stratigraphically younger.

3) Even if it is no longer possible to establish where exactly the cunicular system ended, because it is clogged by sinter in A17, it is highly probable that it was not very far away from this point. At any rate, after A17, no further connecting channels occur in the S wall of the tunnel which indicates that the cuniculi were not meant to accompany the tunnel for its entire length.

All this can thus be used as an evidence that we are dealing with one of the much dispersed draining /extraction cuniculi of considerably older origin. As it has been said initially, the Fosso della Torraccia valley has seen an intense infrastructural remodelling for agriculture from the Early Iron Age onwards, and this cuniculus is most likely to be just one further testimony of prehistoric land reclamation in this zone. Its original opening towards the valley is most probably hidden beneath the massive filling layer in the entrance zone of the tunnel. Furthermore, some companion pieces still exist: also on the N side of the road tunnel, on its first metres from the W entrance, some 9.5 m of a zig-zagged cunicular track can be seen, before it is sinter-clogged as well, with a completely collapsed dividing wall between cuniculus and tunnel (Figs. 4,b; 10). No connecting channels at all exist in the N wall of the tunnel, however. Last but not least, the opening of a completely buried drainage cuniculus, which obviously ran parallel to the rock surface, can be seen on the N side of the tunnel forecourt (Fig. 4,a, marked with a dashed line). Functionally speaking, it is thus reasonable to think that all these water conduits belonged to



Fig. 10: detail of the collapsed N wall between cuniculus and tunnel (photo V. Puggini):

*Fig. 10: particolare della parete nord collassata tra cunicolo e tunnel (foto V. Puggini)*

the same family.

For a positive proof that the cuniculi sections on the S side of the tunnel really had a second use as draining conduits of the tunnel with which they were linked, it would in theory be necessary to open a small sounding trench in one of the connecting channels, in order to compare the ground level of the tunnel, of the connecting channel and of the cuniculus respectively. This is however an impossible task, as we are dealing with at least a metre of sedimentary material saturated with water. However, as we have seen, the mere presence of the connecting channels leaves little doubt that such a convenient opportunity for draining the tunnel pathway was missed.

### ***The Eastern Zone of the Road Tunnel: Tufa Blocks and Geological Instabilities***

Turning back to the road tunnel, in close proximity to the already mentioned zone showing the original height, the tunnel at m 282 opens up for the next 6.5 m to an enlarged space about 5 m wide and 6.5 m long (Figs. 4,B; 11). It has a trapezoidal form, and it was obviously excavated starting from the E side, leaving only an irregular pillar (55x55 cm thick) in line with the original S wall so as to ensure its stability. The slightly concave wall at the S side of the space is interspersed with a large number of small niches. From the SW corner a T-shaped cuniculus begins (spreading southwards for 2.9 m, with a W and a slightly curved E branch 5.3 m and 5.55 m long, respectively), whereas another short cuniculus (5.9 m) starts in the E part of the enlargement. Contrarily to the conduit system discussed earlier, these cuniculi show almost their original height (the E branch of the T-shaped one is 1.78 m high). In the S wall of the enlargement, slightly east of the T-shaped cuniculus, a third one is visible for about 2 m, but cannot be inspected. It is buried deeply and seems to have a substantial downward slope.

The purpose of these undertakings remains unresolved. This is also true for the widened space that must have required a strenuous effort. Its ground, but also the



Fig. 11: enlarged space B with the tufa blocks. General view, looking W (photo L. Mangani).

Fig. 11: allargamento nella zona B con i blocchi di tufo a terra. Vista generale, guardando ovest (foto L. Mangani).

ground of the tunnel, is covered with a mound of infill.<sup>4</sup> Without excavation it is impossible to say if this space was part of the original concept of the tunnel, or if it is a later addition which possibly has not been completed. The most particular thing here, however, are five well-preserved tufa blocks (of irregular size, from 50x55x90 to 53x60x180 cm) distributed at different positions on this sedimentary layer. Three of them lie in the center of the tunnel passage and thus would have blocked it completely (Fig. 11). What is most interesting is that the tufa material of the blocks is different from that from which the tunnel is excavated, as it is clearly visible from the difference in colour and structure. The material of the blocks is more yellowish and corresponds to a hard, compact rock, likely to come from a TGVST stratum, whereas the tufa out of which the space has been excavated is more greyish, and not very consistent (Sacrofano stratum). It is of course very interesting, but at the same time highly hypothetical to assume that the tufa blocks come from one of the cave zones little more than a kilometre E of the Flaminia ridge, where exactly this TGVST tufa was dug (Grotta Oscura; CARBONARA & MESSINEO, 1996; LOMBARDI & MEUCCI, 2006). Furthermore, the blocks show the typical stepping marks which have their origin in the method of gradual quarrying against a hillside with the help of separation trenches and wedges (cf. WARD-PERKINS, 1971). Most of them have modern inscriptions, but on the biggest of them lying in the tunnel passage traces of the ancient quarry numbering are still visible.

So if the blocks were made out of a material different from the local rock, who brought them there? On the

one hand, it is very hard to believe that they have been brought to the tunnel in recent times. On the other hand, their position suggests they were moved not such a long time ago. Apart from the fact that they are lying on the infill and not in it, the way they are aligned makes one think that they were made ready to be re-used here for some kind of construction work. In that case, however, this work was not completed. In fact, one of the blocks lays aligned with the original S wall of the tunnel and fills the gap between the corner of the enlarged space and the pillar (Fig. 11), as if the intention had been to close off the enlarged space again. Resuming the course of the tunnel further eastward, we traverse a zone that can be described as highly chaotic in its geological structure and which manifests itself in a number of irregularities, fractures and statically problematic zones (Fig. 4, between B and C). This stratum can probably be identified with the Tufo rosso a scorie nere layer (ROSICA et al., 1997; VENTRIGLIA, 2002). Due to the inconsistency of the material, much of the original tunnel ceiling dropped off here during the course of time (Fig. 12), no doubt an undesirable effect but, while digging the tunnel, surely nobody expected such an immediate change in the quality of the rock.

But things were to become even worse. After a distance of only 26.5 m from the end of the enlarged space and at a total of 314 metres from the W entrance, all of a sudden the passage starts to cross a natural cave which owes its origin to the fact that the tunnel diggers had touched a mighty arenaceous layer pervading the tufa stratifications here (Fig. 13). It is highly probable that this geological instability caused problems right from the beginning in keeping the underground tunnel in good condition. But today no doubt the natural cave has much bigger dimensions with respect to the original situation, since it must have been washed out through the times by seeping water. The actual top of the cave

4) The consistency of this infill is completely different from the compact muddy filling layer of the W part of the main corridor and must therefore have a different origin. It also seems that in the enlarged space the bedrock has not been completely excavated down to the level of the tunnel.



Fig. 12: tunnel track between B and C. The original ceiling is indicated (photo V. Puggini).

Fig. 12: tracciato del Tunnel tra B e C. È indicato il soffitto originale (foto V. Puggini).

is considerably higher (up to 2.35 m) than the original ceiling of the road tunnel. As a consequence, the original section of the tunnel has completely disappeared in this zone and its pathway lies deeply buried under the accumulated arenaceous material. Furthermore, the soft material has allowed small animals to dig their lairs here; these holes can now be seen everywhere. And some human visitors of the last decades have left their traces, too.

The natural cave has a length of 9.7 m and a maximum width of 7.4 m. Further to the E the well-known rectangular section of the tunnel excavated from the tufa bedrock reappears, but now it is massively filled with very compact earth which has also made its way into the natural cave, where there is a transitional zone between the arenaceous deposits and a much more compact earth layer. Presumably in recent times a trench was dug in the centre of the infill, with the intention to reach the E end of the tunnel. This trench allows the inspection of the following 12 m, at least on all fours (Fig. 14). After this point the tunnel is closed off almost to the ceiling. From here, the tunnel seems to be sealed completely for at least some further 10 m. Some scratch marks on the ceiling in the trench section have already been mentioned which cannot be of recent origin. Rather, in this final part of the tunnel the material seems to have accumulated for centuries. Two stray finds come exactly from these last metres of the trench: a huge dolium rim fragment, and a decorated XVI-XVII centuries potsherd which may be used

as scarce evidence that the tunnel was still in use as a communication road up to that period.

Thanks to the exact survey work of the system hitherto described, the last accessible point in the trench could be precisely determined by superimposing the plan on the topographical map. It corresponds exactly to the junction of via Cornalba and via Lograto on the E slope of the Flaminia ridge, the latter being a secondary but asphalt access road to some individual buildings and leading down, in its first part, in the direction of Fosso del Drago, then twisting off before reaching its bottom (cf. Fig. 1). We tested the accuracy of this result (suggested also from the comparison of the altitude lines indicated on the Carta Tecnica Regionale of that area) by leaving a transceiver in the furthest accessible point in the trench and then checking on the surface where the receiver would get the strongest signal. The corresponding point with the E board of the cross-way gave us a clear confirmation that our map was correct. The position of the former E entrance, finally, can be fixed some 10 metres below the cross-way, in the field a few metres S of Via Lograto. Once this location had been ascertained, it seems, even today, that a slight cavity in the field is visible (Fig. 15). Given the smooth inclination of the hill on this side (cf. Fig. 2), it is likely that the road progressively entered a trench here before plunging underground. Such a morphological situation was predestined to slacken in the course of time, and if JUDSON & KAHANE, 1963, described the entrance as 'bramble-choked' some 50 years ago, it is most proba-



Fig. 13: sandstone cave C (photo V. Puggini).  
 Fig. 13: grotta di arenaria C (foto V. Puggini).

ble that it had already been partly filled up and almost invisible for a long time before. In the end only a little levelling work was necessary to regain an agricultural area, thus sealing definitively the E entrance of the underground tunnel and cutting off the historical communication road. But if it is now again possible to link the cavity in the field with the ancient course of the road, one can say its last traces have not yet completely disappeared.

#### Contextualisation: suggestions and open questions

This brings us to final reflections on the topographical context and on how traffic through this underground tunnel may have been handled in its first period.

First, some words on topography. As it is immediately evident from a glimpse on the maps, the surface morphology of the landscape N of Rome is generally characterized by long ridges and river valleys stretching all the way in a N-S strike, parallel to the Tiber valley. This had (and still has) direct consequences for the viability as east-westbound traffic is subject to a series of obstacles such as steep slopes. This underlines the importance of seeking lateral tributary valleys to assist in establishing easy communication lines and in order to minimize the number of steep uphill and downhill tracks.

In this respect, the position of our tunnel is chosen almost ideally. It is only here that the tributaries of the Tiber valley arrive very close to the Flaminia ridge. Starting from the supposed E entrance of the tunnel, continuing eastward the presumed course of our transversal road, we arrive after less than 300 m at Fosso del Drago, a valley where tufa rocks have been quarried in several zones about one kilometre upstream. The Fosso del Drago leads after another 700 m to Valle Lunga, at whose eastern banks the much more famous tufa quarries of Grotta Oscura extended (CARBONARA & MESSINEO, 1996; SISANI, 2007). Both quarries have been active since Etruscan times, but mining activities (including underground quarrying) started in grand style only after the Roman conquest of Veii: the Grotta Oscura tufa was used as building material during the renovation of the Republican City Walls and for a large



Fig. 14: buried tunnel track D with trench (photo V. Puggini).  
 Fig. 14: tratto interrato D del tunnel, con trincea (foto V. Puggini).

number of architectural structures of Republican temples (such as the podium of the Cybele temple on the Palatine) and other monuments (LOMBARDI & MEUCCI, 2006; GIAMPAOLO et al., 2008).

The important role of the road tunnel under the Flaminia ridge as a communication road between the Etruscan town of Veii which is at an airline distance of only about 6 km from the W entrance of the tunnel and the Tiber Valley, as well as the cave district situated between the Flaminia ridge and the Tiber, has already been stressed by Prof. B. WARD-PERKINS and his collaborators, and this has now been fully confirmed by the evidence documented during our mapping activity. The British survey team successfully showed in the '60s how the communication road followed the most natural line and the most smooth passage beyond the numerous ridges and valleys, with the best possible adaptation to the morphology of the terrain (KAHANE et al., 1968). No doubt the general conditions for such a large-scale survey project were much better than they would be today. In the '60s it was still possible to walk around in the countryside without any hindrance as the territory was sparsely populated, but at the same time carefully cultivated, and many elements of the ancient viability had remained preserved up to those days. In the last decades this situation has changed radically. The rapid increase in construction often has erased the testimonies of ancient settlement, economy and infrastructure. Also the new property limits and their fencing have made further access to the surviving ancient remains impossible or make it hard to understand elements now isolated that once had belonged to the same functional context. This is a phenomenon about which much has been written for at least the last 30 years (cf. also the considerations in BONAMICO et al., 1968). Also in our case the logical communication line between the upper part of Via Lograto (which could be called in some way the successor of our transversal road) and the Fosso del Drago is interrupted by a private property which makes it impossible to retrace the ancient pathway. The situation on the W banks of Fosso della Torracchia, as well as in the cave zone of Grotta Oscura further in the E, is no better.

Surely it would be too restricted a view to see in our



Fig. 15: location of original E entrance, seen from the position of the last accessible point in D (\*) (photo V. Puggini).

Fig. 15: posizione dell'ingresso originario est, vista dal punto in corrispondenza con l'ultimo punto accessibile D (\*) (foto V. Puggini).

W-E road a mere access road from Veii to the caves. In reality the traffic on it was generated by quite a large number of factors. For example, agricultural products were brought to the Tiber Valley for shipping and exporting. In turn, the limestone material extracted in the Tiber Valley had an importance also for Veii (POTTER, 1979). Nevertheless, it seems more than legitimate to assume the need to start a project so laborious as an underground tunnel of 340 metres in length was a direct consequence of an intensification of the tufa quarrying activity (BUSANA, 1997). The underground passage would have been a substantial improvement to transportation. It allowed people to avoid an uphill and downhill passage, a 'formidable obstacle to lateral traffic', as was defined by WARD-PERKINS in KAHANE et al., 1968, with a difference in altitude of about 40 metres on each side. As we have seen, the W slope towards Fosso della Torraccia is particularly steep (Fig. 2). In this context it should also be recorded that it is very interesting, even without a final proof, to see the tufa blocks found in the tunnel in a direct relation with the caves to the E of it.

Another consideration which focuses on the digging technique of the tunnel might also assist in assuming a functional relationship with the quarrying activities. The extremely rectangular section of the tunnel, together with the fact that it was excavated from the rock without the help of a shaft, sets it among the unique group of examples of ancient tunnel construction. In the overwhelming number of cases, the ceiling of ancient tunnels has low vaults instead (BUSANA, 1997). Could it not then be that it was the same workmen

who worked in the quarries and were commissioned to do the excavation of the tunnel? At least the horizontal ceiling makes one think that they applied the same digging technique they were used to from the quarries (VENIER, pers. communication). Also from an economic viewpoint this seems not a too far-fetched idea.

If then we have to imagine a certain amount of traffic with block-loaden carriages (which may well have generated at least some of the scratching marks mentioned above), some practical questions arise. The general width of 2.1m (another feature with only few counterparts; see BUSANA, 1997) allows the passage of carriages travelling only in one direction at the same time. How was the traffic organized in order to avoid the tunnel being blocked by carriages starting to travel from both sides simultaneously? Although a number of examples for passing places in the form of wider sectors in ancient tunnels is known, this does not seem to apply for the enlarged space B in our tunnel, for several reasons:

- a) it is too close to the E entrance and would thus have been of little help in solving eventual conflicts within the tunnel;
- b) the space does not seem to have belonged to the original concept;
- c) the space is too limited for allowing a manoeuvre of two carriages.

One possible solution would be to imagine one-way traffic. Loaded carriages were allowed to use the tunnel, while the empty ones could have used another road.

But probably this was not even necessary. One has to take into consideration that the visibility of the total

stretch of the tunnel is today compromised by the massive and irregular increase of the ground level mainly on its W part. In other words, it is likely that the 350 metres of straight track were perfectly manageable from each entrance. It could have sufficed to station a traffic director at each end in charge of guaranteeing smooth traffic circulation in the tunnel.

Last but not least, as to the functional closeness of tunnels and quarries, a very interesting remark in the short report by CARBONARA & MESSINEO (1996) about the existence of a second tunnel linking the Grotta Oscura quarries directly with the Tiber Valley should be quoted here: 'from there (i.e. a nucleus of the Grotta Oscura quarries closer to the access road from Via Tiberina), it seems that a tunnel road departed with downward inclination and, passing below the ridge, re-emerged in vicinity of the Tiberina (road), thus allowing easy transport of the material to the banks of the Tiber'. This second tunnel is today buried under the rock debris because the whole area had been occupied during the Second World War by German troops and before withdrawing they blew up their underground hiding places. This is most unfortunate since it would have been of extreme interest to compare the two monuments – both were inclined, it seems, both were in direct functional context with the tufa quarries and both may once have made up part, one is attempted to think, of the same transport system.

Let us conclude with some chronological considerations. While the W-E transversal in general has certainly been of substantial strategic importance from about the V century B.C. onwards for linking the territory of Veii with those of Gabii and Praeneste, the tunnel may or may not have been constructed at the same time (ROSICA et al., 1997, however, believe that it cannot but date from the time of origin of the road). As we have seen, its construction constitutes an enormous effort, and a need for facing such an effort may well have been felt only after expanding quarrying activities. This means that even if the Etruscan nature of the road tunnel has very much plausibility,<sup>5</sup> no final proof for it can be put forward at the moment – even more so as the same roads continued to be used and maintained after the Roman conquest of Veii (KAHANE et al., 1968). As far as the later history of the tunnel is concerned, it is reasonable to assume that it had some logistic importance for all the different forms of settlement in the Fosso della Torraccia sketched in the opening lines of this paper, from the Roman villa (BUSANA, 1997) up to the medieval castrum, and it is possible that the road had even some super-regional relevance up to just a few centuries ago.<sup>6</sup>

5) A similar debate is also open about the chronology of the short Pietra Pertusa tunnel. An inviting hypothesis would be to interpret it as another original Etruscan access road to tufa quarries in the S zone of the Fosso della Torraccia, reused in Roman times as an access road to the villae.

6) If it is true that the tunnel under the Flaminia ridge has kept its significance for several centuries, one might also speculate if it was not this one rather than the short rock cut which originally gave birth to the toponym 'Pietra Pertusa (= perforated)' used today for the whole district (KAHANE et al., 1968).

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