

## New Wine for Old Bottles: New Research on the Sources of the Aqua Traiana

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**Fig. 1.** Central chamber of the artificial grotto of Santa Fiora as it appeared in 2009 shortly after its rediscovery. The low door in the right-hand wall leads down into the springhouse. Photo: R. Taylor.

This article aims to bring readers up to date on investigative fieldwork at the sources of the Aqua Traiana, the aqueduct introduced to Rome by the emperor Trajan in 109 AD. Field reconnaissance to recover and document the aqueduct's headwaters began after the discovery in 2009 by two of the present authors, Edward and Michael O'Neill, of a monumentalized source of the aqueduct at a site called Santa Fiora. The source architecture consisted of an artificial grotto in three sections set into a wooded slope in the hills near the town of Manziana above the western shore of Lake Bracciano. The easternmost

chamber of this tripartite grotto was a springhouse connected to capacious intake and offtake galleries (fig. 1, fig. 2).<sup>1</sup> Until the late nineteenth century, the church of the Madonna della Fiora had stood directly over the grotto. The springhouse continued to supply the town of Bracciano with water until 1984 when the drilling of new wells in the vicinity depressed the water table.

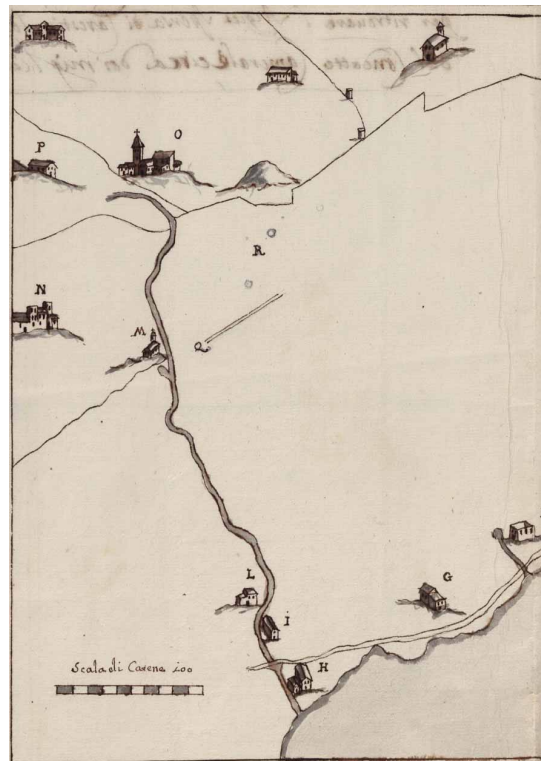
We supplemented our initial publication of Santa Fiora with a brief treatment of an equally monumental source nearby called Carestia in seventeenth-century documents but subsequently lost to memory (fig. 3, fig. 4).<sup>2</sup> We also brought

to light various segments of the aqueduct's branch conduits along four ravines feeding into the lake from the west and north (fig. 5). From south to north, these are: Fosso Bocca di Lupo, encompassing a multitude of springs at Pisciarelli and Grotte Renara; Fosso della Fiora, running from Santa Fiora down to the alluvial flats of Vigna Grande on the lake; Fosso delle Terme, terminating at the flats of Vigna Orsini (Vicarello), within which lies a large Roman cistern that once supplemented the nearby thermal baths (see below); and Fosso della Calandrina, which preserves

sections of a large branch conduit similar to that of the Fiora running parallel to its stream. In each case these branch conduits ran radially down to the main conduit, which followed a path more or less equivalent to the modern channel of the Acqua Paola, tracing a clockwise circuit around the lake not far from the shore. This latter aqueduct, introduced by Pope Paul V Borghese in 1607–1612, was conceived from the very beginning as a revival of the ancient aqueduct. Its engineers consciously sought out the original source architecture scattered about in these four ravines to supply it.<sup>3</sup>



**Fig. 2.** Springhouse of Santa Fiora. The arched intake gallery can be seen below the oculus in the vault. Photo: R. Taylor.



**Fig. 3.** Detail of a 1716 map representing the Fosso della Fiora and vicinity. Feature “M” is the church of Santa Fiora overlying the spring; “Q” is labeled “conduit which collected dispersed water called the Carestia and brought it to the Fiora.” Orsini Family Papers, Collection 902, Charles E. Young Research Library, University of California at Los Angeles.



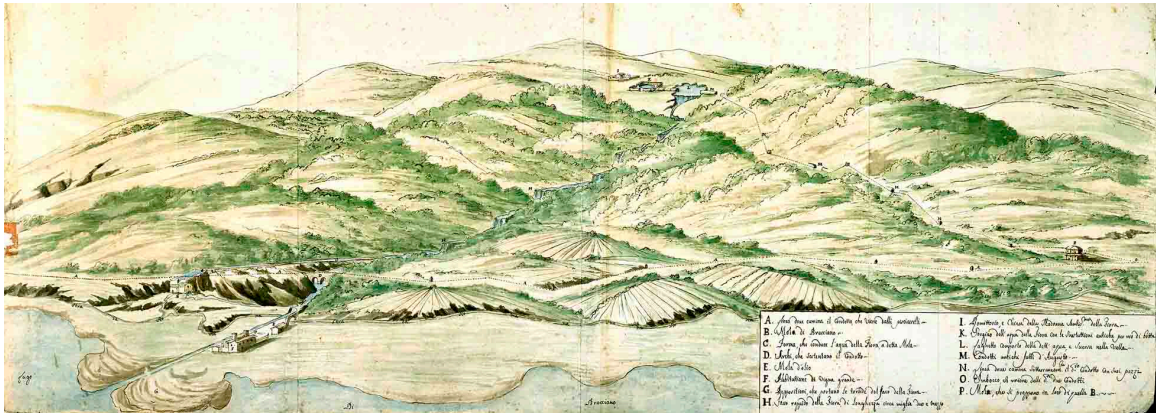
**Fig. 4.** Ruined main chamber of the Carestia source in 2010. Photo: R. Taylor.

### A newly discovered route for the waters of Santa Fiora

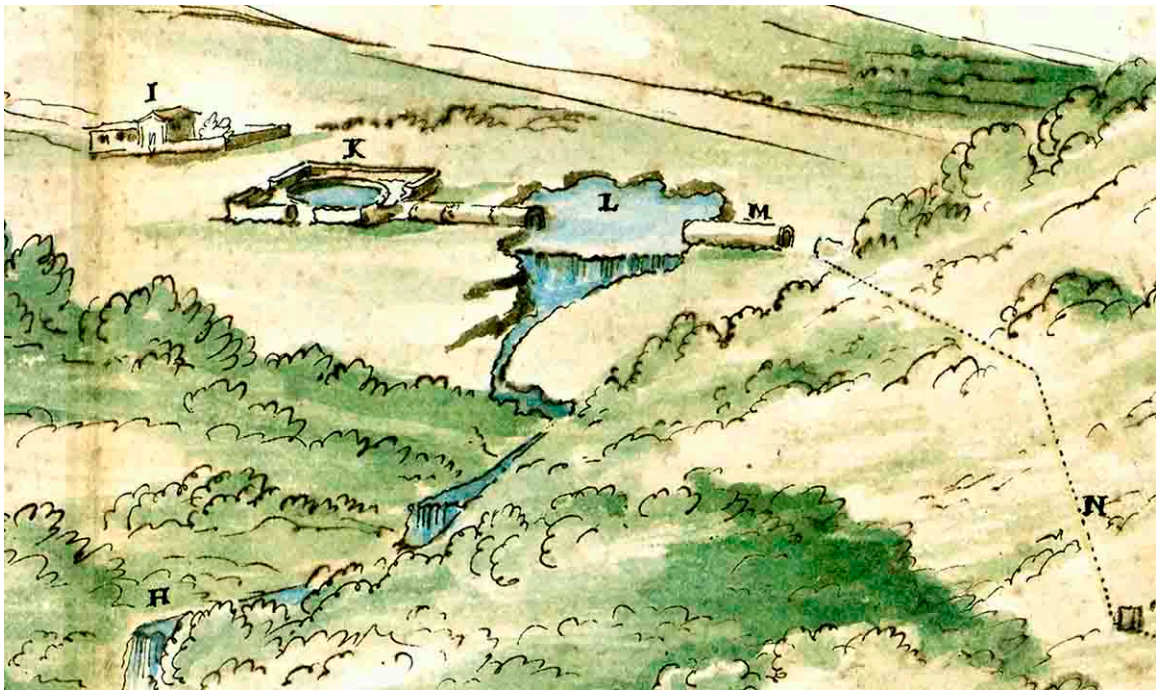
Taken together, the Fiora and Carestia springs may have delivered more water than the rest of the ancient system combined.<sup>4</sup> In the late sixteenth century, when the popes expressed interest in resuscitating the ancient aqueduct, both springs were still functioning along with a third called Matrice. These were delivering an impressive volume of water to a mill complex at Vigna Grande, where the Fosso della Fiora debouches into the lake; but the Fiora was by far the most abundant of them.<sup>5</sup> Today the Carestia is a desiccated ruin, while the Matrice is out of service.



**Fig. 5.** Lake Bracciano with major features of the Aqua Traiana and Acqua Paola. Map; M. McCullough.



**Fig. 6.** Carlo Fontana’s color sketch of the Santa Fiora hydraulic system in 1691 or 1692. Vigna Grande is in the foreground on the left and Vigna Orsini appears on the far right. The main conduit of the Acqua Paola can be seen crossing the Fosso della Fiora on a double-arched bridge. © The British Library Board, Maps 7 Tab 46 (9).



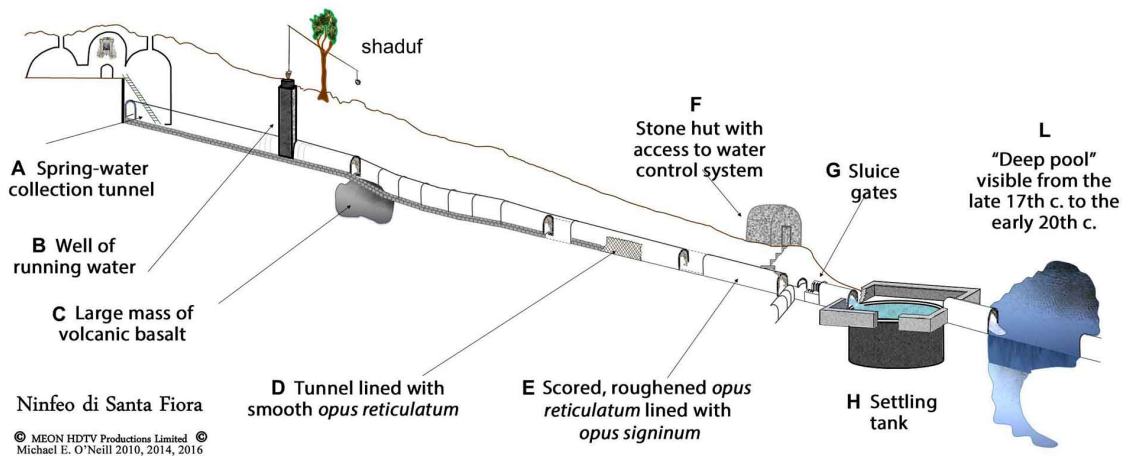
**Fig. 7.** Detail of fig. 6.

In 2014 one of the present authors, Edward O’Neill, published an ink and watercolor drawing of Santa Fiora and its water delivery system accompanying a survey undertaken by the architect Carlo Fontana in 1691 and 1692 (fig. 6, fig. 7).<sup>6</sup> Commissioned shortly after the Odescalchi family had acquired this territory from the Orsini, Fontana was charged with two main tasks: to represent the Fiora system as it existed, and to recover the spring’s ancient conduit in

the hope that it could be restored in order to power a new mill farther north at Vigna Orsini. The watercolor represents several hydraulic features of the Santa Fiora system, some of them otherwise unattested. Just downhill from the modest church of Santa Fiora (feature “I” on the map), which lay directly over the springhouse, is feature “K,” a circular basin set within a square enclosure; Fontana remarks in the key that its substructures are ancient. From it

emerges a conduit—again, ancient Roman—emptying into pool “L,” which is dammed with a weir. The weir may originally have been a masonry wall encasing a short siphon carrying the Fiora’s water under the natural streambed of the ravine, a feature seen elsewhere in the Aqua Traiana system. By Fontana’s

time, the conduit had broken and emptied its contents into the stream. Beyond this the now-empty conduit resumes, breaks, and then runs slightly underground along the hill’s contours in an oblique direction from the ravine. Fontana then followed the conduit underground, marking its vertical service shafts along the way.



**Fig. 8.** Schematic drawing of the source and upper conduit of Santa Fiora incorporating features known from fig. 6, other published sources, and field reconnaissance. Graphic: M. O’Neill.

The basin and pool lay downhill from the known sector of the ancient conduit heading downstream from the source (fig. 8). The ravine is particularly deep where the conduit meets it, but it cannot be closely inspected due to the impenetrable brambles along its banks. A century ago, Thomas Ashby saw a deep pool here and a steep drop of some 15 m, from which we can infer that the weir was still in place.<sup>7</sup> Fontana’s associated ink sketch marks the dead branch of the aqueduct with particular clarity (fig. 9). At its end, where the Fiora water once merged with the main conduit of the Aqua Traiana, Fontana drew the proposed mill.

Nothing ever came of the scheme to reclaim this sector of the conduit, and to our knowledge, apart from Fontana’s drawings no map ever represented it. The

ancient aqueduct route remained lost to history until a few years ago. On the basis of known elevations, we traced the likely route of the branch starting at about 300 m.a.s.l., following the contours of the hill northeast with a final descent to the flats of Vigna Orsini, the site of the intended mill. With the Assistance of Dr. John Hessler of the Library of Congress, we produced various geospatial models of the route (fig. 10), but were unable to verify it in the field. However, a speleological team, relying only on GPS and field reconnaissance, has traced almost the entire ancient conduit; thus we can confidently map most of its route in Google Earth today (fig. 11).<sup>8</sup> Over the course of three years they found numerous segments of the derelict channel and many of its vertical service shafts.

Their results conform gratifyingly to our own conjectural path extrapolated from Fontana's drawings.

Along the way, the conduit crosses three small draws. The first crossing is a low bridge, its exterior displaying a common Trajanic style of *opus mixtum*: a continuous lower band of brick underlying a broad zone of tuff reticulate, which in turn probably carried another band of brickwork, now eroded away. In

its simplest form, this style is seen elsewhere along the Traiana's conduit.<sup>9</sup> Here, though, the continuity of the reticulate is interrupted at intervals by vertical bands of brick in a notched pattern (fig. 12) of a sort well known throughout Roman Latium and Campania.<sup>10</sup> The other two crossings were underpasses—perhaps small siphons—forming weirs across the draws.

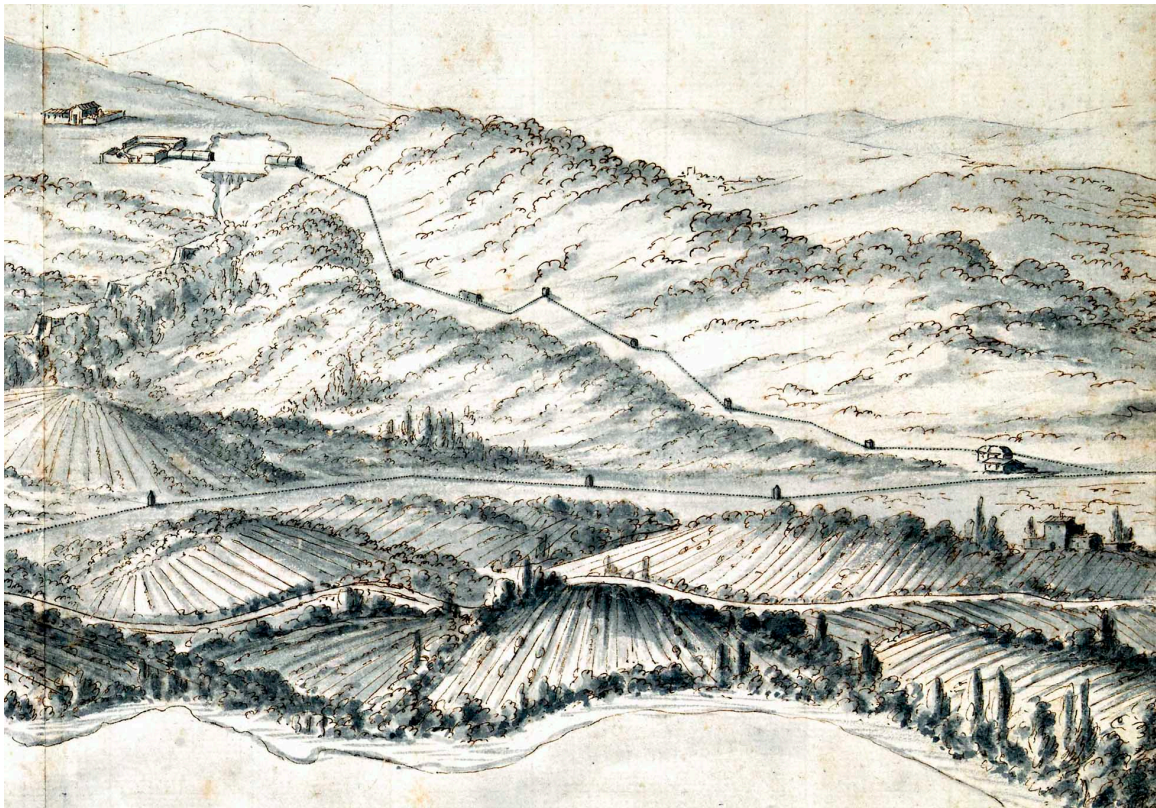


Fig. 9. Detail of Fontana's ink sketch of the Santa Fiora hydraulic system from the 1691-1692 survey. © The British Library Board, Maps 7 Tab 46 (8).

### Underpasses

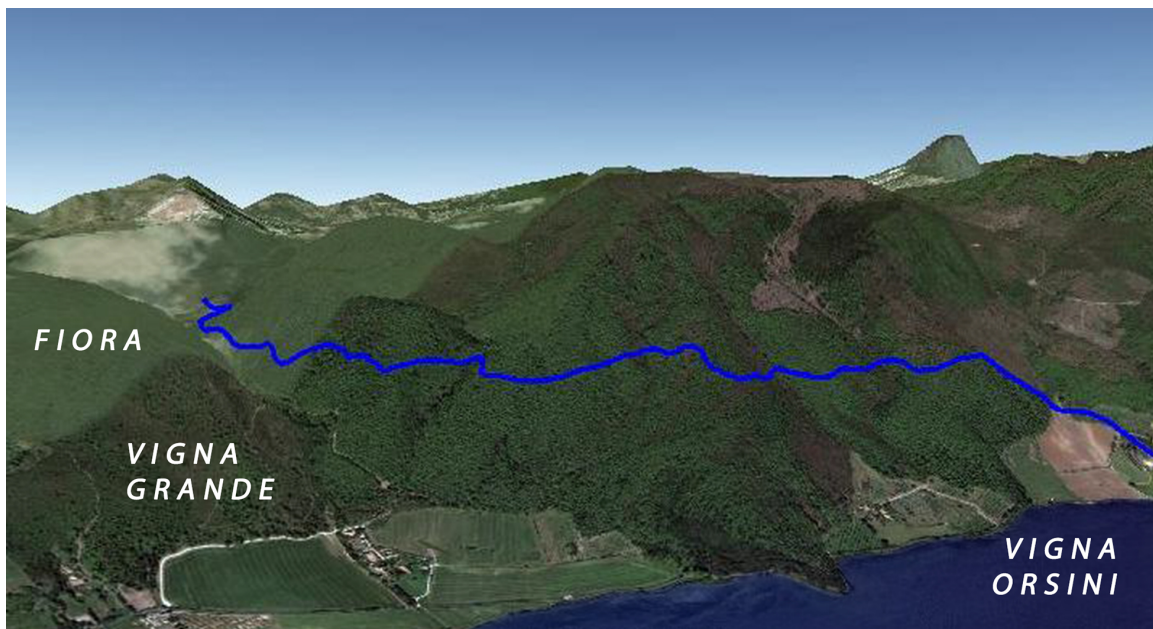
In 2010 we examined a similar weir-underpass farther south in the system crossing the Bocca di Lupo stream at Grotte Renara (fig. 13). The aqueduct's concrete casing runs directly athwart the stream, creating a humpbacked shelf across the descending bed over which tumbles a gentle cascade. A vertical service shaft with a rough mortared-

fieldstone wellhead intersects the conduit on one bank; this communicates with a brick-lined, vaulted reservoir, perhaps a regulating tank for a siphon (fig. 14, fig. 15).<sup>11</sup> That the Aqua Traiana's engineers widely adopted the unusual technique of threading an aqueduct directly through a weir signals their high confidence in the durability and impermeability of the aqueduct's masonry casing, for at these

crossings it would have been in constant contact with moving water on both the outside and inside while keeping both flows perfectly sequestered.

Such an unorthodox design may seem odd when a modest bridge, or a complete underpass,<sup>12</sup> would have done the job without impeding the stream's flow. But quite apart from aqueduct systems, we have observed evidence of rudimentary damming on the upstream side of fords across some of the rapidly descending streams in this area.<sup>13</sup> Steep streams are shallow streams, made even shallower if an aqueduct has captured some of their sources. Thus the purpose of the weirs is evidently to create convenient drinking basins for animals crossing the streams in the dry summer months when the flow is reduced to a trickle. Roman aqueducts, of course, sometimes had to cross streams. When they did, people and animals were

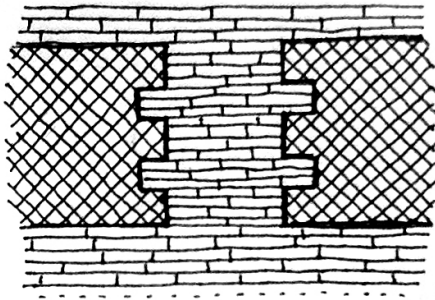
apt to ford the stream alongside them. As Frontinus relates, in extraurban zones a continuous service corridor fifteen feet to a side enveloped every conduit of Rome's aqueducts. Corridors of varying widths are known from other regions of the Roman world.<sup>14</sup> Whether a conduit ran above or below ground, the corridor following it comprised a broad, continuous, and effectively well-tended country lane with public access. At the Aqua Traiana weir-crossings, we can suppose that herds, livestock, horses, and service animals would all have passed along the aqueduct branches' corridors and benefited from the watering troughs fashioned just above the fords in the streams. Simultaneously, their masters or drovers could have availed themselves of the aqueduct waters by lowering a bucket down an adjacent service shaft.



**Fig. 10.** Northeasterly route of the Santa Fiora channel as hypothesized in 2010–2011. Geospatial model by J. Hessler, Geography and Map Division, Library of Congress. This route was largely confirmed by Germani and Colombo 2015.



**Fig. 11.** Northeasterly branch conduit of the Santa Fiora and Carestia sources. Terrain background © 2016 Google.



**Fig. 12.** Masonry style of the bridge discovered by Germani and Colombo (2015) with a hybrid *opus reticulatum* and a stylized *opus latericium* facing. Graphic: R. Taylor.

### The Grotte Renara sources

From the start of our investigations, we have observed that the Acqua Paola made prolific use of Trajan’s ancient aqueduct system, regularly reappropriating and restoring the springhouses, conduits, well shafts, and reservoirs of its ancient ancestor. Much of the field reconnaissance that has advanced our knowledge of the ancient aqueduct, and the extent of the Acqua Paola’s restoration of it, has dwelt on the region of the aqueduct’s remotest southern sources—especially at Grotte Renara (fig. 16). Between our own



**Fig. 13.** Aqueduct underpass forming a weir across the Bocca di Lupo stream at Grotte Renara. Photo: E. O’Neill.

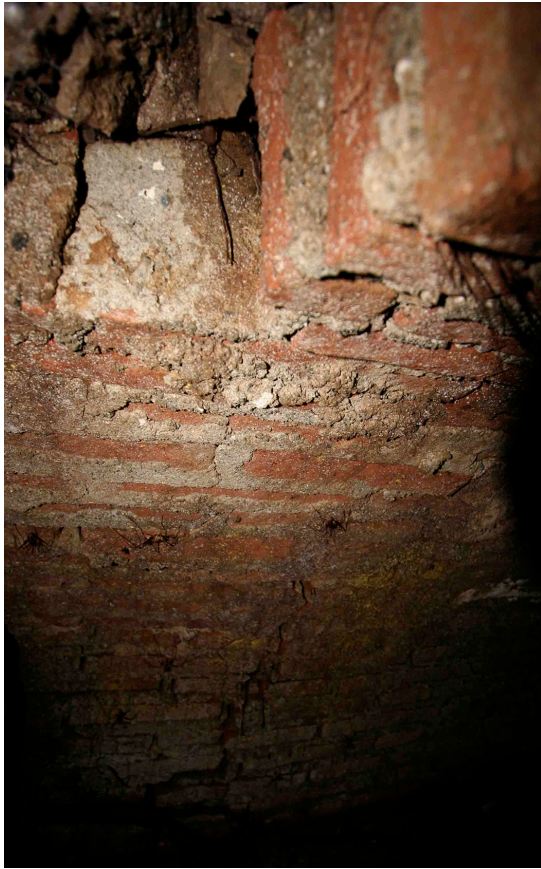


**Fig. 14.** Access shaft aligned with the underpass at Grotte Renara. Photo: R. Taylor.

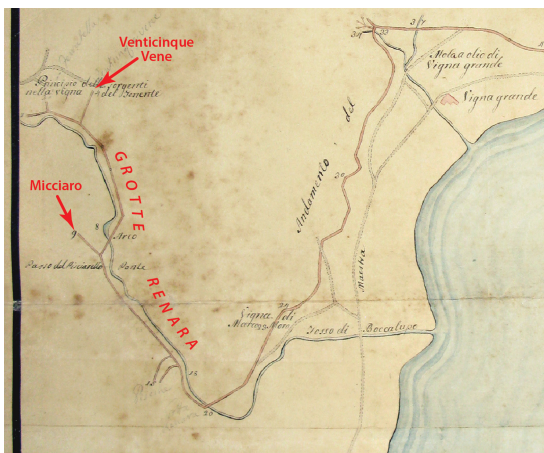
team and an independent group of Italian investigators, at least five springhouses of this kind have been identified in recent years here (fig. 17).<sup>15</sup> Large or small, they all display a uniform architecture utterly unlike that of the Santa Fiora system or the handful of sources we have investigated to its north. While their upper walls and vaults may be plastered, none of them has any kind of wall treatment at water level, apart from an occasional patch of mortar.



So far, the collection chambers of these springhouses have not been securely dated but the masonry is decidedly of Roman imperial character. The walls are routinely faced with brick work in the



**Fig. 15.** Brick-and-mortar vaulting of the reservoir connected to the access shaft and underpass at Grotte Renara. Photo: R. Taylor.



**Fig. 16.** Detail of nineteenth-century map of the Acqua Paola system. Archivio di Stato, Rome, Disegni e Piante I 113bis.

lower zone where the water filters into the chamber. Along the bottom of one or more sides the wall is perforated by a row of uniform pentagonal intakes crowned with pitched bricks; an especially monumental example is the collection chamber of Fonte Micciaro, featuring thirty-nine intakes along three sides (fig. 18).<sup>16</sup> The bricks resemble those found elsewhere in the system, their fabric ranging in color from light buff to deep orange. Many are intentionally broken or sawn in the Roman manner and occasionally a characteristically triangular form can be seen (fig. 19).<sup>17</sup> The barrel vault of the Micciaro springhouse has seen numerous collapses and repairs in post-antique phases, and no part of it can be called definitively Roman. But its precisely semicircular profile and repeating board pattern seem to follow ancient precedent (see fig. 18). Uniquely among the known springhouses, stone corbels project from the wall at the springing of the vault to carry the centering frames. The offtake channels in Grotte Renara tend to be paved with Roman bricks of standard sizes. Some are lined with continuous stepped brick moldings along each side of the floor.

In summer 2015, our team investigated a springhouse of this design in the town's public forest (Macchia della Fiora), this one with twenty-five intakes (fig. 20). Though it is still part of the municipal network of ACEA, the main water and energy authority in the Province of Rome, it has escaped the attention of archaeologists. Characteristically for this design, the wall intakes are not independent but simply form a sort of arcade in the lower part of the wall to allow abundant flow into the collection chamber from the aquiferous rock behind (fig. 21).



**Fig. 17.** Small spring chamber near Venticinque Vene (source of the twenty-five intakes), with three visible intakes, Grotte Renara. Photo: R. Taylor.



**Fig. 18.** Fonte Micciaro springhouse, Grotte Renara. Photo: M. O'Neill.



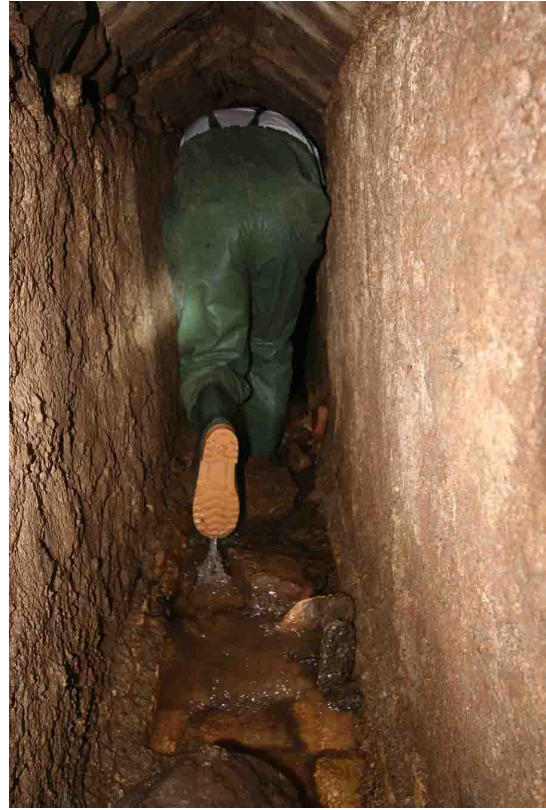
**Fig. 19.** Fragmentary triangular brick at Fonte Micciaro springhouse displaying the pawprint of a dog. Photo: E. O'Neill.

### **The brick stamps of Grotte Renara**

The offtake channel at this springhouse begins at one end of the narrow chamber. It is very cramped—barely shoulder-breadth, traversed only in a crouching or kneeling position (fig. 22). The first few meters of its floor are paved with what appears to be modern brick. But just beyond a shallow drop-off the character of the floor changes dramatically (fig. 23). Here it is paved with ancient *sesquipedales* (square bricks 1.5 Roman feet to a side) and edged with stepped molding made of sawn and stacked *bipedales* (bricks 2 Roman feet to a side). In this sector we identified two partial Roman brick stamps directly opposite each other in the upper tier of the stepped molding (fig. 24, fig. 25).



**Fig. 20.** Springhouse of Venticinque Vene, Grotte Renara. Photo: R. Taylor.



**Fig. 22.** Offtake from the springhouse of Venticinque Vene. Photo: R. Taylor.



**Fig. 21.** Detail of an intake at the springhouse of Venticinque Vene. Photo: R. Taylor.

Brick stamp discoveries remain rare in the ever-growing repertory of Roman remains in the aqueduct network of this region, but those that have turned up, to our knowledge, are mostly in situ in the Grotte Renara source architecture.<sup>18</sup> This sample bias is only to be expected given that the floors of Roman brickwork are exposed to view in these sources whereas the larger source channels to the north either still bear their protective lining or are encumbered with silt and debris.

The two stamps we found at the spring of twenty-five intakes belong to a series produced at the brickworks of Marcus Rutilius Lupus in the Vicus Brutianus, a neighborhood of ancient Rome west of the Tiber, perhaps not far from the clay beds of Monte Mario in the Vatican.<sup>19</sup> Both stamps are of the familiar *orbiculus* form bearing a small circle set eccentrically within a larger one; in each case, about half of the stamp or less is

preserved. The first, displaying the letters LVP- around the border, probably corresponds to the subtype 29e in volume 15 of the *Corpus inscriptionum Latinarum* (hereafter *CIL*), which carries the legend BRVT LVPI counterclockwise around the circular border. The second, bearing the letters -TIANA around the border, originally read BRVTIANA with the name LVPI on a second line. It has the same *CIL* number but could belong to any of the variants a, b, c, or d.

Subtype 29e has been found in two relatively datable monuments, the Baths and the Markets of Trajan in Rome. The great baths, built over a defunct wing of Nero's Domus Aurea on the Oppian Hill, were dedicated—though not necessarily finished—on June 22, 109. Since the



**Fig. 23.** Sector of the offtake from the springhouse of Venticinque Vene displaying the Roman floor. Photo: R. Taylor.

Aqua Traiana supplied them from the start, it is to be expected that the brickworks were serving both projects concurrently. According to the *CIL*, eleven examples of this subtype were found in “the outer part of the semi-circular wall where the entrance is now,” evidently the great southwestern exedra of the bath platform accommodating the modern entrance to the Domus Aurea. Eleven more were observed in one of the straight dividing walls of this structure. No dedication date is recorded for the Markets of Trajan but the abundance of brick stamps found in the fabric of this sprawling complex overlooking the Forum of Trajan suggest a fairly relaxed trajectory of construction spanning several decades from the reigns of Domitian to the Antonines. The single example of 29e found here does not shed any additional light on the matter.<sup>20</sup> The stamps of Lupus' brickworks are well represented in the vicinity of Rome generally, and many carry consular dates.



**Fig. 24.** Fragmentary Roman brick stamp in the floor molding of the offtake with illustrated reconstruction of the surviving portion. Photo: R. Taylor.

But 29e offers no such specificity. Thus the years of its production cannot be much refined beyond a blanket attribution, favored by several specialists, to the period immediately preceding 110 A.D.<sup>21</sup>

Also in the Grotte Renara region, the speleologists Elena Fellucca and Cristiano Ranieri found a source they call the Cinque Vene after the five pentagonal intakes in the wall. Along the floor of its offtake channel they photographed a perfectly preserved stamp from the prolific and well-known brickworks of Anteros Severianus, which supplied many of the major Trajanic and early Hadrianic monuments in Rome as well as Hadrianic buildings at Ostia.<sup>22</sup> This particular example corresponds to either *CIL* 15.811e or 811f. In her 2001

publication of the brick stamps from the Forum of Trajan, Elisabetta Bianchi bundles them together as 811e–f, though the group comprises at least three variants.<sup>23</sup> Of this group, eight examples have been found in Trajan’s Basilica Ulpia at Rome, or more probably the libraries or stairwells adjoining it; two others were reported in the 1991–2000 excavations on the southeast side of the forum—one in a stairway, the other in the sunken forecourt.<sup>24</sup> Eight more are known from the Markets of Trajan.<sup>25</sup> The Forum of Trajan, which culminates at the northwest with an enclosure framed by the basilica and libraries, was dedicated on January 1, 112; the Column of Trajan, centered within the enclosure, in May 113.<sup>26</sup>



**Fig. 25.** Fragmentary Roman brick stamp in the floor molding of the offtake with illustrated example of *CIL* 15.29c, one of four potential analogues to this example. Photo and graphic: R. Taylor.

Lise Hetland dates almost all of Anteros' other types provisionally to about 115–124.<sup>27</sup> 811f, however, is usually placed earlier, apparently just on the evidence of one example found in the Baths of Trajan (the *CIL* gives no more precise information about the findspot).<sup>28</sup> As we have seen, the Baths were dedicated on June 22, 109; the Aqua Traiana's dedication followed only two days later. But one must bear in mind that a monument's dedication date offers no guarantee that it had reached completion by then, and a milestone date such as the Forum of Trajan's—January 1, 112—should arouse particular skepticism.<sup>29</sup> In fact, Bianchi documents 17 bricks from the southeast side of the Forum that can be dated securely to 117 or later, half a decade after the dedication date, and the adjacent Markets contain 18 stamps dating between 115 and 123, constituting fully 27 percent of all the site's known stamps produced up to that time.<sup>30</sup>

Further, the justification for back-dating 811f by comparison with all the many other variants of 811 on the basis of a single example found in a building dedicated in 109—the Baths of Trajan—is considerably impaired when one considers that *another* example of 811f was found in situ in the rotunda of the Pantheon intermixed among numerous other 811 subtypes, none of which Hetland dates before 115.<sup>31</sup> Her reexamination of all the Pantheon's brick stamps leads her to conclude that construction of the famous temple's rotunda commenced not long after the fire that destroyed its predecessor in 110.

To summarize: we have two stamps at one source that could have been produced not long before 109 and a stamp at another nearby source that may well bear a production date after 109. Hypothetically, then, we confront the possibility that *at least one* springhouse

of Grotte Renara, and perhaps two, were begun at a moment very proximate to the dedication date of the Aqua Traiana (June 24, 109), or even later. Whether the other sources of this region will bear out this interesting development remains to be seen. We hope to revisit our hypothesis when Giorgio Filippi of the Vatican Museums publishes additional brick stamps that speleologists have recently found in other sectors of the Grotte Renara network.

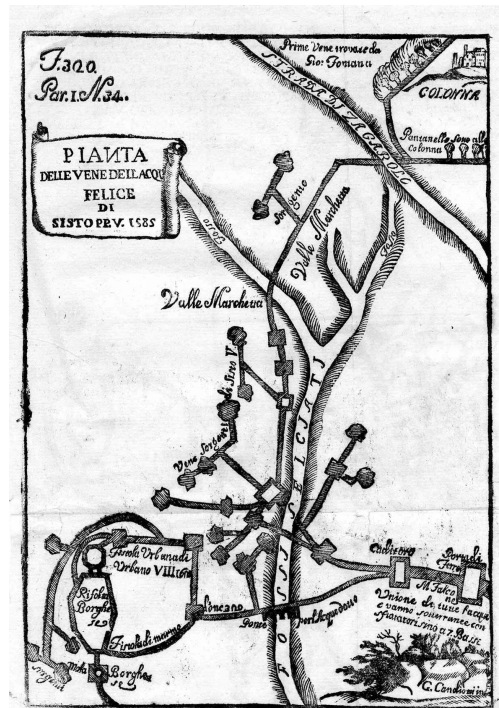
### **Why the dates matter**

There is good reason to support such a staggered chronology. Due consideration of independent evidence may suggest that the Aqua Traiana system originally began well north of Grotte Renara, at Santa Fiora and the nearby Carestia springs. These sources, being in aggregate far more copious than the southern sources and highly visible to the surveyors of the initial aqueduct, would have been the Aqua Traiana's logical starting point. More remote, lower-volume springs could be gathered piecemeal into the system later.<sup>32</sup> Further, if the aqueduct commenced at Santa Fiora, that would explain an otherwise puzzling feature of its plan—the oblique northeasterly path of the Santa Fiora branch recorded in Fontana's drawings and recently confirmed by the speleologists (see figs. 9–11). This should more efficiently have been sent straight down the Fosso della Fiora to join the main aqueduct line skirting the lake. Let us recall that the Fiora's conduit in the early modern era, though it did not merge with the Acqua Paola's main channel, ran directly down the Fosso: Fontana depicted it descending in a series of cascades to the big mill at Vigna Grande down by the lake (see fig. 6).<sup>33</sup> But in antiquity (presuming there was no early ancestor of this mill) the shorter spoke to the lakefront would only

have been justified if it terminated at a junction—that is, if the main line already existed at Vigna Grande to intercept it, having continued its circuit northward from Pisciarelli and the Grotte Renara sources.

But what if the entire southern system was a late addition, or an afterthought? The way that its springhouses were designed and built, in a manner internally consistent but distinct from what is known of the rest of the system, bespeaks a separate contractor overseeing construction teams working in a different building tradition. The tendency to add new clusters of springs to an existing water delivery system is a common enough occurrence. In Roman antiquity, and in the Renaissance, an aqueduct's patron was apt to stake his claim to posterity as quickly as possible by targeting the largest or most available sources and then to augment the system as circumstance and opportunity allowed. The tendency was a commonplace with the ancient aqueducts of Rome, as Frontinus and several inscriptions attest;<sup>34</sup> The tendency is also well attested in the Renaissance predecessors of the Acqua Paola—most notably, the Acqua Felice of Sixtus V, which acquired some of its sources decades after it opened in 1585 (fig. 26).<sup>35</sup> Even the nearby Acqua Alsietina, the only other ancient aqueduct to approach Rome from west of the Tiber, was supplemented shortly after its introduction by the Forma Mentis, a branch conduit that may in fact have exploited some of the same springs around Lake Bracciano later adopted for the Aqua Traiana.<sup>36</sup> Or we might even consider existing evidence in another branch line of the Aqua Traiana itself: La Porcareccia (“The Pigsty”), a huge vaulted cistern some 10 x 40 m in plan built to supplement Domitian's thermal baths at Vicarello with cold water (fig.

27).<sup>37</sup> This appears to be a Trajanic or post-Trajanic replacement of an earlier (Domitianic?), cistern of much smaller dimensions, now ruined, just a few steps downhill from it. To account for the two reservoirs' vast differential in capacity we must suppose that the sources along the local ravine, called Fosso dei Bagni, were significantly augmented in the interim between their construction dates.



**Fig. 26.** Plan of sources of the Acqua Felice. The early sources in the upper right corner date to 1585, whereas those in the lower left were added under Pope Urban VIII (1623–1644). Cassio 1756–1757 vol. 1, following p. 314.

The thermal springs were a significant cult site, and possibly the cultural focal point of the entire lake region. Their importance as a destination point and a locus of activity, and their potential role in augmenting the lakefront villa culture, may help to explain why the Aqua Traiana took the long, clockwise route around the lake rather than heading south along the western shore on its way to Angularia (Anguillara) and eventually Rome.



**Fig. 27.** Roman cistern called “La Porcareccia,” Vicarello. Photo: R. Taylor.

What role did the lower Fosso della Fiora, so important to the mill operations in the early modern era, play in Roman antiquity? This remains a vexing question, its uncertainty compounded by the inhospitable nature of the ravine, whose hard basaltic surface and precipitous drops present a forbidding prospect to any water engineer. In 2010 we determined that a full-sized aqueduct conduit of Roman brick and *opus reticulatum* construction, with a standard *opus signinum* lining, followed the ravine for some distance (fig. 28, fig. 29; see fig. 11). But this is just an upper sector of the oblique conduit later mapped by Germani and Colombo, which turns east shortly downhill. Below this point in the Fosso, the conditions grow less suitable for a conventional conduit, even with drop-shafts, and their presence seems unlikely there at any phase. A Roman brick wall far down the ravine and on the far side of it signals a resumption of ancient construction. This lies near the main channel of the Aqua Traiana / Acqua Paola, which crosses the ravine on a bridge not far downstream (see fig. 11). These remains lie very close to—indeed, may be a part of—a lost triplet of springs known only from a nineteenth-century map of the Acqua Paola in the Archivio di Stato (no. 34 in fig. 16). Their form and function are uncertain but the brick masonry, shaped into a convex,



**Fig. 28.** Sector of the branch conduit of Santa Fiora following the Fosso della Fiora as seen in 2010. Photo: E. O’Neill.

contoured surface, is identical to that in the offtake channel of Santa Fiora and decidedly Roman imperial.



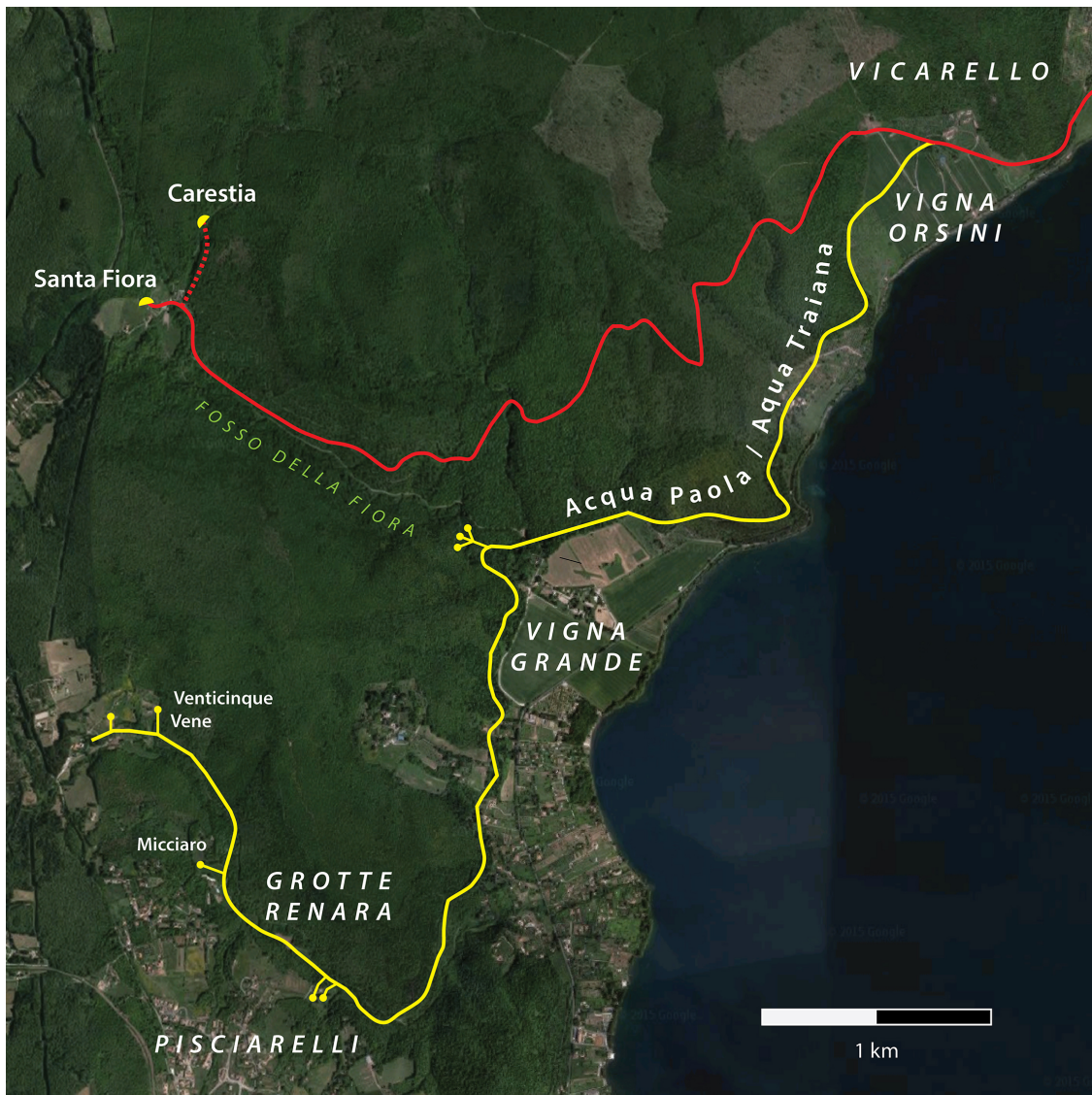
**Fig. 29.** Displaced chunk of *opus reticulatum* faced with *opus signinum* belonging to a side wall of the branch conduit of Santa Fiora in the Fosso della Fiora. Photo: R. Taylor.

We have heard reports that at least one of the old mills in Vigna Grande is built on ancient foundations; we have also examined the slightest remains of a bridge that once crossed the stream, perhaps also Roman. The claims to these features’ antiquity are credible but at the



moment in limbo; we hope to put them to the test soon. If an early modern mill, like so many other components of the hydrological landscape here, proves to have a Roman origin, then our view of the local landscape is enriched considerably, for it brings into play not only questions about the local economy but also about the Aqua Traiana's potential role in it.<sup>38</sup> A bridge, moreover, betokens an attendant conduit, and thus, potentially, a second regulated route of the Fiora water to the main conduit, or to mills, or both.

If we are right that the Aqua Traiana's original headwaters lie at the Fiora and Carestia sources, then we conjecture that the long, oblique, sinuous conduit running northeast from Santa Fiora to Vigna Orsini was originally not a route to the main channel at all; it *was* the main channel (fig. 30). A second channel straight down the ravine remains a mere possibility, so far chimerical; but if it ever existed, it likely belonged to a later phase responding to the augmentation of the system from the Grotte Renara sources.



**Fig. 30.** Main route of the Fiora (red) and the southern extension of the Aqua Traiana's main channel (yellow), hypothetically belonging to a second phase. Background © 2016 Google.

### “Le Colonnacce” and Forum Clodii

One more feature in this southern quarter deserves consideration, if only in a preliminary manner. It never appears on maps of the region, not even the authoritative IGM military maps. Although Nibby and Ashby knew of its existence, to our knowledge no scholar has tried to contextualize it historically within the hydraulic landscape.<sup>39</sup> This was a vast cistern alongside the ancient Via Clodia, a paved Roman highway running west northwest from the lake (fig. 31). The road ran along the southern slope of a ridge dividing the Bocca di Lupo and Santa Fiora ravines. Deep in the public forest of Manziana today, the cistern lies

at a level well above all the sources of the Aqua Traiana discovered so far at Grotte Renara (fig. 32). The structure is a long rectangle—Nibby puts it at 34 x 180 feet—set on a buttressed terrace along the downhill (south) side of the Via Clodia. A row of thirteen piers (hence *colonnacce*, “hulking columns”) along its axis split the vault into two, and lengthwise it was divided into three partitions. An arch framing the intake is still visible in the interior wall on its uphill side, though a berm of alluvium obstructs the opening itself. Comparable in size to a main aqueduct channel, this conduit was designed to deliver an impressive volume of water.



**Fig. 31.** Location of “Le Colonnacce” cistern along the approximate route of the Via Clodia. Santa Fiora is in the upper left. Background © 2016 Google.



Fig. 32. “Le Colonnacce” cistern viewed from uphill (north). Photo: R. Taylor.

Thus we are presented with yet another puzzle in this enchanting hydrological landscape. A large reservoir near the source of an aqueduct requires explanation; generally anything larger than a settling or dividing tank is reserved for an aqueduct’s destination—famously, in the case of the Aqua Traiana, the Sette Sale at Trajan’s baths. Leaving aside Le Colonnacce’s relationship to the Aqua Traiana, we begin with a simple and plausible hypothesis: the cistern served the nearby municipality of Forum Clodii. As yet undiscovered, the town lay somewhere in the vicinity of the venerable church of San Marciano / San Liberato, which preserves a variety of antiquities associated with it (see fig. 31).<sup>40</sup> When Trajan’s men commandeered the town’s springs for his aqueduct, they would have offered tangible compensation, probably

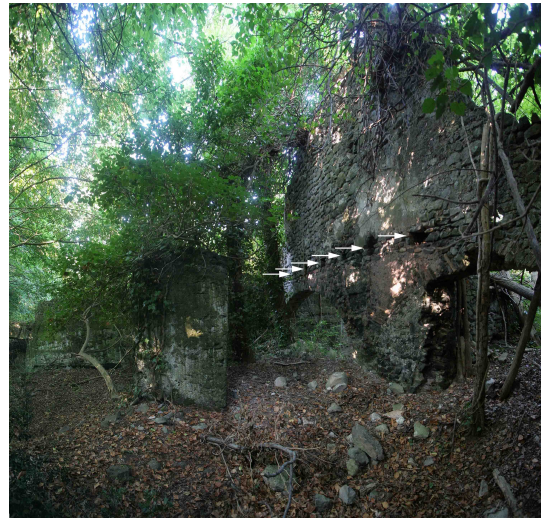
in the form of a new or upgraded municipal hydraulic system. We know from an inscription preserved at San Liberato that the local residents formally thanked Trajan for new waterworks, if only in the characteristically vague language of public commemorations: “The Claudiani [i.e., citizens of Forum Clodii], to the best and most indulgent emperor [i.e., Trajan]—because he brought the water necessary for the benefit and health of the public across a great distance, having first built the works at his private expense.”<sup>41</sup>

Yet the construction technique of Le Colonnacce leaves little doubt that it predates the Trajanic period by some considerable interval. It is made of plaster-lined *opus incertum* with basaltic lava aggregate, indicating a construction date sometime in the second or first

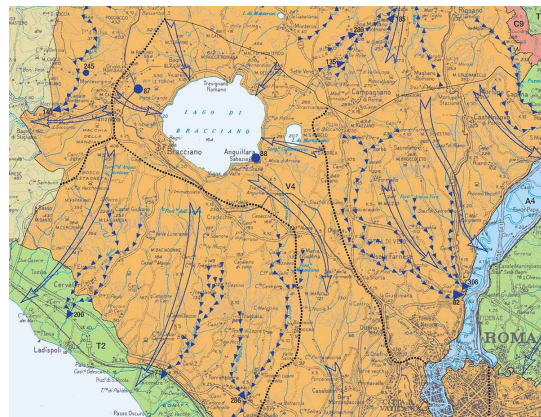
century B.C.<sup>42</sup> The sheer size of the cistern favors the inference that in the Roman period its source delivered a greater volume of water than any known spring in the Grotte Renara network of the Aqua Traiana. The water had vanished entirely by the early modern period; in fact, at some point the structure was repurposed as a conventional building with fieldstone-and-mortar walls running transversely and carrying timber-joist floors, all in ruins when Nibby saw them in 1815 (fig. 33). To be sure, it is conceivable that this massive basin once enjoyed exclusive access to a copious spring somewhere directly up the slope north of the Via Clodia, which has since gone dry. But we prefer Augusto Santocchi’s common-sense proposal that Le Colonnacce drew its water from the Santa Fiora spring, which lies at a slightly higher elevation around the north side of the ridge (see fig. 31).<sup>43</sup>

Under the circumstances, then, we hypothesize that the town of Forum Clodii, and probably a consortium of farms and villas in the vicinity as well, enjoyed an extraordinary abundance of aqueduct water before Trajan ever darkened their collective door. The likely source of their bounty was the Santa Fiora spring, possibly supplemented by the Matrice or Carestia nearby. The potential range of watershed from this geographic point is considerable, extending in a broad swath around the lake and then along a wide corridor southeast toward Rome (fig. 34). After Rome’s watermen arrived on the scene the situation changed dramatically. Some kind of *quid pro quo* was negotiated. The emperor would probably have compensated for the great diminution of local water supply by introducing a more sophisticated and regulated hydraulic system, perhaps operating on a schedule of timed water delivery. At any rate, the

town registered its satisfaction (whether authentic or forced) with this state of affairs by posting an honorific inscription.



**Fig. 33.** Transverse wall built into the “Le Colonnacce” cistern. Arrows indicate floor-joist sockets. Photo: R. Taylor.



**Fig. 34.** Detail of Capelli et al. 2012 illustrating the watershed of the Lake Bracciano / Aronne River basin.

The inscription we have is not very informative. However, we could interpret the public waterworks it celebrates, which were created at imperial expense and carried “across a great distance,” as a new *local* system—completely independent of the Aqua Traiana—brought to Forum Clodii from unrelated sources in exchange for the subtraction of the Fiora waters from the local supply. One source

already had enjoyed a well-established jurisdiction under imperial control for a century. This was the supplementary branch of the Aqua Alsietina originating “from the Sabatine” (i.e., Lago Bracciano), as Frontinus puts it.<sup>44</sup> The Alsietina suffered a calamitous diminution of its main supply in the second half of the first century A.D. when the level of its principal source, the Lacus Alsietinus (modern Lake Martignano), a much smaller body of water just to the east, dropped precipitously.<sup>45</sup> Compensatory interventions at this lake seem to have been ineffective; by the time Frontinus was writing at the dawn of Trajan’s principate, the Alsietina was a mere trickle (at least by Rome’s thirsty standards) and had been decommissioned from its major urban functions.<sup>46</sup> From the words *ex Sabatino*, one might deduce that at some earlier time an offtake tunnel of the Alsietina’s auxiliary line had simply been cut through the upturned volcanic rim of Lake Bracciano (Lacus Sabatinus) to tap the lake waters themselves, just as at Lake Martignano. Rather, we should interpret the Latin to mean “from the Sabatine region,” for the abundant surface springs around the larger lake surely had presented themselves as the lower-hanging fruit even if they were being tapped to supplement an aqueduct that was virtually undrinkable.<sup>47</sup> Under this scenario, Trajan may later have disengaged the higher-quality sources from this now-decrepit aqueduct. These springs’ modest output was potentially more useful for appeasing minor local interests than it was to Rome; accordingly Trajan may have treated them as a “line of credit” to compensate the citizens of Forum Clodii and other interested parties.

We conclude this section with a frank admission that every turn of its argument is subject to change. Even with the

evidence we have, other plausible interpretations are possible. If, for example, the masonry of Le Colonnacce can be attributed to a period as late as the turn of the millennium or even some years after, then the structure may itself qualify as a potential component of the “Sabatine” branch of the Aqua Alsietina. Granting that, one should not discount the possibility that the Alsietina carried off at least part of the Santa Fiora waters (collected in the cistern, perhaps, through the nighttime hours?) a century before the Aqua Traiana swallowed them whole.

### **Did the Aqua Traiana benefit from an environmental disaster?**

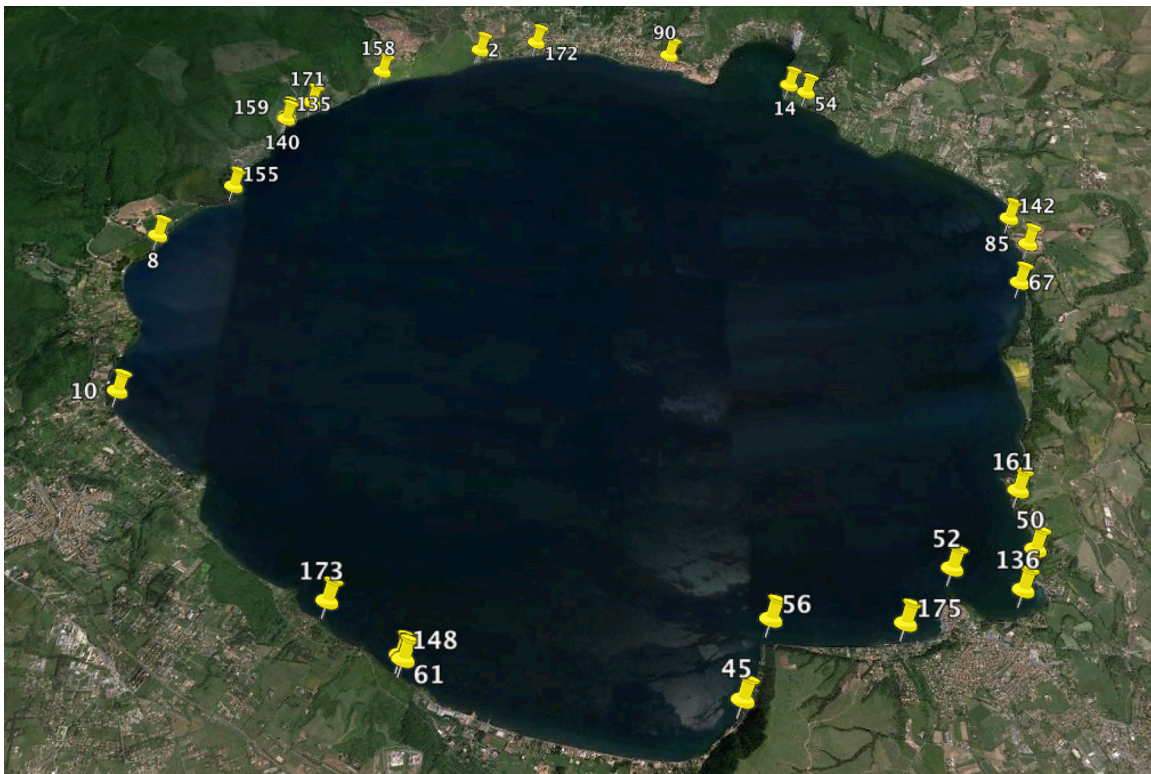
In spite of everything, we now know enough about the ancient source network of the Aqua Traiana to begin to situate it within the historical landscape. The motives behind the introduction of any aqueduct to Rome are contested, and consequently we often discount one factor that is so transparent as to be invisible: opportunity. As our discussion of Forum Clodii implies, it is a rare occasion for a source of water, even a remote one, to be completely available for the taking. Local landowners and communities would have claimed longstanding legal rights to it, either directly by capturing and conducting the water or indirectly by acknowledging right of access to it for persons and their animals. When a powerful entity diverted precious local water resources to a distant city, the act inevitably conflicted with local interests, often prompting the destination city’s agents to negotiate compensatory remedies with the affected communities. Whatever the facts of the matter, it seems evident that Forum Clodii received some kind of systemic remedy for the diminution of local supply. But just as *prima facie* evidence of such political and legal maneuverings often eludes us across time

and distance, it is equally murky business to assess the local conditions that offered an opening for the appropriation of sources in the first place. In the case of the Lake Bracciano region, however, we now have archaeological evidence of a natural event so stark and disruptive that it may well have single-handedly softened local resistance to an imperial play for the local waters.

This area was always sparsely inhabited, but by the late Republic Lake Bracciano was ringed with waterfront villas. The volcanic soil was rich and the graceful beauty of the lake and its vistas from the surrounding caldera attracted a power base from Rome anchored by Domitian's villa and thermal spa at Vicarello on the northwest shore and a dense concentration of production villas to the southeast.<sup>48</sup> But around the mid-

first century an unexpected environmental disaster visited havoc on the villa landscape. Its effect was the opposite of what befell Lacus Alsietinus / Lake Martignano, leaving one to wonder (so far, fruitlessly) whether the two events were related.<sup>49</sup> Whereas the smaller, higher lake was partially drained, at Lake Bracciano—just as abruptly and inexplicably—the water level ascended, inundating the shore.

The most remarkable result of Giuseppe Cordiano's archaeological survey of Lake Bracciano and its territory over the last decade is the documentation of the many ancient features along the waterfront—especially villas, tombs, and roads—that were impaired by this geological episode, which proved to be more or less permanent (fig. 35).<sup>50</sup>



**Fig. 35.** Google Earth Voyager cache displaying loci of submerged Roman remains according to their catalog numbers in Accardo et al. 2007. © 2016 Google.

Domitian's arrival on the scene in the 90s A.D., and his acquisition of a grand villa at Vicus Aurelii (Vicarello), the thermal springs to its north (Aqua Apollinares Novae),<sup>51</sup> and probably the sources of the Fosso della Calandrina extending northward up the ravine not only reflected his appetite for lakefront properties in general<sup>52</sup> but also augured a more ambitious imperial interest in acquiring the property encompassing the eventual sources of the Aqua Traiana.<sup>53</sup> After all, there is solid evidence that Domitian initiated the Baths of Trajan,<sup>54</sup> and he would not have done so without having ambitions for a new urban water supply to serve them. What Domitian likely began, Trajan completed.

To the extent that local springs were already being exploited for purposes other than irrigation and modest amenities to the towns near the lake, it would have been to water the shorefront luxury

villas. The surge in the lake level forced the abandonment of these properties, doubtless inducing a precipitous devaluation of real estate and even a temporary population loss. Those who decamped would have left behind a rudimentary network of source architecture with no destination—including, we may suppose, some of the properties supplied by Le Colonnacce.<sup>55</sup> In the event, the land and water alike would have proven a soft target for Domitian's and Trajan's aggressive campaigns of acquisition, survey, and construction. The complexities of prospecting, negotiation, acquisition, and compensation caused the project to proceed in fits and starts, incrementally, in two distinct phases, if not more, and numerous geographic parcels. But we may nevertheless regard the Aqua Traiana as a unitary project proceeding from a single impulse and a coherent but adaptive plan of action.

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## Footnotes

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- <sup>1</sup> Taylor, Rinne, O’Neill, and O’Neill 2010; Quilici 2009. Much of this material was delivered in a preliminary fashion at the Annual Meeting of the Archaeological Institute of America in January 2010, 2011, 2012, and 2016.
- <sup>2</sup> Fea 1832 138; Taylor 2012; O’Neill 2014 203–04.
- <sup>3</sup> Rinne 136–54.
- <sup>4</sup> From Fontana’s measurements of 1691 and 1692, the Santa Fiora source amounted to 47 and 43 percent of the regional total respectively; see O’Neill 2014 11 fig. 16. By this time the Carestia source was delivering at best a nominal volume. Yet the monumental architecture of the Carestia springhouse, complete with a central statue niche and a vaulted vestibule, indicates that in antiquity, at least, it was in the same league as the Fiora.
- <sup>5</sup> Fea 1832 41, 138; Taylor, Rinne, O’Neill, and O’Neill 2010 370.
- <sup>6</sup> O’Neill 2014 207–11.
- <sup>7</sup> Ashby 1935 200.
- <sup>8</sup> Germani and Colombo 2015. We are grateful to John Hessler of the Library of Congress for applying his GIS expertise to this mapping problem on our behalf in 2010 and 2011.
- <sup>9</sup> The exterior of the conduit regularly features a broad band of tuff *opus reticulatum* sandwiched between narrower bands of brickwork; see Van Deman 1934 331–40; Ashby 1935 300–01.
- <sup>10</sup> Lugli 1957 507–18, tavv. CLI–CLV. We observed a quoinlike join at Santa Fiora where the brick wall of the offtake conduit transitions to *opus reticulatum*. The join is unusual in that it consists partly of orthogonal and partly of diagonal toothing; see Taylor, Rinne, O’Neill, and O’Neill 2010 fig. 12.
- <sup>11</sup> At present we cannot ascertain whether the conduit inside the weir is a proper siphon or simply a continuation of the open-flow channel, but the stream bank would be a strange place for a reservoir if it were merely a settling basin. Nor can we date the conduit with authority. Remote photographs taken inside the reservoir indicate that it is vaulted with pitched bricks—a technique more characteristic of the early modern period than the Roman. But experience has repeatedly taught us that in the Acqua Paola network, which originally included much of the Grotte Renara source architecture, modern work was often little more than a reconditioning of the ancient system. Moreover, the extrados of the conduit’s vault is iron-hard, more like Roman concrete than the more friable mortar associated with seventeenth-century fieldstone masonry.

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- <sup>12</sup> Siphons consisting of small pipes anchored on the bed of a stream or river are rare in the Roman world, but not unknown; see Statius, *Silvae* 1.3.66–67; and for an archaeological example at Arles, Cochet 1993.
- <sup>13</sup> A clearcut example is at the crossing of the Fosso della Calandrina just below the ancient aqueduct bridge called Passo del Guardiano.
- <sup>14</sup> *De aquis* 127; Taylor 2000 57–66. An important inscription by which the Aqua Traiana is dated also attests to a corridor of 30 Roman feet (15 feet on either side of the conduit); see Bloch 1944 337.
- <sup>15</sup> We identify them as follows: Cinque vene; Micciario; Venticinque vene; and a completely forgotten pair of small spring chambers in a steep slope near the latter, one of them crowned at ground level with a pristine marble marker, perhaps of the Fascist era, reading *ACEA*. Some other significant sources and underground chambers in the Fosso di Boccalupo have now been identified, but we have not seen them.
- <sup>16</sup> Filippi, Ranieri, and Felluca 2015 46–49. Nibby (1837 3.259–260) remarks on the acidity of the water here, which has been confirmed in recent tests. According to Nibby, it was “the most notable [springhouse] of those built by Paul V” and bore a papal inscription; but as in other cases, it should be understood that the pope’s men were building upon very substantial Roman remains. When we visited the springhouse in the hot, dry summer of 2015, the local hillside watershed was very dry and only one of the thirty-nine intakes was producing water; but cold, clear water was welling up in significant amounts through the fractured basaltic lava in the floor.
- <sup>17</sup> In area, the bricks regularly exceed those of Renaissance Rome, which tend to approximate rectangles of about 27 x 13 cm. A handy guide to early modern brick dimensions can be found in Giustini 1997 71–74.
- <sup>18</sup> Giorgio Filippi, curator of inscriptions at the Vatican Museums, reports to us that the speleologists with whom he has partnered have found numerous brick stamps in the Grotte Renara network, including some thirty that appear in sequence on the floor of one offtake channel. Many of these latter are badly worn and cannot be easily identified. He hopes to make impressions of the stamps for easier identification.
- <sup>19</sup> On the stamps of Lupus see Bloch 1947 316–21. We are grateful to Franca Taglietti and Luciano Camilli for assistance in identifying these stamps.
- <sup>20</sup> Bianchi 2003 86 no. 3. The stamp is fragmentary and the identification uncertain.
- <sup>21</sup> Bloch 1947 77; Steinby 1974–1975 27–28 and n. 4, 7; Camilli and Taglietti 1979 199 no. 34; Bianchi 2003 85. On Lupus and the problems of dating his output see Bloch 1947 316–20, supplemented by Bloch 1959 234–37; DeLaine 2002 93; Hetland 2007 104–07.
- <sup>22</sup> Filippi, Ranieri, and Felluca 2015 48. On the Anteros brick stamps see *CIL* 15.810–813; Bloch 1947 14–19; Weaver 1998; DeLaine 2002.
- <sup>23</sup> Bianchi 2001 94 no. 15, 100 tab. II, 114. On the two variants of 811f, see Bianchi 2003 105 nos. 70–71.
- <sup>24</sup> Bloch 1947 50 no. 23; 58–59 nos. 33–39 and 98; Bianchi 2001 94 no. 15; 2003 104–06.
- <sup>25</sup> Bloch 1947 52 no. 94a, 57; Bianchi 2003 105.
- <sup>26</sup> Vidman, ed. 1982 48, pl. 12–13; *CIL* 6.960. The basilica and forum proper themselves had relatively little brickwork, whereas the lower levels of the libraries and the stairwells serving all three buildings were constructed of conventional *opus latericium*.
- <sup>27</sup> Hetland 2007 101–04.
- <sup>28</sup> *CIL* 15.811f no. 44; Bloch 1947 43 no. 160a; Hetland 2007 100–04.
- <sup>29</sup> On the dedication date see Bloch 1944 339. A famous example of a monument that was not complete before its dedication is the Colosseum, dedicated and first used in 80 under Titus. Not only is his brother and successor Domitian said to have completed the building “up to the shields,” that is, the attic level (*Chronica Minora* ed Mommsen, p. 146), but the water spectacles held in the arena during the dedicatory festival could only have succeeded if the hypogaea had not yet been built. On these spectacles see Coleman 1993; Sear 1989 141.
- <sup>30</sup> Forum of Trajan: Bianchi 2001 97 nos. 21–23; 110–12. Markets of Trajan: Bianchi 2003 120 grafico 3.
- <sup>31</sup> Hetland 2007 109.
- <sup>32</sup> This at least is our conclusion based on three types of evidence: the smaller offtake channels at the Grotte Renara sources compared to the one at Santa Fiora; the measurements of the Santa Fiora source taken in the seventeenth century (Taylor, Rinne, O’Neill, and O’Neill 2010 359–62; O’Neill 2014 198–99); and the fact that most of the Grotte Renara sources adapted to supply the Acqua Paola have fallen out

- of repair, along with their delivery channels, evidently because their feeble contribution to the Acqua Paola was not worth the trouble of maintaining.
- <sup>33</sup> We know from Fea's account of Luigi Bernini's survey from 1667 that the conduit powered several grain mills, not just the large one depicted in Fontana's drawings some decades later. See Taylor, Rinne, O'Neill, and O'Neill 2010 361–62.
- <sup>34</sup> see Evans 1994 *passim*.
- <sup>35</sup> See Rinne 2010 116–36, fig. 5.6.
- <sup>36</sup> *CIL* 6.31566 = *CIL* 11.3722a; Frontinus, *De aquae ductu* 71; Ashby 1935 183–84; Evans 1994 111–13; Bannon 2009 77–78.
- <sup>37</sup> Colini 1979 fig. 16; Accardo et al. 2007 148–49, UT 26 (G. Cordiano); Cordiano, ed. 2001 fig. 17 (G. Cordiano).
- <sup>37</sup> Anderson 1985.
- <sup>38</sup> The water's route to the Orsini and Odescalchi mills seems to have been by way of a series of open cascades in the streambed itself (see figs. 6 and 7), probably because a more regulated system was impossible.
- <sup>39</sup> Nibby 1837 1.327: "Uscendo da questa vigna e proseguendo a salire pel sentiero, che segue l'andamento del diverticolo antico, dopo un mezzo miglio, sul ripiano del monte è l'avanzo di un sepolcro antico, e ad oriente di questo una gran cisterna quadrilunga, costrutta a sacco, con scaglie di selce, divisa in due grandi aule o corsie da tredici pilastri, il che le fa dare dal volgo il nome di colonnacce, e che probabilmente servì per villa di Mezia. Essa è lunga 180 piedi, larga 34 e verso occidente, dove il monte sfalda è sorretta da contrafforti. L'interno è suddiviso da muri e fabbricati moderni, anche essi in rovina."
- <sup>40</sup> The alternative proposal that the cistern provisioned the "Villa Flavia," a toponym associated with the area directly downhill from the cistern, has no real claim to credibility; the name cannot in fact be attached to any significant Roman ruins. On the location of Forum Clodii, see Accardo et al. 2007 108–10 (G. Cordiano), 139–42, UT 17 (M. Bacci).
- <sup>41</sup> *CIL* 11.3309: [-] *optimo [et indul]gentissim[o principi] quod aqu[am usi]bus et salub[ritati publi]cae necessa[riam per] longum s[patium] structis oper[ibus im]pensa fisci s[ui duxit] Claudiani*. The town also had a bath building, which a certain P. Aelius Agathoclianus improved with marble statues and columns in 173 A.D.; see *CIL* 11.7555.
- <sup>42</sup> <http://www.lagosabatino.com/2014/le-colonnacce/> (E. Felluca).
- <sup>43</sup> <https://augustosantocchi.wordpress.com/2013/12/03/acquedotto-traiano-dalla-sorgente-della-fiora-a-forum-clodii-3/>. (Santocchi's interpretation of the structure itself is strained, however.) Lukas Holste (Lucas Holstenius) may have hinted at the presence of such a conduit when he wrote, "Near [the church of San Liberato] flows the stream of Flora, from which once the Sabatine aqueduct originated, thus appearing to be among the greatest remains of ancient aqueducts" (Prope fluit Flora amnis, unde olim Sabatina aqua concipiebatur, ut ex vestigijs maximis veterum aquaeductuum apparet, Holstenius 1666 44).
- <sup>44</sup> *De aquis* 71. In full, Frontinus rather vaguely remarks that the water of the Alsietina at the time he took office came "from the Alsietine Lake (i.e., Lake Martignano, east of Lake Bracciano) and then from the Sabatine, around the Careiae" (*ex lacu Alsietino et deinde circa Careias ex Sabatino*). This vexed passage of Frontinus seems to imply, as Fabretti observes (1680 185–86), that the branch originated near Lake Bracciano but merged with the main conduit of the Alsietina at Careiae. Careiae is thought to be the deserted village of Santa Maria di Galera southeast of Lake Bracciano (Rodgers 2004 235), but we know of no strong justification for this hypothesis other than the likelihood that the Via Clodia met the conduit of the Alsietina here. Conceivably, though, Frontinus was referring to the springs later called Acqua Polline, which lie between the two lakes.
- <sup>45</sup> Moccheggiani Carpano 1976; Liberati Silverio 1986 73.
- <sup>46</sup> Taylor 1997 471–73; 2000 174–81, 244–45. The poor quality of the water may hint that the sources from the region of Lake Bracciano mentioned in *De aquis* 71 had been cut off from the aqueduct.
- <sup>47</sup> Further, if the supplementary conduit from Lake Bracciano was the same as the Forma Mentis (see main text above), the name itself, which seems to reference a shrine of the goddess Mens, connotes the kind of sacralization that generally attended springs.
- <sup>48</sup> Cordiano et al. 2011 19–79 (G. Cordiano).
- <sup>49</sup> Accardo et al. 2007 83–89 (G. Cordiano).

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- <sup>50</sup> Accardo et al. 2007 83–111 (G. Cordiano). Whether this event was related to the sharp drop in the lake level of the nearby Lacus Alsietinus some decades later, forcing major interventions in the intake channel of the Aqua Alsietina, is unknown.
- <sup>51</sup> Colini 1979.
- <sup>52</sup> Cordiano et al. 2011 21 (Cordiano). The generous hydraulic features on Domitian’s properties at Vicarello have been amply documented; see Colini 1979; Hodges 1995; Cordiano, et al. 2011 19–79 (Cordiano).
- <sup>53</sup> Cassio estimated that the sources around Vicarello were among the most ample in the whole system (Cassio 1756–1757 356; Lanciani 1880 163). While we maintain that the Fiora was the most abundant single source in antiquity, we have observed that the branch conduit descending the Fosso della Calandrina is quite capacious, if not so large as that of the Fiora (Taylor 2012). This branch supplied the great cistern called “La Porcareccia.”
- <sup>54</sup> Anderson 1985.
- <sup>55</sup> Domitian’s villa, being on an escarpment well above the lake, was spared this fate.