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Archaeology of Thermalism

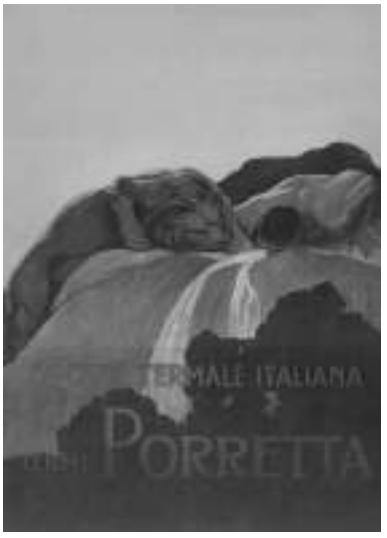
Sommario

Around Water

Archaeology of Thermalism. Living and Working with Mineral Waters

Editorial of Engramma no. 231

Maddalena Bassani and Jacopo Tabolli



This issue of *Engramma* takes water – and especially thermo-mineral water – seriously. Water is not as background scenery to "great" monuments, but as a material, sensory, and political infrastructure through which societies organise bodies, beliefs, labour, and power. Across different chronologies and geographies, from Antiquity to contemporary contexts, the contributions gathered here show how thermalism, springs, rivers, and maritime installations generate forms of knowledge that are never neutral: they are always situated, contested, and historically layered.

Maddalena Bassani's reading of Seneca's *Epistulae* is exemplary in this respect. It refuses to treat moral discourse as a transparent window onto practice and instead extracts from the text a dense micro-archive of technical and architectural cues – especially around the material presence of glass (and possible *lapis specularis*) in early Imperial bathing environments. The result is a methodological provocation: to move from rhetorical *topoi* to testable questions and targeted archaeometric enquiry. From Sicily, Sofia Bulgarini and Andrea Luvaro present a protome of Achelous found near Monte Raffe, and – crucially – place the object back into a damaged and only partially explored landscape, shaped by illicit excavations. Here the river god is not merely iconography: he becomes a reminder that water-cults are also territorial histories, and that heritage protection is inseparable from how we reconstruct (or erase) the conditions of discovery. The sea, too, becomes an archive. Enrico Maria Giuffrè and Jacopo Tabolli reconstruct the long biography of the submerged Fishpond of Bagno del Saraceno (Isola del Giglio), tracing transformations from landing installation to Neronian peschiera and later restorations – while the finding of *tubuli* and heated rooms nearby makes the hypothesis of a villa *balneum* newly plausible. The site's later afterlives – marked by modern lead objects recalling Venetian gondolas – underline a central theme of the issue: aquatic places do not simply "survive"; they are continuously re-used, re-signified, and remembered. Ameur Younès shifts the frame southwards to Ancient Tunisia, mapping six-

teen hot springs and associated installations and insisting on their centrality within local water management, precisely because they have too often been sidelined in favour of monumental urban baths. This becomes where a decolonial reflex is not an external slogan but a scholarly necessity: to undo habitual hierarchies of evidence and attention, and to treat the Mediterranean as a field of multiple centres rather than a single imperial viewpoint. Mila Cvetkovic extends the conversation from Water to Earth, following the Medicinal and Ritual Uses of Clays and "Earths" through classical sources and foregrounding their frequent origin in hydrothermal environments. The body here is a site of exchange between mineral resources, medical theories, and ritual practices – another reminder that "therapy" is never just a technique but also a cultural grammar.

Chronology expands further in Edoardo Vanni's study of the Medieval Thermal Site of the Caldanelle di Petriolo, interpreted as a hybrid space where architecture, hydrothermal technology, hospitality, and productive routines co-evolve between the fourteenth and seventeenth centuries. And in Paola Zanovello's "Unusual" yet revealing case, Thermal-Mineral Water enters the economy of Hemp Processing in the Euganean Area under the Venetian Republic, collapsing the neat divide between wellness and labour: water's chemistry becomes an accelerator of production and, indirectly, of maritime power. The issue also addresses the contemporary politics of thermal heritage. Mauro Marzo and Anna Veronese track the reconfiguration of Italian Thermal Sites from therapeutic infrastructures to experiential destinations, while Paolo Faccio and Silvia Scordo present the New Conservation-and-Enhancement Project for the Archaeological Area of Via Scavi in Montegrotto Terme, where "valorisation" is framed explicitly as a form of preservation and as a redesign of public access. And precisely in relation to the public use of Thermal Mineral springs, Alba Balmaseda offers some reflections based on initiatives for the community reappropriation of Healing places in contemporary Sicily. Finally, Massimo Osanna and Jacopo Tabolli read the Exhibition Itineraries of the Bronzes of San Casciano dei Bagni (Reggio Calabria, Berlin, Aquileia) as interpretative machines: Display is not a neutral container but a narrative technology that can foreground ritual waters, excavation process, and the ethics of looking.

Three contributions widen the temporal and geographical scope: Maddalena Bassani introduces the Bad Dürrenberg burial and its entanglement with a Thermo-Mineral context, pushing "Thermalism" beyond the classical into deep prehistory, *Il mistero della sciamana. Un viaggio archeologico alla scoperta delle nostre origini* [*Das Rätsel der Schamanin. Eine archäologische Reise zu unseren Anfängen*]. Monica Centanni presents *Il Grande Nilo. Esploratori, turisti e conquistatori nell'antico Egitto* by Lorenzo Braccesi, which perfectly illustrates the role of water, in this case river water, not only as a resource to be exploited, but also as a medium of knowledge, history and mythology. Rachele Dubbini in her paper focused on the Northern Adriatic Thermo-Mineral springs as active agents in landscape formation and settlement dynamics, engaging in critical dialogue with Maddalena Bassani's recent study, which places particular emphasis on *the Fons Timavi* and the *Fons Aponi*.

It is therefore fitting to close by looking ahead to the Exhibition "Etruschi e Veneti. Acque, culti e santuari" at Palazzo Ducale (Appartamento del Doge), Venice, running 6 March-29 September 2026. The show begins from the sacred in the Etruscan world to analyse cult practices connected to water, moving from the Tyrrhenian ports of Vulci and Pyrgi to sanctuaries of healing thermo-mineral waters at Chiusi, Chianciano, and San Casciano dei Bagni, and then into the territories of the ancient Veneti – from Montegrotto Terme (linked to the curative power of thermal waters) to Lagole di Calalzo and Este, before culminating at lagoon-Altino as a space shaped by mobility and integration. What matters, here, is not only the thematic overlap with this issue, but the shared epistemic wager: water, and especially thermo-mineral water, is treated as an agent of connection rather than a mere resource-capable of generating plural ritual geographies and cross-cultural relations without forcing them into a single, hegemonic storyline. If Engramma 231 insists that the "classical" must be read against its own margins – textual, material, territorial – then the Venetian exhibition offers a public arena where those margins become visible: where healing springs, port sanctuaries, and lagoon rituals are not footnotes to history, but frameworks through which we can re-think how past worlds were made, inhabited, and shared.

Abstract

This issue of Engramma approaches water—especially thermo-mineral water—not as a background element but as a material, sensory, and political infrastructure through which societies have organised bodies, beliefs, labour, and power. Across a wide chronological and geographical spectrum, the contributions show how thermalism, springs, rivers, and maritime environments generate forms of knowledge that are historically situated and never neutral. Maddalena Bassani re-reads Seneca's *Epistulae* as a micro-archive of technical and architectural data on early imperial bathing, foregrounding the role of glass and proposing a methodological shift from moral discourse to archaeometric enquiry. Sofia Bulgarini and Andrea Luvaro analyse a protome of Achelous from Monte Raffe (Sicily), reinserting it into a landscape altered by illicit excavations and highlighting the territorial and political dimensions of water cults. Enrico Maria Giuffrè and Jacopo Tabolli reconstruct the long biography of the submerged Fishpond of Bagno del Saraceno (Isola del Giglio), from Roman maritime installation to subsequent phases of reuse, advancing the hypothesis of a nearby villa balneum. A broader Mediterranean perspective is offered by Ameur Younès, who maps hot springs and installations in Ancient Tunisia and argues for their centrality within local water management, challenging monument-centred historiographies. Mila Cvetkovic explores the Medicinal and Ritual Uses of Clays and "Earths" in classical sources, emphasising their connection with hydrothermal environments and the body as a site of exchange between natural resources, medicine, and ritual. Later chronologies are addressed by Edoardo Vanni, who examines the Medieval Thermal Site of Caldanelle di Petriolo as a hybrid space of architecture, technology, hospitality, and production, and by Paola Zanovello, who analyses the use of Thermal-Mineral waters in Hemp Processing in the Euganean Area under the Venetian Republic, collapsing the divide between wellness and labour. Contemporary perspectives include the work of Mauro Marzo and Anna Veronese on the transformation of Italian Thermal Sites, Paolo Faccio and Silvia Scordo on the Enhancement Project of Via Scavi in Montegrotto Terme, and Alba Balmaseda on community reappropriation of Healing Waters in contemporary Sicily. Rachele Dubbini engages in critical dialogue with Maddalena Bassani's recent study, which places particular emphasis on *the Fons Timavi* and the *Fons Aponi*. Finally, Massimo Osanna and Jacopo Tabolli reflect on the Exhibition Itineraries of the Bronzes of San Casciano dei Bagni as interpretative devices, while the reviews by Maddalena Bassani, Monica Centanni further expand the temporal and conceptual horizons of water as a medium of ritual, knowledge, and memory.

keywords | Thermalism; Archaeology of water; Hydrothermal landscapes; Healing practices in antiquity; Archaeological heritage of thermal sites.

La Redazione di Engramma è grata ai colleghi – amici e studiosi – che, seguendo la procedura peer review a doppio cieco, hanno sottoposto a lettura, revisione e giudizio questo saggio (v. Albo dei referee di Engramma)

Waters in Antiquity

Seneca and the Thermal Baths, between Sobriety and Splendour

Maddalena Bassani

The study of mineral waters and related healing facilities has benefited over time from numerous contributions, some of a distinctly archaeological nature (Annibaletto, Bassani, Ghedini 2014; Matilla, González 2017; Bassani, Tabolli 2024; González Soutelo 2024; Bassani 2025), others with a historical-literary and epigraphic approach (Guérin-Beauvois, Martin 2007, in particular 97-101; Rizzi 2013; Zanetti 2013). There are also contributions that have examined, from a chemical-physical point of view, the classification of waters attested in Roman texts in relation to modern parameters (Bassani A. 2014), others that have highlighted the healing properties of waters and their applications, comparing their ancient uses with modern ones (Mantovanelli 2014; Caldara, Chiappetta, Scimemi 2024). Furthermore, new important data are highlithed through the digs at amazing thermal site of San Casciano dei Bagni (Mariotti, Salvi, Tabolli 2025).

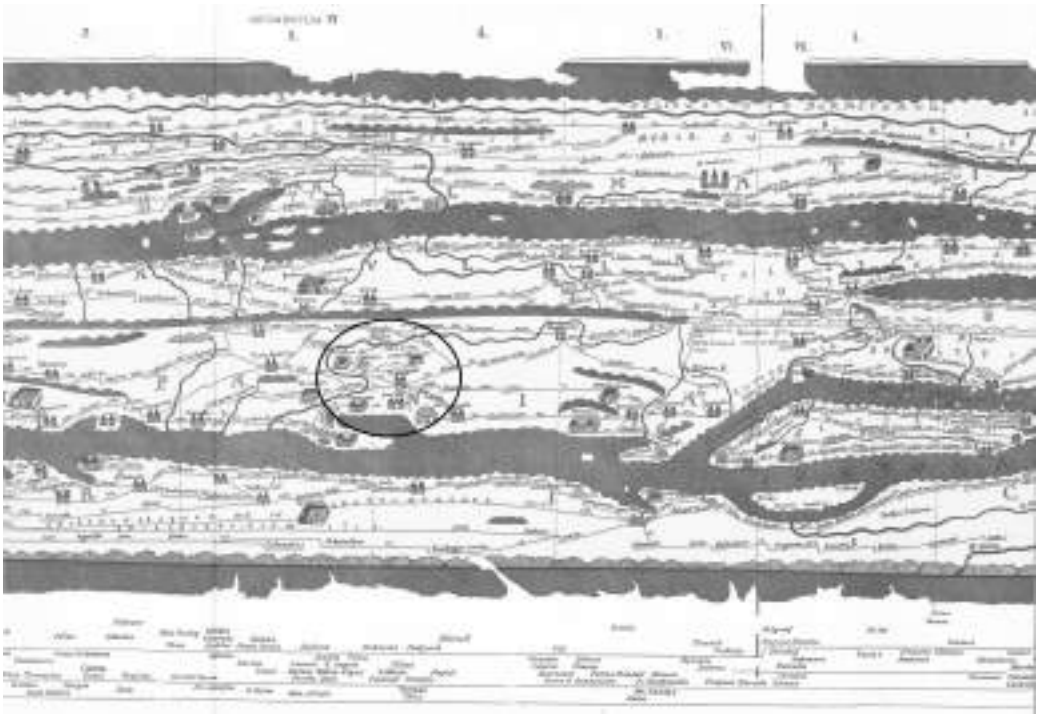
The article aims to highlight the documentary and informative value that can be gleaned from reading some of Seneca's *Letters* to his friend Lucilius, which contain significant data on bathing facilities and their uses in the Roman Italian Peninsula both in the case of facilities for therapeutic purposes, with thermal mineral water, and in the case of facilities for hygienic purposes, which therefore used fresh water. The reference edition for the *Letters* is that of BUR, edited by Giuseppe Monti and published in 1997; where necessary, few changes have been proposed to enhance specific words pertaining to natural thermalism in the Latin text.

Specifically, attention will be focused on a particular element that seems to be of significant interest from an architectural, material and functional point of view, namely glass, leaving the examination of the wealth of information that Seneca left us in his *corpus* of letters on *thermae* and, in general, on curative *aquae* to a subsequent publication.

I. Seneca and leisure at the *aquae*

In order to contextualise Seneca's thoughts on the characteristics of bathing facilities and the tendency of his contemporaries to spend a lot of time at the baths (whether for hygiene or healing purposes), it may be useful to briefly recall Seneca's biography in the thirty years between 37 and 65 AD, the date of his death.

As is well known (Lana 1956), Seneca gained fame as a rhetorician and philosopher first under the *principatus* of Caligula and then under those of Claudius and Nero. Sources remember him as the lover of *Iulia Livilla*, Caligula's sister, who was also the incestuous lover of her own



1 | The section of the *Tabula Peutingeriana* with the drawing of the possible healing building (*Syllas*) attributed to the springs of Monte Tifata and the Sanctuary of Diana Tifatina near Capua (*Tab. Peut. segm*. V, 3: ©www.omnesviae.org).

brother (Svet. *Cal*. 24). Due to internal disputes, *Iulia Livilla* was sent into exile and then recalled in 41 upon Caligula's death at the behest of Claudius. For this reason, Seneca was overwhelmed by scandal, as he was accused of aiding and abetting Julia Livilla's adultery. However, the philosopher managed to escape death thanks to the intercession of Claudius, who saved him by confining him to Corsica while confiscating half of his assets. Soon, however, he returned to Rome, where he served as tutor to Domitius, son of Agrippina (Claudius' wife) and future Nero. From that moment until the last years of his life (62-65 AD), Seneca held positions of great importance thanks to the favour of Nero, who had meanwhile become emperor. The philosopher retired from public life in 62 and, until 65 AD, composed the volumes entitled *Ad Lucilium epistularum moralium libri*, containing 124 letters: these are a *summa* of moral precepts aimed at suggesting ways of living inspired by wisdom (see Traina 1984).

This brief reference to Seneca's life story helps us understand why his *Epistulae* contain numerous references to a life inspired by moderation, with which the wise man can face difficulties of all kinds, such as those that affected him in his later years (remember that he was forced to commit suicide in 65 AD by Nero). Therefore, it is not surprising that in those pages he dwells, sometimes with significant details, on describing the decline in morals and the ex-

cessive waste of money in the construction of buildings that no longer served as dwellings or places from which to derive benefit, such as thermal baths, but as spaces in which to display wealth and power and where to carry out actions that were harmful to the body and, above all, to the spirit.

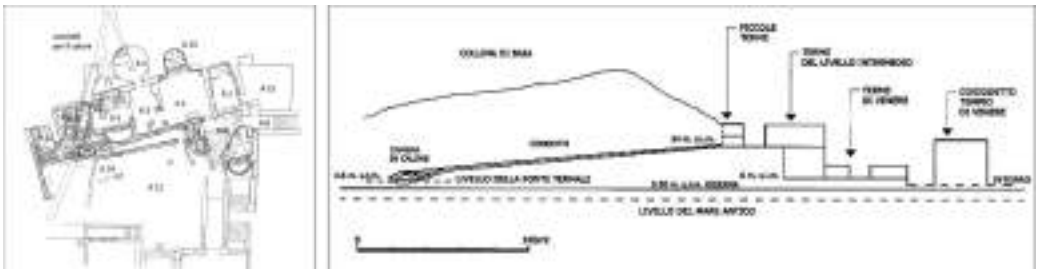
In the *Epistulae*, as in his treatises, Seneca often contrasts lifestyles inspired by simplicity with others characterised by excessive use of *ars*. For example, with regard to the power of nature unaltered by human works, he reminds that everyone, if inspired by wisdom, can find guidance in the god present in every natural resource: if a cave not dug by human hands but created by natural causes offers a sense of religious awe to a pious soul who enters it (*liber* IV*, ep*. 41, 3-4), so too are the hot mineral springs that gush from the subsoil objects of worship, because they emanate the power of the divinity that shows itself without intermediaries:

> *Magnorum fluminum capita veneramur: subita ex abdito vasti amnis eruptio aras habet; coluntur aquarum calentium fontes, et stagna quaedam vel opacitas vel immensa altitudo sacravit.*
>
> We worship the sources of big rivers: where water suddenly bursts forth from the depths, altars are erected; hot springs are objects of worship, and some lakes are considered sacred either because of their dark colour or their immense depth.

In this case, the direct relationship between man and the beneficial thermal spring is evident. Precisely because it springs spontaneously from the rock or the earth, it is venerated in the same way as dark and deep rivers or lakes, near which altars are erected. Conversely, an overly artificial and unnatural relationship with the same resource can, in his eyes, constitute a trap from which it is best to escape. In fact, the best places to stay for a wise man of his time were not the famous spa town of Baia, where he also had a villa: that land so conducive to human health had now become a place of vice at any time of day and especially at night (thus in *liber* V, *ep*. 51, 2-4). Indeed, Seneca draws attention to the deleterious effect that the practice of *balneum* with hot and mineral waters could have on a general such as Hannibal, who in a single winter had managed to become soft because he had been made lazy by the pleasures enjoyed during his stay at the thermal baths and in the lands of Campania (*liber* V, *ep*. 51, 5-6):

> *Id agere debemus ut inritamenta vitiorum quam longissime profugiamus; indurandus est animus et a blandimentis voluptatum procul abstrahendus. Una Hannibalem hiberna solverunt et indomitum illum nivibus atque Alpibus virum enervaverunt fomenta Campaniae: armis vicit, vitiis victus est.*
>
> Let us fortify our spirit and keep it away from the lure of pleasures. A single winter spent in idleness sapped Hannibal's energy. This great leader, whom even the snow-capped Alps could not stop, allowed himself to be weakened by pleasures during his stay in Campania; victorious in battle, he was defeated by vice.

This is a negative example most likely taken from Livy's unfair pages devoted to the African general (Liv. XXIII, 45), in which the Carthaginian army is portrayed as deprived of its ardour and strength for having lingered to bathe in the vicinity of Capua, where the men and the general



2 | Plan and section of the “Le Piccole Terme” bathing establishment, which exploited the healing springs at Baia (Medri 2013, 122, fig. 3).
3 | Section of the “Le Stufe di Nerone” bathing establishment, which exploited the healing springs at Baia (Medri 2013, 131, fig. 10).

himself indulged in the pleasures of wine and the flesh. In this regard, I have already pointed out (Bassani 2014a, in particular 155-160) that this is a completely distorted pro-Roman interpretation of the events that took place at the springs of Mount Tifata between 216 and 211 BC (victory of the Carthaginians over the Romans at *Cannae*, with the Carthaginians moving to Capua). There, I suggested instead that Hannibal’s decision to stop at Mount Tifata with his army should be attributed to the need to treat the wounds sustained during the battles by men and animals, including the famous elephants, thanks to those healing springs: which were not at all hot like those in Baia, but cold and sulphurous. The springs were part of the sanctuary of Diana Tifatina, and it was no coincidence that a healing facility was built there at the behest of Sylla during the 1st century BC, the shape of which can be recognised in the image in *the Tabula Peutingeriana* (*segm*. V, 3, already mentioned in Quilici Gigli 2012: [Fig. 1]). In short, Hannibal had brought his men and animals to the *aquae* of Diana Tifatina to ensure they received healing treatments with the cold sulphurous springs, and certainly not for entertainment: this practice has been attested for a long time and goes beyond ancient times, as demonstrated by the design of a treatment facility, also equipped with an area for horses, dating back to the late nineteenth century (Bassani 2014a, in particular 157).

It therefore seems reasonable to conclude that Seneca may have exaggerated his criticism of the Campania thermal baths in order to warn Lucilius, or any aspiring sage, against idleness at the *aquae*, because the latter would distract him from the activities of a simple life devoted to meditation. Thus, the overlap of places in Campania with different therapeutic characteristics (the hot springs of Baia and the cold springs of Tifata) does not seem to contradict Seneca’s reasoning, but rather seems to serve to emphasise that wisdom can only be achieved through moderation in one’s habits, unlike the relaxation that pervades everyone when taking a therapeutic bath: the feeling of tiredness and the need for rest that one experiences after undergoing treatment in mineral waters, caused by a drop in body pressure, is well known. And in fact, immediately afterwards (again in *liber* V, *ep*. 51, 6), Seneca states:

> *Quid mihi cum istis calentibus stagnis? quid cum sudatoriis, in quae siccus vapor corpora exhausurus includitur? Omnis sudor per laborem exeat.*

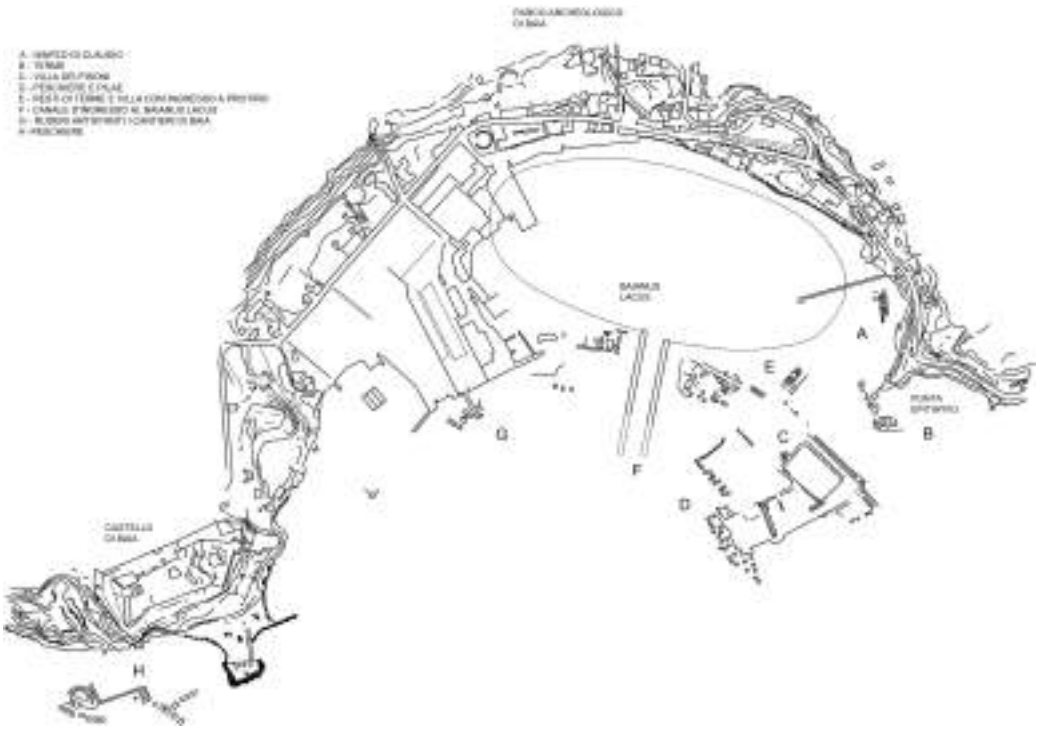
> What use are these hot pools or sweat baths to me, in which dry vapour develops that will exhaust the body? Sweat should only be caused by fatigue.

Thermal treatments using dry steam baths, which then as now induced profuse sweating and a consequent feeling of fatigue, were not considered by Seneca to be an effective remedy for the treatment of many diseases, but rather an obstacle to leading a simple life, free from luxury and ostentation, befitting a wise man. After all, those hot, sometimes very hot steam baths were typical of the Campi Flegrei: numerous facilities had already been built here in the late Republican era to exploit the geothermal potential, including the Piccole Terme di Baia and the Stufe di Nerone complexes [Fig. 2 and Fig. 3]. These complexes also included rooms where hot vapours were channelled through dug-out conduits, capturing them from the underground heat source and transferring them to designated rooms (Medri 2013). However, Seneca's disappointment does not seem to be directed solely at public health resorts, since in another letter he appears to refer to private residences on the Phlegraean shores equipped with *balnea*, where thermal waters had been brought. In letter 122, he acknowledges that it is entirely inappropriate to build a thermal mineral facility directly in the sea (*liber* XX, *ep*. 122, 8):

> *Non vivunt contra naturam qui fundamenta thermarum in mari iaciunt et delicate natare ipsi sibi non videntur nisi calentia stagna fluctu ac tempestate feriantur?*
>
> Those who build thermal baths with foundations immersed in the sea do not live contrary to nature, perhaps convinced that they cannot swim voluptuously if their hot water pools are not beaten by waves and storms?

Now, it is impossible to identify the private dwelling that Seneca had in mind in his invective, but it is worth remembering that several villas, now largely submerged due to bradyseism (Davidde Petriaggi *et al.* 2024), have been investigated in the Phlegraean area, which had been built on the sea (cf. the results obtained by the Superintendency of the Sea for the conservation and enhancement of these submerged contexts are important). Among these was a residence known as the Villa dei Pisoni near Punta Epitaffio, which dates back to the 1st century BC but later passed into imperial ownership. Recent underwater investigations have clarified that it was equipped with a thermal baths system that used thermal mineral waters, and that it had a long terrace whose foundations consisted of numerous *pilae* resting directly on the seabed [Fig. 4]. This is therefore clear evidence of the building practice mentioned by Seneca in the passage examined, but on the other hand, it cannot be overlooked that it was in Baia that the conspirators led by *Gaius Calpurnius Piso* gathered with the aim of eliminating Nero. After being discovered, they were either executed or forced to commit suicide: in addition to *Gaius Calpurnius Piso*, Seneca was also included, although his involvement in the conspiracy had not been proven (Tac. *ann*. XV, 49-57).

Therefore, even in private homes, people sought the pleasures of a healthy bath, building villas on the seabed with rooms equipped with hot water baths. It should be noted that the *calentia stagna* mentioned in the passage are the same ones that Seneca had already men-



4 | Topographical map of the submerged remains in the Gulf of Baia, including the Villa di Punta Epitaffio (©www.progettomusas.eu/baia/).

tioned in *Epistula* 51 of *liber* V mentioned above, in relation to dry steam bath therapies, which were very fashionable in his day and which he detested. For him, the foolish owner had spent a lot of money for the pure pleasure of swimming in tamed waters, such as the thermal waters brought into his home, alongside the untamed waters of the sea, whose waves broke on the perimeter of the seaside villa, believing that he would achieve complete enjoyment through *ars*. But in his opinion, it was pure illusion, since the man lost sight of the full meaning of life, which should be inspired by moderation and contemplation and not by the futile amusements of idleness at the *aquae*.

II. Baths compared

Seneca's polemic against unbridled luxury has long been examined by scholars (Berno, De Finis 2004) and, in the context of this contribution, it may be useful to draw attention to some data contained in *Epistula* 86, the subject of two recent studies (Fucecchi 2019; De Maria 2021).

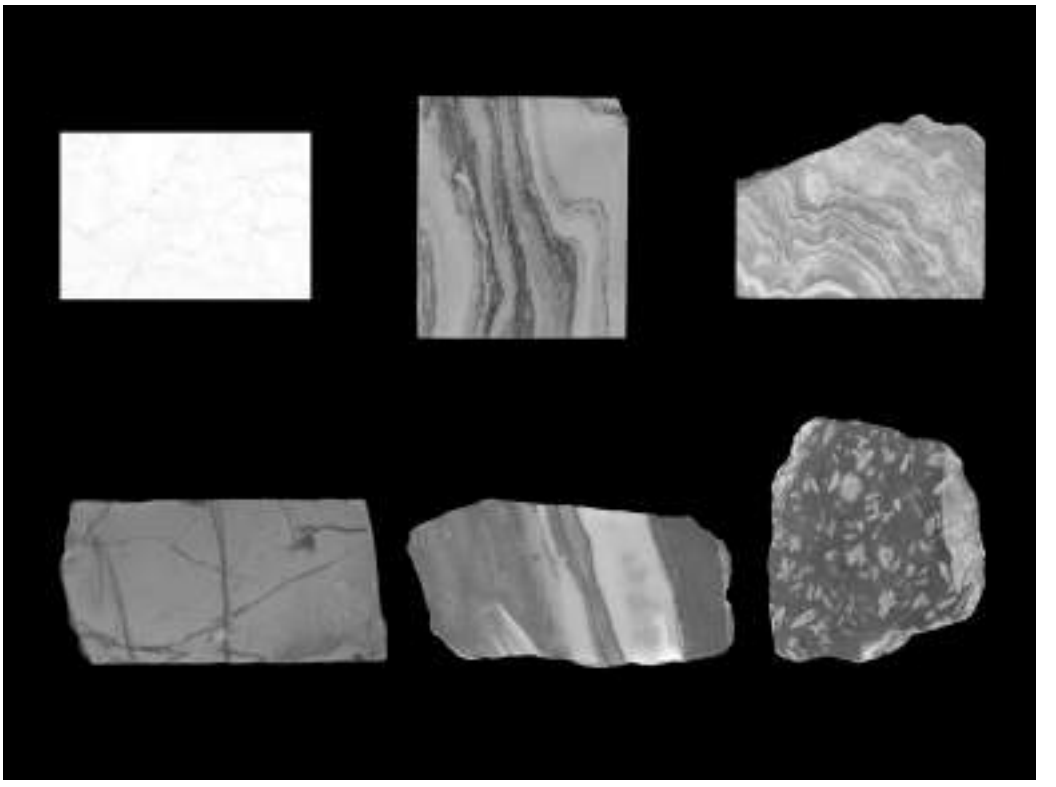
The context to which Seneca refers is the villa of *Publius Cornelius Scipio Africanus* on the coast of Literno, south of Naples, where the general who defeated Hannibal at Zama retired to private life between the end of the 3rd and the beginning of the 2nd century BC, devoting him-

self to rest and the care of his vegetable garden. Here he spent his time sweating with fatigue because he cultivated the land according to the *mos maiorum*, certainly not because he took dry steam baths (*liber* XI, *ep*. 86, 4-5):

> *Vidi villam extructam lapide quadrato, murum circumdatur, silvae, turres quoque in propugnaculum villae utrimque subrectas, cisternam aedificiis ac viridibus subditam, quae sufficere in usum vel exercitus posset, balneolum angustum, tenebricosum ex consuetudine antiqua; non videbatur maioribus nostris caldum nisi obscurum. Magna ergo me voluptas subiit contemplantem mores Scipionis ac nostros. In hoc angulo ille Carthaginis horror, cui Roma debet, quod tantum semel capta est, abluebat corpus laboribus rusticis fessum. Exercebat enim opere se terramque, ut mos fuit priscis, ipse subigebat. Sub hoc ille tecto tam sordido stetit, hoc illum pavimentum tam vile sustinuit. At nunc quis est, qui sic lavari sustineat?*
>
> I visited the villa, built of square stones, the park enclosed by a wall; the two towers that stand, one on one side, one on the other, defending the villa; the cistern hidden among the buildings and plants, which could suffice for the needs of an entire army; and a small, dark bathroom, according to ancient custom. It seemed to our ancestors that the room could not be heated unless it was dark. It gave me great pleasure to compare Scipio's customs with our own. In this corner, the great man who was 'the terror of Carthage' [quoted from Lucretius, *De rerum natura* III, 1034], and to whom Rome owes the fact that it was only occupied by enemies once, rested his weary limbs from farm work in the bath. In fact, he practised working the land with his own hands, according to ancient custom. He stayed in this humble room and walked on this rough floor. In our times, who would be willing to bathe here?

Scipio, therefore, was content with a small and modest bath to restore his body and spirit, which appeared very different from the sumptuous baths in vogue in Seneca's time and which perhaps used fresh water. This was not an anomaly: several studies (Yegu¨l 1992; Lucore, Trümper 2013) have drawn attention to the presence of bathing facilities in Greek and Roman homes since archaic times, although the custom of providing a *dedicated* room seems to have become established only from the 2nd century BC onwards, driven by Roman culture. Initially, houses may have had a small room, often adjacent to the kitchen in order to make use of the same drain and heat, and equipped with a basin, or there may have been a mobile tub or basin filled with hot fresh water and placed in a private room of the dwelling as needed.

Scipio's *balneolum* seems to be one such environment: Seneca describes it as a small, dark room with a floor of no decorative value. Later in the letter, he recalls that in the small bath Scipio washed himself with 'unfiltered water, which was often cloudy and, if there had been a storm, even muddy' (*Non saccata aqua lavabatur, sed saepe turbida et, cum plueret vehementius, paene lutulenta*: § 11): this indicates that the water supply system did not include a filtering system, and it cannot be ruled out that it drew from the large cistern mentioned at the beginning of the paragraph. Therefore, Scipio only cared about rinsing himself and washing away the sweat, without immersing himself in sumptuous baths filled with thermal waters and without then sprinkling his body with perfumed ointments.



5 | Ancient marbles mentioned in the literary sources analysed: 1. Thasian marble; 2. Carystian marble or cipollino verde; 3. alabastro cotognino; 4. giallo antico; 5. cipollino rosso; 6. porfido verde (graphic design by the author, photos of the marble present in the Laboratorio di Analisi di Materiali Antichi, Iuav University of Venice).

The second part of the letter is dedicated to the rich thermal baths of the mid-1st century AD, in which Seneca draws attention to what the *balnea* looked like during the early imperial period. The latter had walls covered with circular mirrors, alabastro (*Alexandrina marmora*) combined with giallo antico marble (*Numidicae crustae*), in turn inlaid with mosaic decorations alternating with slabs of Thasian marble [Fig. 5]: they at one time would have been admired only in temples and not around the baths, now also equipped with silver taps (*liber* XI, *ep*. 86, 6-7):

> *At nunc quis est, qui sic lavari sustineat? Pauper sibi videtur ac sordidus, nisi parietes magnis et pretiosis orbibus refulserunt, nisi Alexandrina marmora Numidicis crustis distincta sunt, nisi illis undique operosa et in picturae modum variata circumlitio praetexitur, nisi vitro absconditur camera, nisi Thasius lapis, quondam rarum in aliquo spectaculum templo, piscinas nostras circumdedit, in quas multa sudatione corpora exinanita.*
>
> In our day, who would be willing to bathe there? They would feel poor and tasteless if the walls were not adorned with large circular mirrors; if Alexandrian marble were not combined with slabs


6 | View of the Roman villa of Silin near Leptis Magna and the bathing complex after restoration and roofing (Musso 2024, fig. 4).
7 | View of the windows of the so-called *calidarium* in the therapeutic baths of Terme Taurine near Civitavecchia (photo by the author, 2012).

> of Numidian marble; if these marbles were not adorned on all sides with artistic decorations and various paintings; if the ceiling were not made of glass, if Thasian marble, which once could only be admired, and rarely, in temples, did not surround its pools, in which we abandon our bodies exhausted by abundant sweat; if the water did not flow from silver taps.

Seneca goes on to point out that in those years it was inconceivable to have bathrooms without statues by famous sculptors, large windows, and precious inlays in the floors, all elements considered necessary to enliven the stay of the users, who would have considered the baths of Scipio, victor over Hannibal, a rat-infested hovel (*blattaria*: *liber* XI, *ep*. 86, 7-8):

> *Et adhuc plebeias fistulas loquor; quid, cum ad balnea libertinorum pervenero? Quantum statuarum, quantum columnarum est nihil sustinentium, sed in ornamentum positarum inpensae causa! Quantum aquarum per gradus cum fragore labentium! Eo deliciarum pervenimus ut nisi gemmas calcare nolimus.*
> *In hoc balneo Scipionis minimae sunt rimae magis quam fenestrae muro lapideo exsectae, ut sine iniuria munimenti lumen admitterent; at nunc blattaria vocant balnea, si qua non ita aptata sunt, ut totius diei solem fenestris amplissimis recipiant, nisi et lavantur simul et colorantur, nisi ex solio agros ac maria prospiciunt*.
>
> But these are plebeian baths. What should I say when I move on to the bathrooms of the libertines? How many statues! How many columns that have no supporting function, but are placed there only for ornamental purposes and to flaunt wealth! What an abundance of water flowing down the steps with a roar! We are so demanding that we cannot set foot on anything but precious stones.
> In this bath of Scipio, instead of windows, there are small slits in the stone wall; this allows light to enter without damaging the stability of the building. Nowadays, however, we call bathrooms 'rat holes' if they are not built in such a way that the sun shines through the windows all day long, if you cannot tan while bathing, if you cannot enjoy the view of the countryside and the sea from the bathtub.

Leaving aside for a moment the moralistic intentions behind the letter, it is worth noting here that Seneca's account is of great interest not only for its list of the types of marble and decorative motifs used to cover the rooms, and perhaps, perhaps exaggerated, of precious metal fittings, but above all for its references to the construction methods used for the baths.

On the one hand, there is a reference to the many statues, remembered because they embellished areas intended mainly for freedmen and people of high rank, and to the columns, which did not necessarily serve to support the ceilings, but were placed there to show off their splendour, like the floors decorated with precious stones. On the other hand, Seneca draws attention to the windows in the baths, which could have been a problem for the structural integrity of the buildings: this is a very well-documented building feature in hygienic constructions, as evidenced, for example, by the cases of Herculaneum (Guidobaldi *et al.* 2015) or, at a private level, the well-known example of the maritime villa of Silin in Leptis Magna (Rind 2009, 44-45; Musso 2024: [Fig. 6]). Windows were also present in mineral water spas, such as the Terme Taurine (Annibaletto 2014: [Fig. 7]) and the Terme di Santa Venera in Sicily (Branciforti 2006). The brightness of a room was not functional in ensuring a safe tan and a splendid view of the landscape, but provided constant air exchange, especially if several dozen people could stay in the room with the bath at the same time, or if the vapours from the mineral waters used could be harmful if inhaled for too long. However, on rereading the passages just quoted, it is impossible to overlook the fact that Seneca explicitly mentions the existence of a 'glass ceiling' among the many other manifestations of wealth lavishly displayed in the thermal baths. Given the peculiarity of this reference, it is worth dwelling on it.

III. Glass ceilings in thermal baths or simply glass mosaics?

8 | Fragment of *lapis specularis* (courtesy of the Laboratorio di Analisi di Materiali Antichi LAMA, Università Iuav di Venezia).

In the letter 86, Seneca also mentioned the presence of glass ceilings among the indicators of extreme luxury in the baths: it may be useful to refer to the passage (*liber* XI, *ep.* 86, 6):

> *At nunc quis est, qui sic lavari sustineat? Pauper sibi videtur ac sordidus, nisi parietes magnis et pretiosis orbibus refulserunt, nisi Alexandrina marmora Numidicis crustis distincta sunt, nisi illis undique operosa et in picturae modum variata circumlitio praetexitur, nisi vitro absconditur camera (etc.).*
>
> In our day, who would be willing to bathe there? They would feel poor and tasteless, unless the walls were adorned with large circular mirrors; unless the Alexandrian marble was combined with Numidian marble encrustations; unless these marbles were adorned on all sides with artistic mosaics and various paintings; unless the ceiling were made of glass (etc.).

The text contains the phrase *vitro absconditur camera*, which can be literally translated as 'the vaulted ceiling is covered by glass', meaning 'the ceiling is made of glass'. The word *camara/ camera* is analysed in Latin dictionaries, particularly in the *Thesaurus Linguae Latinae*, which lists numerous occurrences where it refers to part of a building. It is a noun that specifically indicates a vaulted ceiling, or the vault itself: it is found in Varro (*rust*. I, 59, 2) in reference to rooms used as warehouses, or in Propertius, who uses the term to indicate sumptuous halls (III, 2, 10). The word is also found in Vitruvius, who discusses it in relation to baths or

basement facilities (V, 10, 3; VII, 2, 2; VIII, 6, 3). With regard to the latter, it should be noted that *concameratio* is properly a vaulted construction typical of cement substructures used to build cryptoporticoes and underground constructions (see *Les cryptoportique*s 1973; Callebat, Fleury 1995, s.v. *camera*, *concameratio*; Bassani 2003; Basso, Ghedini 2003). In later times, the word *camera* was used by Caelius Aurelianus in his treatise on medicine, particularly in the chapter dedicated to acute pain: here he uses this term in reference to baths with vaulted rooms, referring to therapies for various forms of acute ache (*acut*. III, 17, 151 f.: *Cum autem declinare passio coeperit, etiam embasim adhibemus ex oleo uel calida et oleo aut decoctione laxatiuarum materiarum, non sine cautione.* [152] *declinanda est enim perfrictio, quapropter erit facienda in calido loco vel balnei fornice, quem appellant achitholum siue cameram*).

Then, the term does not refer to a flat ceiling: Latin used the word *tectum*, or *lacunar*, when referring to a coffered ceiling for this part of the building. The word *camara/camera* derives from the Greek καμάρα, a vaulted object, or a vaulted chamber (see, for example, Agatharch. 62; *CIG* 2241, Chios, where the term refers to the vault of a tomb). Finally, the verb *abscondo* seems to be used in Seneca's passage more in the sense of *covering* than *hiding*, and its use in the passive voice properly conveys the action of covering performed by the glass on the room. *Vitrum* is in fact the neuter noun for glass as a material, while *vitreum* is the derived adjective that can also indicate, by metonymy, a glass vase or tessera. Some scholars believe that with this sentence, Seneca meant the covering of surfaces with glass tiles (Vlad Borrelli 2016, 64). But is this the only way to interpret this testimony?

The information provided by Seneca is therefore of great importance because it raises the issue of recognising vaulted structures made of materials other than brick and *opus caementicium* within thermal baths. Similar information can be found in Stace's *Silvae* (*silv*. I, V, 31-44, see Fontaine, Foy 2008, 425), which mentions the thermal baths of a certain *Claudius Etruscu*s. After invoking Apollo, the Muses and the Nymphs who were the patronesses of the springs, the poet lists the types of marble that could have been used to cover the walls of a *balneum* of the time: white Thasian marble, green cipollino from Carystus, alabaster (onyx), Numidian marble also known as giallo antico, marble 'the colour of Tyre and Sidon red with white veins', i.e. pavonazzetto, green Laconian also known as green porphyry or serpentine, etc. (see Lazzarini 2004; Lazzarini 2007: [cf. *supra* Fig. 5]). The thresholds of the rooms were also covered with marble, and the vaults were equally resplendent, perhaps covered with glass tiles, on which animal designs were chiselled (Stat. *silv*. I, V, 41-43):

> [...] *Non limina cessant,*
> *effulgent camerae, vario fastigia vitro*
> *in species animosque nitent.*
>
> The thresholds are no less impressive,
> the vaults shine, their summits gleam
> with the multicoloured glass of animated figures.

In this passage, Stace's use of the word *camerae* (in the plural form) refers to vaulted ceilings, but the verb *effulgeo* seems to evoke the brilliance of the figurative compositions with coloured glass: the poet was describing decorative glass compositions that imitated marble by juxtaposing different polychrome slabs.

Pliny the Elder, on the other hand, seems to refer to glass vaults, recalling the vaulted ceilings in the Baths of Agrippa (Plin. *nat*. XXXVI, 189), but it cannot be ruled out that he was referring to the same mosaic technique, which also used glass tiles on the surfaces of public and private rooms. In fact, when discussing the technique of mosaic making, he states that

> *Agrippa certe in thermis quas Romae fecit figulinum opus encausto pinxit in calidis, reliqua albario adornavit, non dubie vitreas facturus camaras si prius inventum id fuisset aut a parietibus scanae, ut diximus, Scauri pervenisset in camaras* [...]
>
> Agrippa, at least, in the Baths he built in Rome, had the brick walls of the hot rooms painted with the encaustic technique, and adorned the rest with stucco: while he would certainly have made glass vaults, if that technique had been discovered earlier, or if from the walls of Scauro's scene, as we said (36, 114), it had already passed to the decoration of the vaults [...].

These testimonies, together with that of Seneca, contain clear references to vaulted roofs with glass elements in some rooms of the baths dating from the middle of the 1st century AD, but one wonders whether, at least in Seneca's case, he intended to draw Lucilius' attention to a vaulted roof system made entirely or partially of glass, and, if so, what kind of glass it was.

The use of glass windows in public and private buildings is well known in Roman architecture from the 1st century AD. Recent studies have highlighted the Roman practice of making quadrangular window panels measuring between 40 and 60 cm, onto which moulded glass was fixed within wooden or metal frames, which were then attached to the walls of houses and public buildings (Allen 2002; Roffia 2008; Fontaine, Foy 2011). Archaeological remains of hemispherical window glass found in Spain, Portugal, Italy, France, Great Britain and Switzerland, mostly from thermal contexts, have also been examined. In particular, the recovery of a 3rd century AD ship known as the 'West-Embiez' wreck off the coast of Provence revealed a cargo consisting exclusively of glass: the quadrangular window panes measured approximately 30.5 x 23.5 cm, while the dome-shaped window panes had a diameter of 40-52 cm. It cannot be ruled out that this glass could also have been used for the *oculi* of the vaults, which were useful for air exchange and the escape of vapours (Fontaine, Foy 2011).

However, it should be noted that in addition to window glass, obtained by melting silica and soda compounds with the possible addition of other components to obtain a specific colour, another type of 'glass' material, *lapis specularis*, has also been analysed recently (Guarnieri 2015; Guarnieri 2015a; Tempesta 2015; for modern uses, see Alberti *et al.* 2018). This is a translucent stone mentioned by Strabo (XII, 2, 10) and later by other authors, including Pliny the Elder (*nat*. 36, 45-46), which is identified as selenitic gypsum (Lugli 2018). It is found both in the quarries of Spain, near Segobriga (Cuenca: Bernardez Gomez, Guisado Di Monti

2002), in the area of the Parco del Gesso in Emilia-Romagna (which also includes the Grotta del Re Tiberio, long frequented for its mineral springs: Bassani 2014b, 181), and finally in the Agrigento area (Gullì 2015). This material comes in wide transparent crystals, which even in ancient times could be cut into very large slabs that then thinned to achieve the desired thickness [Fig. 8]. Examples have been found in various contexts, but their chemical and physical characteristics have not always been recognised by archaeologists, who have confused them with simple glass (see Guarnieri 2015a).

IV. A research hypothesis for the Roman healing complex at Montegrotto Terme

Returning to Seneca's testimony and as we draw to a close, there is no evidence to say with certainty whether he was referring to vaulted ceilings with glass slabs or rather with *lapis specularis* slabs: in this case, it can be hypothesised that they were assembled together to cover all or part of the vaulted ceiling of a *balneum*, possibly combining them with curved glass parts, such as dome-shaped windows for the *oculi*.

Further research may perhaps attempt to provide an answer to these uncertainties, but for the moment it seems interesting to open up a line of research that could prove to be of great importance not only for understanding Seneca's reference in greater detail, but above all for studying the glass remains found in ancient thermal mineral contexts through laboratory analysis.

9 | Plan of the Roman healing context in Via Scavi at Montegrotto Terme (Bassani, De Venanzi 2024, fig. 3).

The archaeological thermal mineral contexts of Montegrotto Terme can be a field of investigation. In particular, excavations in Via Scavi carried out first in the late 18th century and then in the second half of the 20th century brought to light a large area [Fig. 9] equipped with three interconnected pools, as well as several service rooms, a small theatre and a *nymphaeum* (on the Roman thermal area, see Bonomi, Malacrino 2012, with previous bibliography; on the *nymphaeum*, see Bassani 2022). The public thermal baths date back to the second half of the 1st century BC until the 3rd century AD. Here, several fragments of architectural glass have been found in the public baths in Via Scavi (as well as in the complex under the Hotel Terme Neroniane: Cipriano 2012): no archaeometric analyses have been carried out on them, and it might therefore be useful to dedicate investigations in order to ascertain their composition and reconstruct the production technique of those artefacts in the main structures. For this reason, specific research will be conducted to study the glass and its composition through laboratory tests, but also to reconstruct in detail the structures to which it belonged. In fact, the state of preservation of the rooms in which the ancient glass was recovered in the public healing context of Via Scavi is rather altered because it was severely compromised and underwent extensive restoration

work at the end of the 20th century. The dimensions of the rooms are known (hall with the pool A: 12x30 m; the pool A measures 8,5x20 m; hall with the pool B: 37x16,7; the pool B measures 24,5x9,5 m; pool C: diam. 9,30 m), but the question of the possible roofing system remains unresolved. It is almost certain that the circular pool C, which had a continuous wall 2,15 m thick, was covered: this covering system ensured that the internal temperature of the pool, which was lined with marble slabs, was maintained. Conversely, it is not clear what the two large rooms A-B were like: covered or uncovered? Giovanna Tosi emphasised that, given the rather thin walls surrounding the halls (0,45 m), it would have been difficult for them to support the weight of a large vault (Tosi 2004, 882). Simonetta Bonomi and Carmelo Gianluca Malacrino also referred to this aspect when analysing the complex in Via Scavi (Bonomi, Malacrino 2012, 166) and proposed a roofing system made of wood and clay elements. In my opinion, and in light of the literary and archaeological evidence presented, a working hypothesis could be that of a mixed wood and glass roof, the latter to be correctly defined, specifying whether it is fused glass in sheets or *lapis specularis* sheets. The work may develop insights that take into account, on the one hand, the methods of construction of similar structures in an unstable geomorphological context such as that of the Euganean thermal area and in relation to the building techniques developed between the end of the 1st century BC and the early empire. On the other hand, the study may address issues related to the use of the various building materials available, not least *lapis specularis*.

The research to be conducted on a specific scale in Montegrotto Terme could then be extended to other thermal mineral contexts where the presence of glass has been confirmed: it would in fact be appropriate to review and reconsider the interpretations of materials defined as “glass” in therapeutic contexts, which could be examples of selenite gypsum slabs (from macrocrystalline rocks), or, conversely, glass melted and spread into special slabs. This analysis may also provide useful information for understanding whether, given the different qualities of mineral waters present in evaporated and/or liquid form, there was a preference in the use of materials for roofing and ventilation systems in bathing establishments.

In conclusion, a re-reading of the literary sources relating to natural thermalism and bathing practices may prove of some interest in focusing attention not only on socio-cultural dynamics such as those highlighted in the pages of Seneca, but above all on the ways in which these facilities were built in relation to the different materials used, as in the case of glass and *lapis specularis*. Useful clues may also be derived from the analysis of the initial design choices and any restoration work carried out during the ancient era, to adapt or renovate the facilities to the treatment practices in vogue at different periods. Finally, these areas of study may be accompanied by investigations into the trade in raw materials: in the case of *lapis specularis*, its origin from quarries known only in three areas of the empire may suggest possible research for the raw material or the places where it was processed and finished for use in the construction of thermal architecture.

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Abstract

The article offers a reflection based on the reading of several passages from the *Epistulae ad Luciulium* written by Seneca between 61 and 65 AD, which are of interest for investigating aspects relating to Roman healing and hygiene facilities, both in their articulation with respect to the former, modest private facilities, and in the decorative elements of the early imperial period, with particular regard to the possible presence of vaulted ceilings made of glass or *lapis specularis*. The prospect of further study highlights the need

to carry out archaeometric analyses on fragments of building materials found in both public and private thermal and mineral contexts from the imperial period.

keywords | Seneca; Thermalism; *Thermae*; *Aquae*.

The God among the Rivers

Mount Raffe (Mussomeli, Sicily) and the Cult of Achelous

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1 | Map of Sicily with the indication of Monte Raffe site (graphic design by the authors).

I. Territorial and archaeological context of Monte Raffe

The hill of Monte Raffe rises in the territory of Mussomeli (CL), on the border with the municipalities of Sutera and Bompensiere, in the province of Caltanissetta [Fig. 1]. This area is dominated by the presence of water, as it was in ancient times. In fact, in the past, all the Sicilian hinterland must have been characterised by an abundance of water: the main rivers, which are currently torrential, were navigable for most of their course (Tramontana 2012, 272), and the landscape must have been characterised by a wealth of springs and sources, favouring considerable soil fertility and the presence of shrubs and tall trees. In this landscape, the hill of Raffe (423 m above sea level) occupied a strategic position controlling the courses

2 | Female protome in terracotta, first quarter of the 5th century BC, Monte Raffe (CL), Regional Archaeological Museum of Agrigento (Congiu-Chillemi 2015).

of the Fiumicello, Salîto and Gallo d'Oro rivers, natural routes connecting the coast and the inland.

Monte Raffe is considered one of the centres of the Platani Valley that underwent the process of Hellenisation between the end of the 6th century BC and the first twenty-five years of the 5th century BC. In particular, the presence of stamped and painted pottery in Raffe suggests that Hellenisation began here in the last decades of the 6th century BC and took on characteristics typical of Agrigento (De Miro 1962, 150; Congiu, Chillemi 2015, 237). In fact, the site of Monte Raffe was founded in the shadow of Polizzello, whose acropolis was abandoned in the second half of the 6th century BC. Raffe, meanwhile, experienced a real demographic and cultural boom. Archaeological finds show a growing interest by the centre of Agrigento in Raffe as part of the new political strategies implemented by Falaride to control the territory (Congiu, Chillemi 2015, 237).

Furthermore, the materials found in the *extramoenia* sanctuary demonstrate an intense vitality of the centre between the last quarter of the 6th and the beginning of the 5th century BC, which seems to have remained constant until the 4th century BC (Congiu, Chillemi 2015, 240; Congiu, Chillemi 2009, 129). In the second half of the 4th century BC, there was also a demographic increase, perhaps due to the displacement of part of the population from Polizzello, following which Monte Raffe, like the rest of the territory of Mussomeli, came under Carthaginian influence (Belvedere 2000, 46).

Archaeological investigations, begun by Antonino Salinas (1883) and continued by Pietro Griffo (1956-57) (Griffo 1958, 28-29; Lagona 1997, 179-180; Lagona 2003, 235-236; Congiu, Chillemi 2015, 233), Sebastiana Lagona (1980s-1990s) and the Soprintendenza of Caltanissetta (2007-08) (see Congiu, Chillemi 2009, 117-147 and Congiu, Chillemi 2015, 233-264), have revealed the image of a long-time settlement from pre-protohistoric times to Middle Ages. The site, firstly occupied during the early Iron Age, was fortified by an impressive defensive wall maybe dated to the Late Archaic period; there are also necropolis areas and a small rock sanctuary outside the town, which can no longer be traced. The settlement, arranged on terraces on the eastern slope, includes rock dwellings and dry-stone structures (Congiu, Chillemi 2009, 121-127). Among the most significant materials found here, we note a bronze hoard containing a small ring, seven arrowheads with through-holes and thirteen bronze coins, nine of which can be traced back to the mint of *Kainon* (Sole 2017, 273), dating from between the 5th and 3rd centuries BC. Among these, the so-called 'casa scaletta' stands out, divided into two levels connected by a staircase carved into the rock.

The main necropolis extends along the south-western slope of the hill, with rock tombs and shaft burials (6th-4th century BC). The most recent investigations have identified nine burials dug into chalk outcrops, some of which have already been violated. According to Congiu (Congiu 2018, 423), the burial area extended well beyond the modern road, which has partially compromised the western ridge.

At the foot of the mountain, in an area near the Salîto river, an *extramoenia* sanctuary has been identified (Congiu, Chillemi 2009, 118), which was frequented between the 6th and 5th centuries BC and was probably abandoned following a natural event or war. Near the area identified as a space for cult practices, several ritual deposits were found, consisting of groups of fragments and votive objects (For further information on the materials found, see Congiu, Chillemi 2009, 119-120. For the coin finds, see Sole 2012, 151-184) that were partly burnt, in some cases stacked or overturned, evidence of a complex sequence of ritual actions. Particularly significant for the interpretation of the complex was the discovery of a small group of votive terracotta objects, the study of which provided essential elements for defining the cult context.

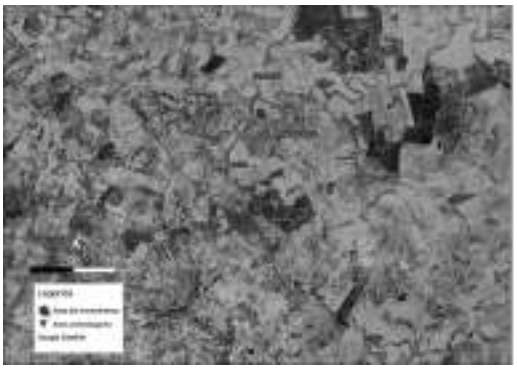
Based on the type of materials and their chronological classification, the collection of finds can be interpreted as pertaining to a Demeter sanctuary. The constant presence of the figure of Demeter in the votive deposit found could refer to the figure of Achelous, as Maria Raffaella Ciuccarelli points out with regard to the connection between the two figures and the underworld (Ciuccarelli 2006, 121-122). The relationship between Demeter, thermal waters and springs in general is also a recurring theme, as many shrines to the goddess include a natural spring or watercourse as a primary element, especially in relation to purification rites (see Portale 2009, 54, note 3), dating from the late 6th to early 5th century BC, in line with what has been documented in two of the sanctuaries dedicated to Demeter in the city of Gela. This attribution is further confirmed by typological and stylistic comparisons with contemporary votive productions from the same area. Among the materials found, two examples of female bust-protomes are particularly noteworthy and can be compared with models from Agrigento (Congiu, Chillemi 2015, 239) [Fig. 2].

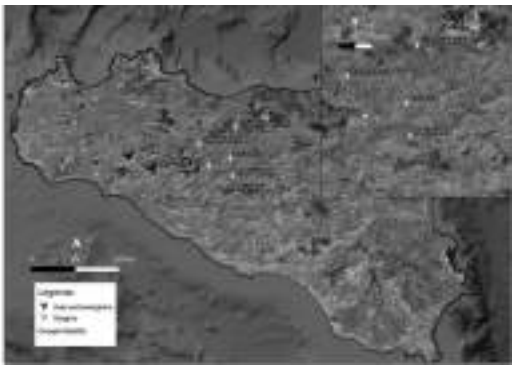
Further tests have revealed traces of a protohistoric settlement, while illegal excavations carried out between the 1970s and 1990s have unfortunately compromised most of the structures and altered the orographic profile of the hill.

The site's heyday was between the 6th and 4th centuries BC, as indicated by the materials found in the votive deposit identified at the rock sanctuary excavated by Griffo. The terracotta finds – over two hundred pieces including statuettes, ceramics, oil lamps and metal objects – also include fragments of Late Corinthian pottery, evidence of contact between the Greeks and the indigenous people of Monte Raffe (Congiu, Chillemi 2015, 234-235. Specifically, these are two fragments of Corinthian pottery dating from between 590 and 550 BC). The stylistic evolution of materials from the 6th century onwards reflects a period of recovery for the site, perhaps linked to Phalaris' policy of controlling the hinterland between the Halykos and Himera rivers (Congiu, Chillemi 2015, 237).

II. Thermal springs near the site

As mentioned, the site of Monte Raffe is in a particularly strategic position from a landscape point of view, being at the confluence of three waterways, which were navigable in ancient times and used as communication routes [Fig. 3]. Furthermore, the location of the *extramoenia*





3 | Location of the discovery in relation to the main waterways in the area (graphic design by the authors).
4 | Mapping of the mail thermal water springs near Monte Raffe (graphic design by the authors).

sanctuary at the foot of the hill, right next to the river, appears unusual, an element that could be linked to the discovery of the head depicting Achelous. At the same time, the location of the Monte Raffe site corresponds precisely to the chalky-sulphurous basin that, as mentioned above, characterises this area (Bonica Santamaria 2001, 22); the richness of thermal springs in central-southern Sicily, which, together with the volcanic territories of the Etna area, has the largest number of springs on the island, is certainly linked to the characteristics of this subsoil.

Furthermore, the entire area between the Platani and Himera rivers is characterised by a concentration of chalky-solifery outcrops which, in many cases, are interspersed with deposits of pyroschist and naphthoschist from which bituminous mineral oil is extracted. This phenomenon, in central-southern Sicily, also affects some natural cavities, where the presence of thermal mineral and sulphurous waters can contribute to the formation of bituminous oils (Cultraro 2016, 129).

The most famous Sicilian thermal springs – namely those of Alì Terme, Terme Vigilatore, Lipari, Vulcano (Messina), Acireale (Catania), Sclafani Bagni and Termini Imerese (PA), Segesta and Gorga (TP) and, finally, Monte Kronio-Fazello cave in Sciacca and Montevago (AG) – have thermal manifestations ranging from 25 °C to 58 °C, with the exception of the Santa Venera spring in Acireale (22 °C). There are also sub-thermal and hypothermal springs, especially in central and south-eastern Sicily, with temperatures around 20 °C. Among these, we have chosen to mention those closest to the area under consideration.

Some are mentioned here because they are known exclusively through oral tradition and are often used as watering places for livestock, such as the La Bella spring in Villalba (CL), located in Contrada Casabella, immediately west of the village, or the so-called Pozzo della Mascellorgia, locally known as ‘u Ciurciu’ and located in the area between the centre of Mussomeli (CL) and the site of Polizzello, while others are well-known and studied through the years [Fig. 4].

5 | Acqua Fitusa cave in San Giovanni Gemini (AG).
6 | Shrine with Heracles at the fountain in Colle Madore (PA) (Belvedere, Vassallo 2019).

The 'Acqua Fitusa' spring, on the other hand, is in the municipal area of San Giovanni Gemini (AG) at an altitude of 375 m above sea level [Fig. 5]; it emerges at the contact between Holocene limestone and sandy marl. The spring is located inside a cave, where no definite traces of activity related to permanent habitation have been found, except for the oldest phase documented to date, referring to the Epigravettian levels (Gullì 2013, 259). The cave takes its name from the presence of sulphurous water springs and has an internal development of almost 200 m along the main axis, with a series of sub-horizontal galleries of varying heights. In the northern branch of the cave, the remains of numerous burials have been found, disturbed by illegal excavations, which, based on the numerous ceramic fragments, date from the Middle Neolithic to the entire Eneolithic period.

Equally interesting is the site of Sclafani Bagni, located in a dominant position above the Salîto river valley in the northern basin of the Imera; the spring – from which "[...] sulphurous-salty-bromine-iodine thermal water [...]" (Bonica Santamaria 2001, 50-51) flows is located at 430 m above sea level, on the left bank of the river, has a temperature of 33-35 °C and is immediately conveyed to the pools of the establishment built in 1846, now abandoned. In addition, there are salt springs with lower temperatures in the vicinity.

Finally, we cannot fail to mention Colle Madore, located in the indigenous hinterland of Himera, about 1 km from the town of Lercara Friddi. This is an originally Sican settlement, whose origins date back to the 8th-7th century BC, but which, from the mid-6th century BC onwards, underwent a process of profound Hellenisation, favoured by its location along the routes of the Torto and Platani river valleys (Raimondi 2024, 398-399; Belvedere, Vassallo 2019; Vassallo 1999a; Vassallo 1999b; Vassallo 1999c; Chiovaro, Vassallo 2014; Allegro *et al.* 1993; Allegro 1996; Allegro 1999; Allegro 2008). On the northern side of the hill, there is a sulphurous spring; not far away, in Contrada Savochetta, there are the so-called *maccalube*, "[...] mud volcanoes with intermittent activity determined by the pressure exerted by gases contai-

ned in pockets within the plastic clay-marl complex" (Favarò 1999, 249-250; see also Cultraro 2016, 130). From the sacred area of Colle Madore comes an archaic sandstone shrine depicting Heracles drawing water from a fountain [Fig. 6] (Belvedere, Vassallo 2019; De Bernardin 2012, 306; Raimondi 2024, 398). The figure of Heracles is frequently associated, in sources and cult testimonies, with the presence of thermal waters or hot springs; in this perspective, it seems likely that the presence of a sulphurous spring at the foot of Colle Madore was a determining factor in promoting the spread and acceptance of the cult of the hero in the indigenous environment.

III. Achelous at Monte Raffe: analysis of the discovery

In January 2021, during an inspection carried out by the authors[1] around the Monte Raffe site, a clay protome depicting Achelous was found [Fig. 7]. The head was found in an area overlooking the northern necropolis of the site, just outside the archaeological area, near the road connecting Mussomeli to Bompensiere. The head measures 4.5 cm in height and 2.5 cm in width. The quality of the workmanship is quite refined and, even though it is partially damaged, the details of the face are clear and easily distinguishable. On the front, there is a rather elongated male face, seen from the front, with a thick beard and moustache, a furrowed brow and an expression of intense suffering in the eyes, which are close together and slightly asymmetrical. The arched and well-defined brow creates a shadow over the eye; the full, slightly parted lips are turned downwards. The nose is partially preserved, as is the upper part of the head, where the left horn is recognisable, albeit truncated; the right horn is missing due to the poor state of preservation. The crease of the eyes, the expressiveness of the face, the wrinkles on the forehead and the half-open mouth give the representation an evident *pathos*, which is also emphasised by the strong chiaroscuro effect. At the back, the artefact is concave, with a well-smoothed surface and a fracture in the lower part, at the neck. From a technical point of view, the protome was made using a single flat matrix technique[2] on orange clay with no traces of engobe or color.

During excavations carried out over the years at the two main archaeological sites in the area, Polizzello and Monte Raffe itself[3], no other depictions of the god Achelous have been found in the territory of Mussomeli, with the exception of a second example unearthed at Girafi, a district located north-east of the municipality of Mussomeli. During some surface surveys, Gianluca Calà discovered an archaic antefix with the protome of Achelous, with bull-like attributes, in association with a clay slab with a palmette in relief [Fig. 8]. The site of the discovery is located within the district of Girafi, on the southern slopes of the so-called 'Pizzo della Bandiera', at 882 m above sea level, on a hill overlooking a large part of central Sicily. The district is characterised by a remarkable wealth of springs, probably exploited since ancient times, and the presence of an Achelous in these territories could be justified by the need to divert a spring for agricultural purposes (Calà 2015, 155). These are, as is evident, two very different types of representation: the antefix from Girafi, as far as can be understood from the considerable erosion of the surface, is of the archaic type and probably of local production[4], characterised by geometric features, little chiaroscuro and a lack of expressiveness; it depic-

7 | Protome of Achelous found at Monte Raffe (CL), terracotta, second half of the 4th century BC (photo by the authors).

ts a youthful, beardless Achelous with an oval-shaped face, well-defined eyes and nose, and small bull-like horns.

The protome from Monte Raffe, on the other hand, is closer to the iconographic types common in the Hellenistic period[5], characterised by skilful chiaroscuro, strongly contracted forehead muscles and an expressive face. The discovery of the protome depicting Achelous, a river god rarely attested in inland Sicily – with only one known comparison, represented by the antefix of Girafi – is of particular interest due to its location at the confluence of the Fiumicello and Salìto rivers. This location could suggest the existence of a votive offering of thanksgiving, perhaps connected to the construction or completion of hydraulic works, in keeping with the tradition widespread in the ancient world, of entrusting the regulation of water to divine protection. From this perspective, the presence of the river god could take on an apotropaic value, linked to the canalisation or diversion of the course of the Salìto, aimed at preventing swamping and, consequently, promoting greater fertility of the surrounding soil.

An alternative interpretation could consider the protome to be a decorative element, given its small size and concave rear surface, characteristics that would suggest its use as an *applique* on a wooden or architectural support. An equally interesting hypothesis could be that the fragment is part of one of those *focula* widespread in *Magna Graecia* and Sicily between the 5th and 4th centuries BC, often decorated with *appliqués*. In this case, a possible functional comparison could be made with a terracotta artefact in the Pietro Griffo Regional Archaeological Museum in Agrigento, which represents a naked male figure interpreted as the Egyptian god Bes. Regarding the interpretation of this artefact, other hypotheses link it more closely to the theatrical masks of Lipari, depicting the servant or a Silenus. Furthermore, the ceramic form in question, which can be classified as a perfume burner, deserves further consideration. This allows us to link the artefact to the theme of fertility: “The fragments of *focula* with Silenus-shaped *appliqués* distributed between *Magna Graecia* and Sicily between the 5th and 4th centuries BC seem to confirm this private significance of the cult of female fertility, especially during childbirth, when the use of hot water was necessary” (Fariselli, Lepore, Mangione 2024; Costanzo 2018).

However, the absence of reliable stratigraphic data and of a defined context of discovery limits the possibility of formulating conclusive hypotheses about its original function. From a stylistic point of view, the protome is distinguished by its intense chiaroscuro modelling, the asymmetry of the gaze, the furrowed brow and the slightly parted lips: features that refer to the pathetic rendering of the face of Achelous typical of the 4th century BC, subsequently taken up and reworked in the Hellenistic figurative language.

In any case, beyond the Sicilian hinterland, which reveals a very small number of representations of the god, the rest of the island shows many examples that can be used for comparison. This is not the place to review iconographic types and comparisons (already done in Bulgarini, Luvaro 2024), but it is worth mentioning at least the *balsamari* from the Fusco necropolis in Syracuse (Ciuccarelli 2007, 126; Mussini 2002, 107; Pelagatti, Voza 1972, 94; Isler 1970, 19 n. 106), or from sanctuary contexts in Selinunte (Ciuccarelli 2007, 126; Isler 1970, 141 n. 104, 143 n. 114). Isler, in his monograph dedicated to the god Achelous, even states that



8 | Clay antefix with protome of Achelous found in Contrada Girafi (CL) (Calà 2015).
9 | Polychrome tragic mask with the head of Achelous, from Lipari, tomb 890, first half of the 4th century BC.
10 | Antefix with protome of Achelous, terracotta, late 5th century BC, Regional Archaeological Museum of Agrigento (*Sikanie* 1985).

all depictions of the androprosopic bull should be interpreted as images of Achelous, thus including those on the main Sicilian coinage (Isler 1970, 80-91). In fact, there are numerous representations of rivers in the form of bulls (Martorana *et al.* 1993, 89), such as the river Gelas, depicted as a bull with a human face (Ciaceri 1910, 255), or the *Amenano*s in Catania, depicted with a head adorned with horns and a diadem, surrounded by fish or, on some tetradrachms, in the form of a bull with a beard (Ciaceri 1910, 255).

Expressive solutions that can be put in comparison with the one in Monte Raffe can be found, for example, in a clay theatre mask from Lipari (first half of the 4th century BC) [Fig. 9] and in an antefix from Agrigento (late 5th century BC) (For a more in-depth analysis of the subject of the god Achelous and his significance, particularly in the Sicilian and *Magna Graecia* contexts, with a list of some possible comparisons, see Bulgarini, Luvaro 2024) [Fig. 10], both characterised by the same emotional tension and the intention to convey a sense of inner suffering.

Based on the iconographic evidence and the chronology of the site, the head of Achelous can be dated to the second half of the 4th century BC, a period that coincides with the final phase of occupation of Monte Raffe. It therefore represents significant evidence of the persistence, in this area of the Sicilian hinterland, of a syncretic religious culture, in which elements of Greek tradition intertwine with local components, giving rise to artistic production of remarkable expressive intensity and symbolic value.

[*] The topic of this paper has already been presented in “Cronache di Archeologia” 43, 2024, see Bulgarini, Luvaro 2024, where it is possible to find a more in-depth analysis of the subject of the god Achelous and his significance, with a list of iconographic types and possible comparisons; in this paper we would like to present a further investigation into the presence of thermal springs in the vicinity of the site.

Notes

[1] The inspection of the Monte Raffe area, carried out exclusively outside the archaeological site, was carried out as part of a five-week *internship* at the Municipal *Antiquarium* of Mussomeli, in conjunction with the authors' participation in the Advanced Training Course "*ArcheoUp*: knowing the past to plan the future", a training and support programme for the launch of cultural and creative enterprises to be established in public spaces, which the Department of Archaeology of the Università Cattolica di Milano has designed within the POR-FSE resources of the Lombardia Region.

[2] As is well known, coroplastic manufacture from Greece*, Magna Graecia* or other areas of the Mediterranean, especially in the Hellenistic period, was produced exclusively using the matrix technique, in this case unique. For a technical analysis of the preparation of the matrices and the production of the relief works, see Cuomo di Caprio 2007, 225-230.

[3] See the following bibliography for further information: for the Polizzello site, De Miro 1988; Panvini *et al*. 2009; for the Monte Raffe site, Lagona 1997; Lagona 2003; Congiu 2018; Congiu, Chillemi 2015; Congiu, Chillemi 2009.

[4] According to Calà, this could be an artistic and religious event organised by locals but in a typically Greek manner, with the aim of appeasing the violated source and the god of rivers (Calà 2015, 155).

[5] This chronological horizon can also be hypothesised thanks to the comparisons made by Elena Mussini in Mussini 1998 in the Slovenian context, also considering the revival of the Hellenistic model in the subsequent Roman imperial age.

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Abstract

This paper aims to illustrate a previously unseen depiction of the river god Achelous, in the form of a protome, which was discovered by chance in January 2021 during an inspection carried out by the authors near the site of Monte Raffe, located in the municipality of Mussomeli, in the province of Caltanissetta. The finding is of considerable interest not only for its iconographic and formal characteristics, but also for the territorial context in which it was identified, which is still unknown and only partially explored. We intend to provide an overview of the Monte Raffe site, outlining its main topographical and archaeological characteristics, even though its stratigraphic legibility has been compromised by numerous illegal excavations. The analysis aims to understand the possible relationship that existed in ancient times between the cult or symbolism of Achelous and the specific territory of the Raffe mountain. In addition, it was deemed appropriate to map the thermal and hypothermal springs located in the immediate vicinity of the site to outline the geo-environmental picture of the area more precisely.

keywords | Acheloos; Monte Raffe; rivers; Thermal waters.

A Gondola, a Fishpond and, perhaps, a Thermal Bath

New evidence from Isola del Giglio

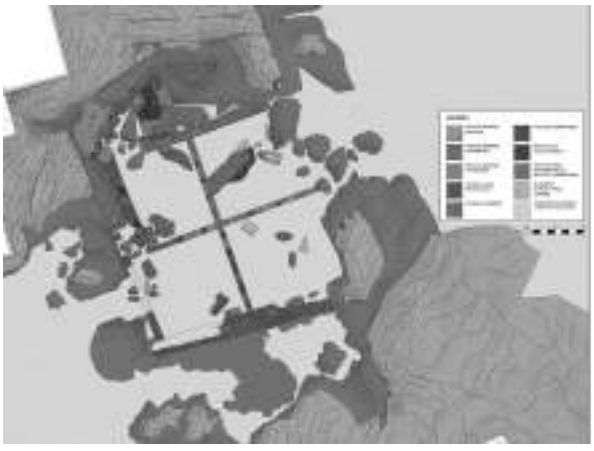
Enrico Maria Giuffrè, Jacopo Tabolli

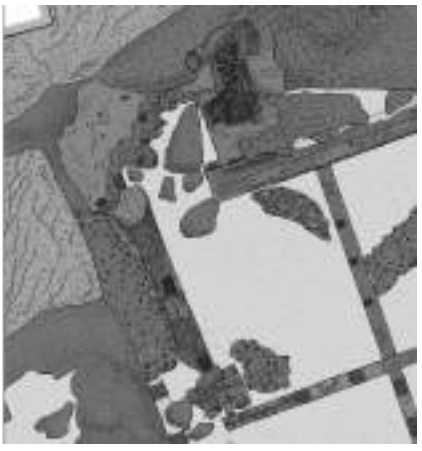
1 | Isola del Giglio. Bagno del Saraceno. Underwater excavation outlined on the general plan of the maritime villa, plan oriented towards the north (drawing and photo by J. Tabolli).

Excavation campaigns conducted between 2019 and 2021 at the Roman *peschiera* (fishpond) of Bagno del Saraceno in Giglio Porto (Tuscany, Italy) have, for the first time, allowed a systematic investigation of this submerged structure, carried out within the framework of the SEASCAPE project [Fig. 1] (Tabolli, Grimaudo 2022; Rendini, Tabolli 2023; Grimaudo, Tabolli forthcoming). Unlike the sole survey undertaken in the early Seventies (Schmiedt 1975),

the new excavations have revealed multiple construction phases of the fishpond. In an earlier phase — possibly dating to the late 1st century BC and contemporaneous with the construction of the great western pier of Giglio Porto — a small landing installation was cut into the granite cliff at Bagno del Saraceno. This structure served the maritime villa (most recently Rendini 2022, with previous bibliography) immediately to the south, which was arranged on several terraces projecting over the sea. The deep cuts in the granite bedrock at Bagno del Saraceno remain clearly visible today and form a nearly rectangular basin, probably partially open to the east, toward the open sea. During the Neronian period, and in conjunction with the first major refurbishment of the maritime villa — when the complex was provided with the richly decorated terrace with *anterides* and the central block featuring a courtyard adorned with splendid frescoed wall revetments, mosaic pavements, and *opus sectile* flooring (Rendini 2016) — the original landing place was converted into a fishpond. This new installation consisted of four interconnected tanks, equipped with a system of perforated lead grilles [Fig. 2]. A small quadrangular chamber to the northwest, accessed by a descending staircase, clearly provided entry to the structure. Freshwater entered the complex from the west through what is now interpreted as the access channel to the tanks, which originally featured a closing mechanism adorned with columns. This water derived from the Bonsere valley, fed by a spring that is no longer active today. Historical records indicate that up to fourteen perennial springs once existed on the island of Giglio; at present, seven remain active, with modest and seasonally variable discharge. Additional minor seasonal or perched springs are also documented. The deeper groundwater circulation follows the island's fracture system along relatively short pathways, with spring temperatures in the range of 15–18 °C — typical of non-thermo-mineral aquifers. Originating from the resurgences of the Foriano (Forano) quarry (Bruno 1998; most recently, Tabolli *et al*. 2019) — an area characterized by extensive colluvial deposits — the watercourse passed through the valley where the Roman *darsena* (harbour basin) is believed to have been located, along modern via dell'Asilo. It continued near the present-day School buildings before reaching the Bagno del Saraceno. It is therefore plausible that the admixture of freshwater from the valley with seawater produced the brackish conditions required for the operation of the fishpond attached to the large imperial maritime villa. The complex was probably restored during the late Hadrian period, when the masonry structures were consolidated using *opus mixtum*, and new sections of *opus reticulatum* were rebuilt. At the same time, the entire maritime villa underwent a major programme of reconstruction and repair. The large octagonal lighthouse, situated at the summit of Poggio dei Castellari and directly connected to the villa, also belongs to this phase, reflecting the recurrent villa–lighthouse association frequently observed in the ideology of imperial villas, particularly during the 1st century AD (Rendini 2009).

Excavations conducted in the fishpond yielded a total of 550 isolated finds, many of them redeposited or washed in by marine action. These materials were identified either on the exposed surfaces of the detrital deposits or recovered during the excavation of several limited areas of the basin floor. The assemblage includes metallic objects — mostly of lead, but also



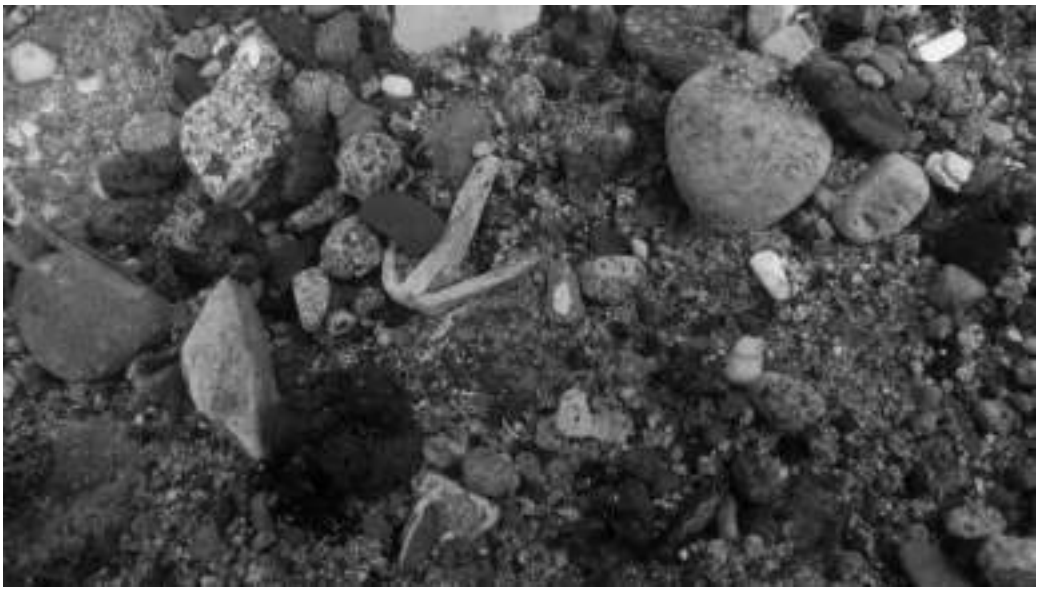


2 | Isola del Giglio. Bagno del Saraceno. Roman Fishpond. Final plan of the excavation, plan oriented towards the north (drawing by Rasta Divers). It is evident the south-west interruption of ancient structures corresponding to the access of fresh water into the fishpond.
3 | Isola del Giglio. Bagno del Saraceno. Roman Fishpond. Detail of the final plan of the excavation, with the north-west access, plan oriented towards the north (drawing by Rasta Divers).

of iron, bronze, and copper — alongside stone fragments, as well as ceramic, glass, and faunal remains. Portions of stucco and mortar bedding layers were also documented, together with iron concretions and small fragments of mineral deposits. In particular, the excavation conducted within the small north-western tank [Fig. 3], despite the presence of substantial accumulations and debris — partly resulting from the reuse of the western wall as a foundation for a telegraph structure with a platform up to the last century — brought to light a noteworthy deposit of predominantly metallic artefacts [Fig. 4].

At an upper stratigraphic level, an anchor was uncovered, and subsequent excavation phases revealed what clearly appears to be the hull of a vessel, found in association with a pseudo-triangular element designed to be fitted to the hull [Fig. 5]. Associated with this deposit were two semicircular decorative finials (similar to small helmets) and two serpentine elements. All of the finds were identified at the time of discovery as being made of lead. The presence within the same deposit of several modern depictions of towers enabled the assemblage to be interpreted as of modern date.

Nevertheless, the hull itself appears to belong to an entirely ‘exceptional’ piece, considering the provenance and the context [Fig. 6]. The hull measures 32 cm in length and 4.5 cm at its maximum width. Near its ends, it curls upwards at two points, reaching a maximum height of 3.5 cm. While the outer base is flat, the interior is decorated in relief. In the area near the bow, a wooden planking pattern with rectangular panels is represented; in the central section, longitudinal planks are depicted; and in the distal portion, near the stern, the panels are filled



4 | Isola del Giglio. Bagno del Saraceno. Roman Fishpond. Appearance of the deposit with lead elements. An anchor is visible (photo by G. Grimaudo).

with small circular motifs, followed again by longitudinal terminations that have been heavily abraded by seawater.

The interlocking element is decorated in imitation of wooden carving and displays, in its lower portion, a stepped profile. Although at first we hypothesised that the find might represent an ancient model of a Roman ship, it was Giulio Ciampoltrini who identified clear parallels with lead toys and inkwells depicting Venetian gondolas, widely produced between the eighteenth and nineteenth centuries. The significance of this curious deposit of lead toys, discovered within the late sediments of the Roman fishpond, remains enigmatic. It may, however, be interpreted within the broader context of the mementoes and small objects that Giglio's sailors are believed to have brought back to the island after long periods of service at sea. In this sense, the discovery not only provides insight into the later reuses and transformations of the ancient site, but also symbolically connects the maritime identity of the island's modern seafarers with the enduring memory of its Roman maritime landscape.

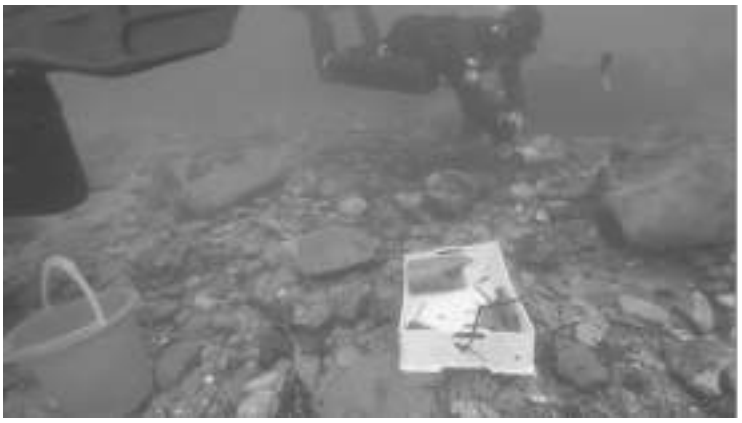
The continuation of the excavation, beneath the modern deposits, made it possible to identify abundant remains from the phases of abandonment of the fishpond, mixed with materials originating from the maritime villa located to the south and from the harbour structures situated to the west and north of the tanks [Fig. 7]. Numerous bessales were also recovered, attributable to the *figlinae* of the *Domitii*, although a substantial portion of the assemblage belongs to the production of *Gobathus*, given the notable diffusion of the stamps of *T. Claudius Gobathus* within the province of Grosseto (Gliozzo *et al*. 2020). An unexpected element within these

5 | Isola del Giglio. Bagno del Saraceno. Roman Fishpond. Detail of the lead anchor and hull (photo by G. Grimaudo).

stratigraphic levels was the discovery of several quadrangular tubuli (9 fragmentary ones, and one intact as in Fig. 8), characteristic of Roman structures equipped with water-heating systems, such as thermae and balnea. The presence of *balnea* associated with complexes that also included Roman fishponds is well attested and widespread — one may cite, for example, the *balneum* of Le Guardiole at *Castrum Novum* (Enei *et al*. 2016), or the *Domitiana Positio* itself (Ciampoltrini, Rendini 2023, with previous bibliography). However, at the conclusion of the 2021 excavation at Bagno del Saraceno, no structural remains were yet known that could be directly associated with the *tubuli* recovered from within the deposits of the fishpond.

J.T

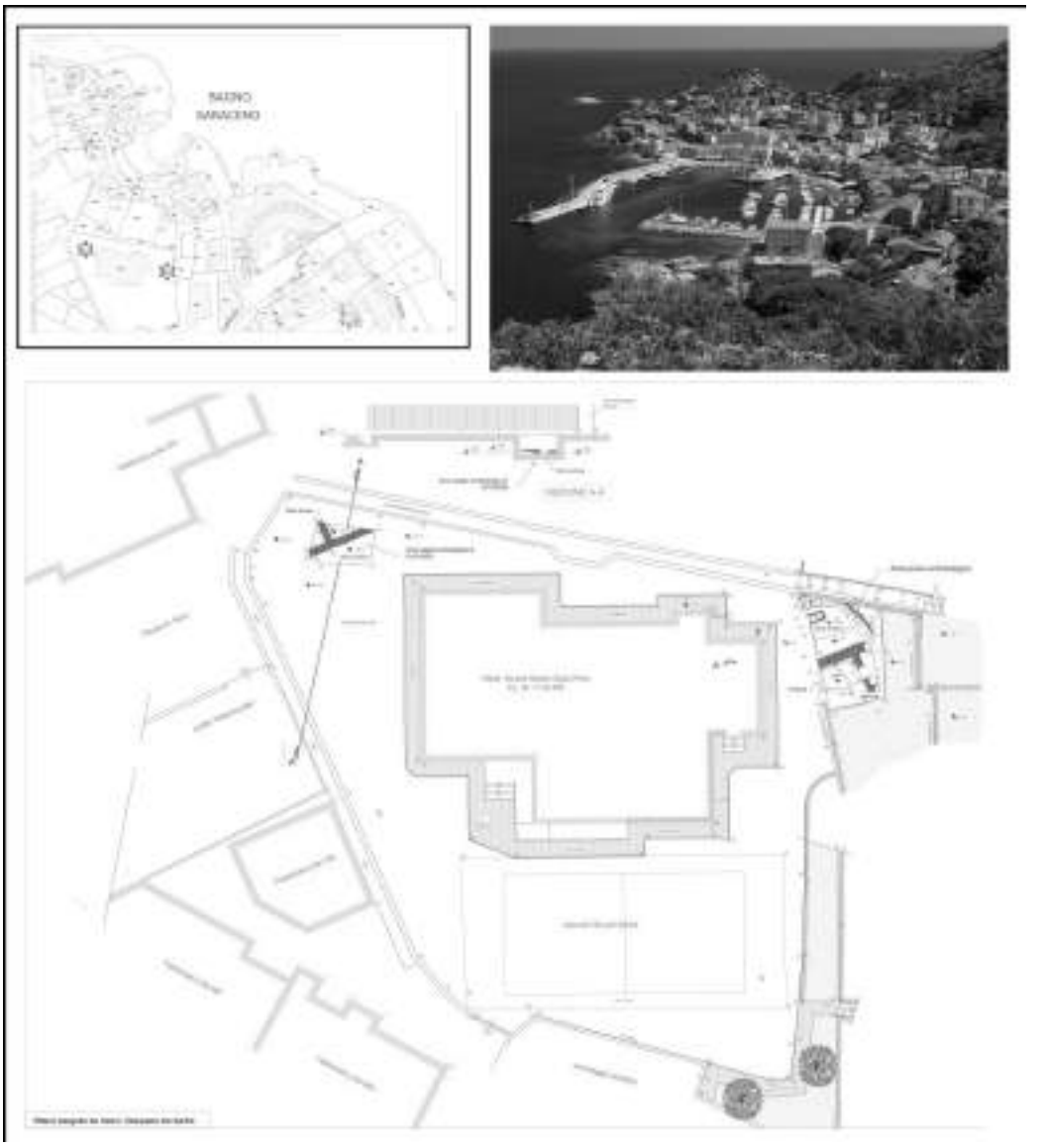
6 | Isola del Giglio. Bagno del Saraceno. Roman Fishpond. The lead hull (photo by Rasta Divers).



7 | Isola del Giglio. Bagno del Saraceno. Roman Fishpond. Excavation phases with detail portraying a rectangular *tubulus* (photo by Rasta Divers).
8 | Isola del Giglio. Bagno del Saraceno. Roman Fishpond. Rectangular *tubulus* (photo by G. Grimaudo).

Between November 2022 and December 2023, during a campaign of preventive archaeological investigations carried out in the locality of Giglio Porto, near the present-day R. Maltini School, new and highly significant remains of the Roman period came to light. These remains can be attributed to the above-mentioned large Roman complex of the *villa del Saraceno*, which once stood on Poggio del Castellare, overlooking and controlling the island's harbour. The traces of this villa, scenographically overlooking the sea and continuously occupied from the late 1st century BC to the 4th century AD, are still visible today interspersed among the modern settlement — at the *Bagno del Saraceno* (the villa's fishpond) — and further north, along the southeastern slope of the cliff, where an extensive system of *cryptoporticus* and terraces stretched up to the summit of the hill crowned by the octagonal lighthouse.

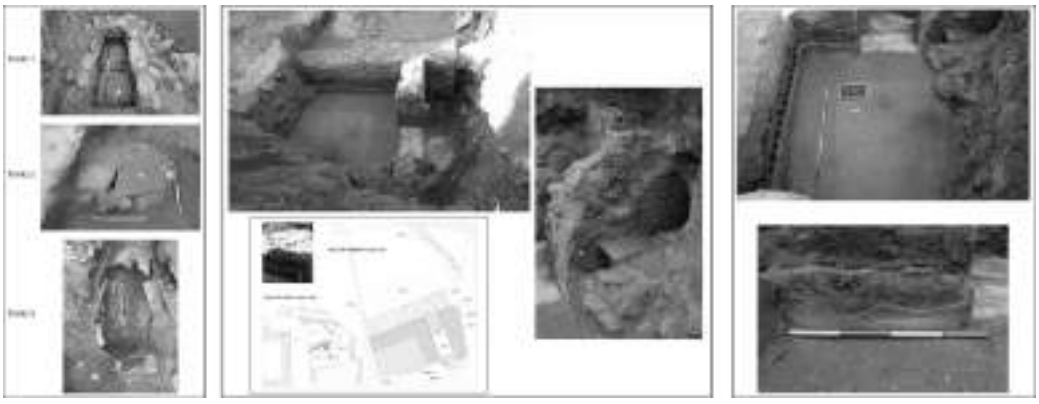
Descending toward the sea in the direction of the harbour from the central quadrangular core connected to the large lower terrace with a semicircular plan and *anterides* buttresses, embellished with mosaic pavements and *opus sectile* flooring, other structures were directly connected to the main villa, serving productive or utilitarian functions (Rendini 2007; 2022). Precisely on the terrace below the large semicircular hall, at less than 50 meters southwest of the Bagno del Saraceno, two distinct archaeological trenches revealed, on one side, at least two heated rooms (the better-preserved measuring approximately 4×3 m), equipped with *suspensurae* and a perimeter cavity with *tubuli* for the circulation of hot air (S.1); and on the other side, two additional rooms set at a slightly lower level and arranged orthogonally to a wide corridor (S.2) [Fig. 9]. These rooms can plausibly be interpreted as part of a *balneum* or



9 | Isola del Giglio. Giglio Porto. Location of the two excavated areas close to the School, plan oriented towards the north (drawing by F. Lodovici).

thermal installation and the *tubuli* are identical to those found in the stratigraphic deposits in the *peschiera*.

The first trench, located further east, exposed a rather significant stratigraphic sequence composed of at least three burials — one within an amphora and two in trenches built in stone, and



10 | Isola del Giglio. Giglio Porto. Graves found at the excavation near the School (photo by F. Lodovici).
11 | Isola del Giglio. Giglio Porto. Possibly the *balneum* close to the School with evidence of rectangular *tubuli*, plan oriented towards the north (photo and drawings by F. Lodovici).
12 | Isola del Giglio. Giglio Porto. Details of the mosaics and use of marble (photo by F. Lodovici).

brick-lined graves — belonging to the late phases of the imperial complex, as attested by the types of amphorae employed [Fig. 10]. These burials, devoid of grave goods and consistently documented elsewhere within the complex, especially in the late phase of occupation, dating to the 6th and 7th centuries AD (Rendini 2022, with previous bibliography), cut directly into the abandonment layers of the heated rooms [Fig. 11].

Underneath the burials, the high construction quality of this sector of the complex — clearly connected to the imperial villa itself — is attested not only by the masonry technique, featuring a robust concrete core rich in *pozzolana* mortar and an external facing of blocks of varying size alternated with brick courses laid in roughly horizontal rows, but also, and above all, by the pavements in white mosaic tesserae bordered by a broad black band, and by marble *crustae* wall revetments found both in situ and within the obliteration layers [Fig. 12].

From these same levels, and on two still-preserved *bipedales*, several stamped brick fragments were recovered, bearing a characteristic crescent-shaped mark already known from earlier discoveries in the area (after Bronson, Uggeri 1970), dating to the first half of the 2nd century AD-between the late Hadrian period and the early years of the reign of Antoninus Pius. Additional finds include fragments of Italian and African sigillata pottery, several oil lamps, a bronze handle probably belonging to a jug, iron and lead nails, and a possible iron tap [Figg. 13–14]. The two rooms were directly connected on their short side by a marble threshold (57 × 98 cm) with two recesses — one rectangular, likely for a hinge, and the other semicircular on the opposite side — together with six small circular holes, two of which still contained lead-plugged nails [Fig. 15]. Another threshold, only partially visible during excavation, probably connected the eastern room, recently investigated, with the space immediately to the north. Although the excavated area remains relatively limited — and further investigation is currently hindered by

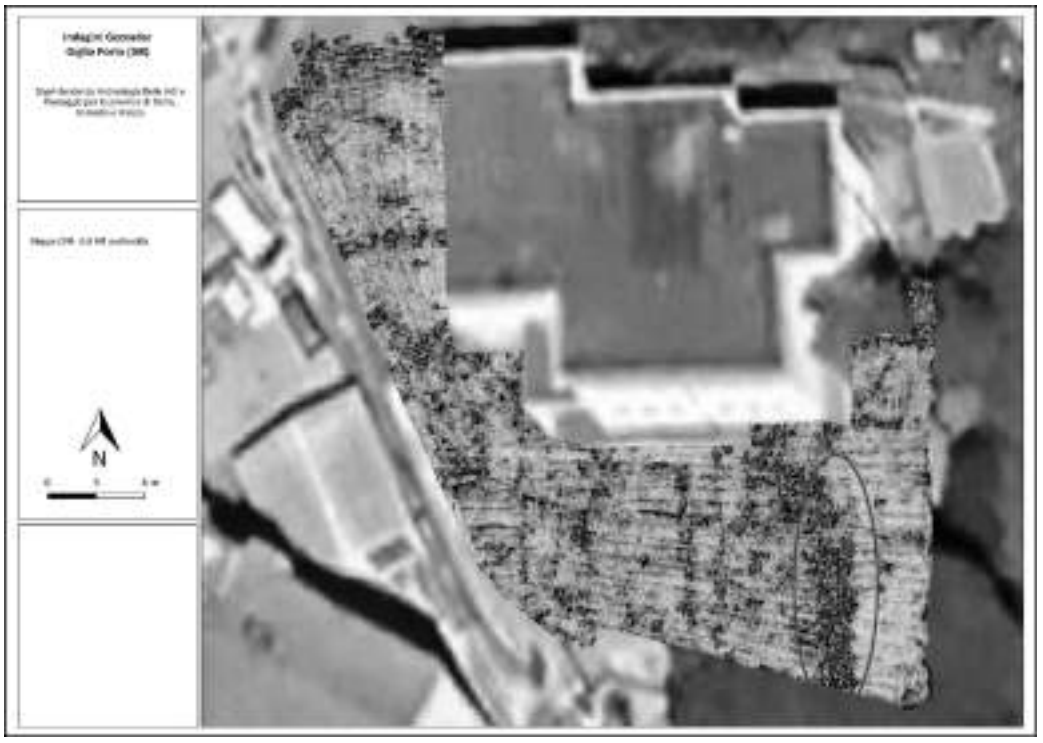
13 | Isola del Giglio. Giglio Porto. Presence of Imperial stamps. Detail of underground *suspensurae* (photo by F. Lodovici).
14 | Isola del Giglio. Giglio Porto. Artefacts discovered during the excavation (photo by F. Lodovici).
15 | Isola del Giglio. Giglio Porto. Excavation of the heated room (photo by F. Lodovici).
16 | Isola del Giglio. Giglio Porto. Second excavated area, with traces of plastered wall (drawing by F. Lodovici).

the considerable overlying deposits — it nonetheless provides an interesting glimpse into the late Hadrian phase of the complex and its development toward the actual harbour district.

Proceeding westward, a second trench—opened immediately beyond the currently used school complex—exposed additional structures, including at least two orthogonal rooms aligned SW–NE along a perimeter wall, traceable for approximately 4.4 m in length and about 60 cm in thickness, constructed once again in opus *caementicium* with an outer facing of pseudo-regular blocks arranged in horizontal courses. Traces of wall plaster, up to 4 cm thick and composed of mortar mixed with *cocciopesto*, suggest that these rooms served a functional or service role within the broader complex [Fig. 16]. It is worth noting that these latter rooms lie at a slightly lower elevation than the thermal spaces to the east, and their floor level could not be reached for safety reasons. From their obliteration layers came numerous ceramic fragments — mainly African cooking ware and amphora sherds — together with brick pieces, *cocciopesto* fragments, and a few iron nails. The difference in elevation between the two groups of rooms described above may be explained by an additional terrace wall that likely connected the thermal level with a lower terrace corresponding to the villa's *peschiera*. Although this retaining wall was not excavated directly, a pronounced linear anomaly oriented north–south, identified through a ground-penetrating radar survey conducted in the school courtyard, may represent its trace [Fig. 17].

E.M.G

In conclusion, the combined results of the excavation campaigns carried out between 2019 and 2023 —first at the Roman *peschiera* of Bagno del Saraceno and subsequently in the area immediately to its south— offer, for the first time, a coherent and stratified picture of the lower sector of the *villa del Saraceno*, revealing the complex articulation of its maritime front. The



17 | Isola del Giglio. Giglio Porto. Results of the geophysics survey (GPR) around the School (digital elaboration by ATS).

new evidence not only refines the understanding of the villa's structural layout and chronology but also illuminates the functional and hydraulic interconnections between its residential, productive, and leisure components. The discovery within the *peschiera* deposits of several *tubuli* — quadrangular hollow tiles typical of wall-heating systems — anticipated the later identification (although from a context with modern material associated) less than fifty metres to the southwest, of a series of heated rooms equipped with *suspensurae* and *tubuli* for the circulation of hot air. The identical typology of these architectural elements, the presence of the same stamps, leaves little doubt as to their association, strongly suggesting that the possible baths (*balneum*) discovered near the modern School were functionally and structurally linked to the fishpond complex. This connection is further supported by their shared orientation, the gradual terracing of the terrain descending toward the sea, and the hydraulic logic of the installations, which exploited the natural flow of freshwater descending from the Bonsere valley.

Taken together, the evidence delineates an articulated sequence of terraces descending from the residential nucleus of the villa to the maritime structures on the shoreline. At the intermediate level lay the *balneum*, elegantly decorated with mosaic pavements and marble revetments, while at the lowest terrace the *peschiera* combined practical and symbolic func-

tions — serving both as a fish-breeding installation and as an element of aesthetic display in the maritime façade. The integration of these features mirrors a widespread pattern in the design of imperial *villae maritimae*, where the control and enjoyment of water-whether fresh, brackish, or marine — played a central role in shaping the architecture and the ideological representation of leisure and power. The Hadrianic reconstruction phase, now securely attested both in the thermal complex and in the masonry of the *peschiera*, marks a moment of comprehensive renewal in the life of the villa, paralleled by the construction of the octagonal lighthouse on the summit of Poggio del Castellare. This monumental alignment — from the upper residential quarters to the baths and the fishpond below — embodies the characteristic unity of landscape, architecture, and seascape that defined the Roman conception of the *villa maritima*.

Beyond its architectural significance, the close correspondence between the stratigraphic, structural, and material data recovered from these two excavation areas confirms the exceptional state of preservation of the complex and underscores the importance of these recent investigations. Even the curious discovery of a small lead "gondola" — a modern object later redeposited within the ancient *peschiera* — serves as a poignant reminder of the site's enduring maritime vocation and of the symbolic continuity that links the island's modern seafarers to its Roman past. The coordinated study of the *peschiera* and the *balneum* thus not only advances our knowledge of the *villa del Saraceno* but also contributes to a broader understanding of the management of water, space, and sensory experience in Roman coastal villas of the Tyrrhenian region.

E.M.G, J.T

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Abstract

Between 2019 and 2021, excavation campaigns at the Roman *peschiera* (fishpond) of Bagno del Saraceno in Giglio Porto, carried out within the SEASCAPE project, provided the first systematic investigation of this submerged complex. The research revealed multiple construction phases, beginning with a late 1st-century BC landing installation hewn into the granite cliff and associated with the nearby maritime villa. During the Neronian period, this structure was transformed into a fishpond of four interconnected tanks supplied with freshwater from the Bonsere valley, which created the brackish environment necessary for fish farming. A late Hadrianic restoration phase saw the consolidation of the masonry in *opus mixtum* and *opus reticulatum*, contemporaneous with the reorganisation of the villa and its octagonal lighthouse on Poggio dei Castellari. Excavations yielded over 550 finds, mostly metallic artefacts, alongside ceramics, glass, stucco, and faunal remains. Among these, a remarkable lead model resembling a gondola, probably a late eighteenth- or nineteenth-century toy, was found within the fishpond sediments, testifying to later reuse of the site. Beneath the modern deposits, layers associated with the abandonment of the complex contained *bessales* from the *figlinae* of the *Domitii* and *Gobathus*, as well as quadrangular *tubuli* indicative of heated-water installations, suggesting possible connections between the fishpond and now-lost *balnea* within the villa's maritime sector. Excavations carried out in 2023 and 2024 brought to light, beneath the modern school buildings, mosaic-paved rooms with *suspensurae* and *tubuli* similar to those found in the fishpond of Bagno del Saraceno. It is not yet certain whether these remains represent a *balneum* annexed to the fishpond or rather a section of the large maritime villa itself.

keywords | Isola del Giglio; Bagno del Saraceno; Roman Fishpond; Lead models of gondolas; Balnea and fish-tanks.

Aquae calidae and Thermal Constructions in Tunisia during Antiquity

Ameur Younès

Introduction

Water played a crucial role in the cities of *Africa Proconsularis*. Local authorities captured both sources and groundwater, and collected rainwater to meet various water needs in a province characterized by a Mediterranean climate. A considerable proportion of this water was allocated to the baths, as each city was equipped with one or more thermal complexes.

In addition to baths intended for regular bathing, the inhabitants of *Africa Proconsularis* also frequented hot springs (*aquae calidae*) where they built facilities designed to exploit their therapeutic and healing properties. Although the study of these thermal complexes is essential for understanding an aspect of Roman society in *Africa Proconsularis*, this topic has received far less scholarly attention than that devoted to the urban baths of the province. The few publications dealing with hot springs and thermal complexes are based mainly on literary and epigraphic sources.

Beyond the valuable information provided by these classical sources, archaeological, physicochemical, mineral, and therapeutic data now offer new insights that enrich our understanding of thermalism in *Africa Proconsularis*.

For several reasons – including the large number of *aquae calidae* and bathing complexes, as well as the constraints of this paper's length etc. – this study focuses exclusively on the hot springs (*aquae calidae*) and thermal installations of ancient Tunisia. The number of identified hot springs with simple constructions (such as pipes or basins) or with preserved thermal complexes in ancient Tunisia now exceeds those recorded in ancient texts and inscriptions (Jouffroy 1992, 87-99; Pettenò 1998, 133-148; Aounallah 2018, 267-272) [Fig. 1]. Indeed, sixteen (16) *aquae calidae* and thermal constructions have been registered: *Aqua calida* of *Utica*, *Aquae Persianae*, *Aquae calidae* of *Capsa*, *Aquae Tacapitanae*, *Aquae*, *Aquae calidae* of Theudalis (!), *Ad Aquas*, *Aquae Aptuccensium*, *Aquae Traianae*, *Aquae Carpitanae*, *Aqua calida* of Wadi Mellègue, *Aqua calida* of Jebel Oust, *Aqua calida* of Zriba, *Aqua calida* of Jedidi, *Aqua calida* of Maamar, *Vaporium* of Jebel Trozza [Fig. 1].

These sites are located within Roman cities or their territories, and the exploitation of certain thermal springs may date back to the Punic period.

1 | Map of *aquae calidae*, baths and ancient towns (A. Younès)

This paper examines the hot springs located both within Roman cities and in their surrounding territories, providing a synthesis of their geographical distribution, the thermal structures built around them, and the relationship between the springs, therapeutic treatments, and water cults.

Aquae calidae and thermal facilities in the ancient cities

Among the sixteen (16) currently identified *aquae calidae* and thermal structures, five (5) are located in *urbes Romanae*: *Aqua calida* of *Utica*, *Aquae Persianae*, *Aquae calidae* of *Capsa*, *Aquae Tacapitanae*, and *Aquae*.

I. *Aqua calida* of *Utica*

The hot spring known as Ain el-Hammam is located at the site of the ancient city of *Utica*. Recent archaeological excavations have revealed that the spring was associated with an early temple dating from the second half of the 7th to the mid-4th century BC. This structure was later replaced by a second temple, built directly over the earlier one in the mid-4th century BC and destroyed around the end of the 2nd or the beginning of the 1st century BC (Ben Jerbaia *et al.* 2021, 61-90). The spring supplied a quadrangular basin within the second temple, and it is likely that it had also provided hot water to the earlier temple. According to the physicochemical and mineral analyses conducted by the Thermal Office, the spring's flow rate is 1 L/s, and the water temperature does not exceed 38.5 °C. The major elements identified – calcium (54 mg/L), magnesium (25 mg/L), sodium (215 mg/L), potassium (16.7 mg/L), bicarbonates (348 mg/L), sulphates (60 mg/L), and chlorides (270 mg/L) indicate that the water is low-sodium chloride in composition (Office Du Thermalisme 2000, 24). Archaeological evidence suggests that the spring was connected to the Phoenician-Punic temple, allowing worshippers to honour a deity – currently unidentified – while benefiting from the therapeutic properties of the sodium chloride hot water. Today, local inhabitants continue to use the spring water both to relieve rheumatological pain and to irrigate their crops.

II. A*quae Persianae*, *Ad Aquas*, *Naro* (Hammam-Lif) *Aqua calida* of *Utica*

Two hot springs are attested in the present-day city of Hammam-Lif, the successor of the Roman city of *Naro*: Ain Dar el-Bey and Ain el-Aryan. Located close to one another, both were already known in Roman times, as attested by Latin literary sources. In *Florida XVI*, *Apuleius* reports that he visited the *Aquae Persianae* to treat a sprain with the waters of the hot springs: *Contulerim me ad persianas aquas, gratissima prorsus et sanis natabula et aegris medicabula* (Apuleius, *Florida*, XVI). In 1854, an inscription dedicated to the God of medicine, Aesculapius, was discovered during the excavation of a probable Roman thermal complex at Hammam-Lif. The inscription reads: *Aesculapio /T(itus) Iulius Perseus cod(uctor) IIII p(ublicorum) Africae* (CIL, VIII, 997; Guyon 1864, 4 et seq.; Toutain 1912, 335; Jouffroy 1992, 87-99; Pettenò 1998, 133-148; Ben Seddik 2010, t. 2, 27). The dedication, carved on the architrave of the building, dates from the early Roman Empire (2nd-early 3rd century AD) and was commissioned by *Titus Iulius Perseus*. During the construction of the Dar el-Bey

3a-b | Ain Dar el Bey channel and Roman basin (Termil errjel).

hammam in the mid-18th century, archaeological remains very likely belonging to Roman baths were unearthed (Abidi-Belhaj 2016). Today, the spring of Ain Dar el-Bey supplies water to Hammam Sidi Bourigua, formerly known as Dar el-Bey hammam, and later as Hammam En-Nsa [Fig. 2]. The spring has a flow rate of 2 L/s and a temperature of 43 °C. Its mineral composition indicates a highly chlorinated, sodium-rich, and sulphated water, with major element concentrations exceeding those of the *Utica* spring: calcium (960 mg/L), magnesium (162.94 mg/L), sodium (3776.60 mg/L), potassium (124.02 mg/L), bicarbonates (622 mg/L), sulphates (1056 mg/L), chlorides (7268 mg/L), fluorides (2.80 mg/L), and nitrates (7.17 mg/L). Trace elements are quite abundant: SiO_2, Sr, Rb, B, Mn, Li, Fe, Zn, Cu, Ni, Pb (Office Du Thermalisme 2000, 64). The spring of Ain el Aryan supplies thermal water to the Assouri hammam, also known as Hammam Sidi al Aryan, which is currently closed. Its flow rate is 2.5 L/s and its temperature reaches 46°C. Its mineral composition is close to that of the previous spring. The concentrations of major elements are as follow: calcium (960 mg/L), magnesium (182.40 mg/L), sodium (3776.60 mg/L), potassium (124.02 mg/L), bicarbonates (597 mg/L), sulphates (1116 mg/L), chlorides (7963 mg/L), fluorides (2.70 mg/L), and nitrates (1.94 mg/L). The trace elements include SiO_2, Sr, Ba, B, Rb, Mn, Li, Fe, Zn, Cu, Co (Office Du Thermalisme 2000, 67).

III. *Aquae calidae* of *Capsa*

The baths were built in the ancient city of *Capsa* (modern-day Gafsa). Their existence is attested by an inscription dedicated by *Cnaeus Iunius* to Neptune and the Nymphs, as well as by archaeological remains (CIL VIII, 120; Shaw 1743, 271; El Bekri 1913, 100-102; Saumagne 1962, 520-523; Trousset 1993, 1758-1759). Today, only two quadrangular basins (known as Roman pools) remain. They were built in *opus quadratum* and are connected by an underground channel. The larger pool, called Termil Errjel/Hammam Errjel, measures 19 meters in

length and 16 meters in width [Fig. 3]. The smaller pool, called Termil Ennsâ/Hammam Ennsâ, measures 15 meters in length and 6.5 meters in width. The Tunisian term *Termil* is derived from a distortion of the Latin word *thermes*. Accordingly, Termil Errjel can be interpreted as the "Baths for Men" (*Errjel* means "men" in Arabic), while Termil Ennsâ refers to the "Baths for Women" (*Ennsâ* means "women" in Arabic). The two basins are supplied by a hot sodium-chloride spring (called Ain Dar el Bey) located beneath the Hafsid Kasbah (citadel) [Fig. 3]. Physicochemical and mineral analyses confirm that the spring water is sodium-chloride and sulphurous. Its flow rate is 26 L/s (pumped) and its temperature is moderately warm, at 28 °C. The concentrations of both major and trace elements are slightly lower than those recorded in the *Aquae Calidae Persianae*. Major elements include calcium (760 mg/L), magnesium (170.24 mg/L), sodium (3460 mg/L), potassium (170 mg/L), bicarbonates (390.40 mg/L), sulphates (1817 mg/L), chlorides (6514.25 mg/L), fluorides (1.14 mg/L), and no nitrates. Trace elements are: SiO_2, Sr, Ba, B, Rb, Mn, Li, Fe, Zn (Office Du Thermalisme 2000, 158). In addition to the thermal spring that once supplied the Roman baths in the city, another thermal spring is located at Sidi Ahmed Zarrouk, about 5 km northwest of Gafsa. A modern thermal facility has recently been constructed there, and the spring has been replaced by a deep borehole to ensure an adequate flow of hot water.

IV. *Aquae Tacapitanae* / Hammat Gabès

Aquae Tacapitanae is located approximately 31 km west of the ancient city of *Tacape* (modern-day Gabès). It was mentioned both in the *Antonine Itinerary*, 74,1 and 78,2-3 (Cuntz 1929), and in the *Peutinger Table*, segment VI, 3-4 (Weber 1976). Today, the site of the ancient Roman town is occupied by the modern city of El Hamma, which, like its predecessor, owes its name to the abundance of hot water (Shaw 1743, 277; Guerin 1862, t. 1, 235; Tissot 1888, t. 2, 645 and 699). According to archaeological remains uncovered during development and construction work in the modern town, as well as interviews with local residents, three thermal springs are located in the centre: Ain el Borj, Ain Sidi Abdelkader, and Ain Ezzairi. These three springs currently supply three modern hammams: Hammam el Borj, Hammam Ezzairi, and Hammam Sidi Abdelkader. During the construction work of the municipality and Hammam el Borj, the ruins of a significant ancient thermal complex were uncovered [Fig. 4]. Physicochemical and mineral analyses of Ain el Borj attest that the spring water is sulphated-calcium and sodium-chloride rich. Its temperature is 40 °C, and the concentrations of major elements are lower than those of the previously two springs: calcium (424.65 mg/L), magnesium (74.20 mg/L), sodium (506.57 mg/L), potassium (99.13 mg/L), bicarbonates (183 mg/L), sulphates (1187.05 mg/L), chlorides (883.83 mg/L), fluorides (0.55 mg/L), and nitrates (2.64 mg/L). Trace elements are comparable to those found in the *Capsa* baths spring: SiO_2, Sr, B, Rb, Mn, Li, Fe, Zn, Cu (Office Du Thermalisme 2000, 161). Outside the town of El Hamma, in the village of El Kasr, there is another thermal spring mentioned by V. Guérin (Guerin 1862, t. 1, 235). A small modern thermal facility has been constructed on the site of an older one, of which only compartments built in *opus quadratum* remain. The hypothesis that these structures belonged to a Roman thermal complex is plausible. An archaeological investigation

of the site would not only uncover additional ancient remains but also provide further insight into the architecture, operation, and dating of the complex.

V. *Aquae* / Hammet el Jerid

Aquae, corresponding to the present-day town of Hammat Gabès, is located approximately 10 km north of the Roman city of *Tusuros* (modern-day Tozeur). The ancient name *Aquae* reflects the abundance of springs in the area, including hot springs. It was mentioned in the Acts of the Conference of Carthage in 411 (Lancel 1991, 1308). Authors from the Medieval period such as Al-Marrakchi (Chtioui, Sila 2021, 32) and Ibn Chabbat (Chtioui, Sila 2021, 32), as well as visitors and travellers from the 18th and 19th centuries, such as Al-Sijilmassi (Chtioui, Sila 2021, 32-33), Al-Warthilani (Chtioui, Sila 2021, 33), De Florac (Chtioui, Sila 2021, 34), V. Guérin (Guerin 1862, t. 1, 269), and Ch. Tissot (Tissot 1888, t. 2, 683), all noted the hot springs and praised their therapeutic virtues. One of the ancient and still-known thermal springs is Ain Sidi Haraket [Fig. 5]. According to accounts by 18th and 19th centuries' visitors and travellers, this spring—whose temperature exceeds 50 °C—flows into two adjacent ancient basins built with finely cut stone (Guerin 1862, t. 1, 269; Tissot 1888, t. 2, 683). The first basin is oblong, and the second is square. It is very likely that both basins were part of an ancient thermal complex dating from the Roman period (Chtioui, Sila 2021, 73). Today, the two basins are connected to the small structure of the Marabout of Sidi Haraket. An archaeological investigation around the marabout would likely uncover remains of the Roman baths.

Aquae calidae and thermal facilities in the territories of ancient cities

Eleven hot springs with associated thermal installations have been identified within the territories of Roman cities: *Aquae Calidae* of *Theudalis*, *Ad Aquas*, *Aquae Aptuccensium*, *Aquae Traianae*, *Aquae Carpitanae*, *Aqua Calida* of Wadi Mellègue, *Aqua Calida* of Jebel Oust, *Aqua Calida* of Zriba, *Aqua Calida* of Jedidi, *Aqua Calida* of Maamar, and *Vaporium* of Jebel Trozza.

VI. *Aquae calidae* of *Theudalis* (Hr Aouan) (!)

Three hot springs are located about 5 km west of the Roman city of *Theudalis* and only a few hundred meters from Jebel Ichkeul: Ain Sidi Ben Abbès, Ain Sidi Abdelkader, and Ain Djerab (or *Ain Ennegrez*). These springs lie at a low elevation, not exceeding one meter. According to the *Archaeological Atlas of Tunisia (AAT) 1892, sheet n°6, Jebel Ichkeul, site 6*, the remains of an ancient thermal complex are still visible at Ain Sidi Abdelkader. In modern times, three small hammams were constructed around the hot springs— Hammam Sidi Abdelkader, Hammam Sidi Ben Abbès, and Hammam Djerab (also known as Hammam Ennegrez)—all of which are currently closed. Archaeological investigation, particularly around Hammam Sidi Abdelkader, could reveal further remains of the ancient bathing complex. Hydrochemical analyses show that the three springs are highly mineralized, characterized by sodium-chloride, sulphated-calcium, and magnesium-rich waters.

- Sidi Abdelkader Spring

Temperature 43 °C. The concentrations of major elements are higher than those recorded at

Hammat Gabès spring and comparable to those of Hammam Lif: calcium (1120 mg/L), magnesium (182.40 mg/L), sodium (3000 mg/L), potassium (78 mg/L), bicarbonates (353 mg/L), sulphates (2253.36 mg/L), chlorides (5502.50 mg/L), fluorides (1 mg/L), and traces of nitrates. Trace elements differ slightly from those observed at *Capsa* and Hammat Gabès, with the presence of Sr, Si, B, Ba, Mo, Li, Fe, Zn, Cu (Office Du Thermalisme 2000, 16).

• Sidi Ben Abbès Spring
Temperature 42 °C. The concentrations of major elements are similar to those of the previous spring: calcium (1240 mg/L), magnesium (121.60 mg/L), sodium (3160 mg/L), potassium (74 mg/L), bicarbonates (366 mg/L), sulphates (2200.50 mg/L), chlorides (5573.50 mg/L), fluorides (1 mg/L), with traces of nitrates. Trace elements have not been determined (Office Du Thermalisme 2000, 14).

• Hammam Djerab Spring
Temperature 45 °C and a flow rate of 0.3 L/s. The concentrations of major elements differ from those of the other two springs: calcium (900 mg/L), magnesium (668.80 mg/L), sodium (2600 mg/L), potassium (69 mg/L), bicarbonates (353.80 mg/L), sulphates (952.50 mg/L), chlorides (4686 mg/L), fluorides (1.55 mg/L), and traces of nitrates. Trace elements have not been determined (Office Du Thermalisme 2000, 20).

The archaeological remains belong to an ancient thermal complex that very likely depended on the nearby Roman city of *Theudalis*. Further excavation would provide valuable information concerning the size, architectural features, and chronology of the structure.

VII. *Ad Aquas* / Hammam Ali Daoua / Argoub Assaboun

The hot spring is located about 1.5 km west of the Roman city of *Thuburnica* and 11 km north of the modern town of Ghardimaou. It represents the most significant spring outlet emerging from the bed of the wadi el-Hammam. This main outlet was tapped and channelled to supply the baths since Antiquity. Archaeological remains — including small masonry blocks, limestone rubble, and large stone blocks — are still visible on the surface near the modern Hammam Sidi Ali Daoua. It is very likely that these remains belong to the Roman thermal complex associated with *Thuburnica*, over which the modest modern hammam was later constructed [Fig. 6]. Excavations in the vicinity of the hammam would likely uncover additional remains of the Roman thermal complex. The physicochemical and mineral analyses indicate that the spring water is sulphated, highly mineralized, characterized by a typical sodium–chloride hydro-chemical facies, and enriched in manganese. Its flow rate is 0.5 L/s and the temperature reaches 40 °C. The concentrations of major elements are generally higher than those of the previously described springs: calcium (986 mg/L), magnesium (249.28 mg/L), sodium (17128 mg/L), potassium (3.90 mg/L), bicarbonates (707.60 mg/L), sulphates (3456 mg/L), chlorides (25915 mg/L), and fluorides (1.90 mg/L). Trace element concentrations (Sr, Mn) are lower than those in the preceding sources (Office Du Thermalisme 2000, 49-50).

VIII. *Aquae Aptuccensium* / Hammam Biadha

Aquae Aptuccensium is located approximately 4 km north-northwest of the Roman city of *Aptucca* (Henchir Semmech, also known as Henchir Oudeka), and about 24 km west-southwest of the modern town of Teboursouk. The existence of a thermal complex at this site is confirmed by an inscription dedicated to the healing god *Aesculapius*, similar to the one found at *Aquae Persianae*. The inscription reads:

> *Aesculapium arg(enteum) / libris quinque et sen(is) /Aquis Aptuccensium, /Aemilia Tertulla Marciana /Cornelia Rufina Africania/na, clarissima f(emina), consecrauit eadem/que Marciana signum mar/moreum Aesculapi(i) d(onum) d(edit)* (Ben Seddik 2010, t. 2, 26).

The archaeological remains of the Roman thermal complex are partially visible today, as the modern hammam (Hammam Biadha) was constructed over part of the ancient structure. Among the preserved elements are large rock-cut rooms coated with hydraulic mortar, hot-water conduits, and cisterns [Fig. 7]. It is very likely that this Roman bath complex dates to a period after the reign of Emperor Hadrian (117–138 AD) (Diez De Velasco 1998, 109). Given its proximity to the Roman city of *Aptucca*, this Roman bath complex was most probably dependent upon that ancient city. At present, the spring feeding Hammam Biadha is captured through a rock-cut well (or grotto), approximately 20 meters deep and 5 meters wide. It has a flow rate of 3 L/s and a temperature of 45 °C. Its mineral composition indicates a sodium-chloride spring rich in CO_2. The concentrations of both major and trace elements are higher than those recorded at Ad Aquas. Major elements include calcium (1540 mg/L), magnesium (644.50 mg/L), sodium (19056 mg/L), potassium (248.68 mg/L), bicarbonates (1647 mg/L), sulphates (3778 mg/L), chlorides (33015 mg/L), fluorides (0.84 mg/L), with traces of nitrates. The trace elements are comparable to those of *Aquae Persianae*: SiO_2, Sr, Ba, B, Mn, Li, Fe, Zn, Cu, Ni, Rb (Office Du Thermalisme 2000, 109).

IX. *Aquae Traianae* / Hammam Saiala

Aquae Traianae is located approximately 5 km south-southwest of Beja (ancient *Vaga*). The existence of the spring is attested by a dedication made by the imperial freedman, *Marcus Ulpius Menophoon* to the *Genius Aquarium Traianarum — Genio Aquar(um) Traian(arum)* (ILAfr. 440; Jouffroy 1992, pp. 87-99; Pettenò 1998, 133-148) — as well as by a fragmentary inscription referring to the restoration of the bath complex (CIL, VIII, 14457; Jouffroy 1992, 94), and by the archaeological remains of the Roman baths themselves (*AAT 1892, Sheet n°26, Wadi Zerga, site 2*; Vincent 1884, 38; Monchicourt 1913, 131-134). Today, the site is partially covered by the modern Hammam Saiala. The remains of the Roman thermal complex are still visible, consisting of masonry blocks, rubble and block stones [Fig. 8]. According to H. Jouffroy (1992, 94), "this was most likely a small thermal station located on an imperial estate", administratively linked to the city of *Vaga*. A preventive archaeological investigation would likely reveal additional buried remains of the ancient baths — a particularly urgent task given the ongoing construction in the vicinity of the modern hammam. At present, the spring supplying Hammam Saiala is captured through a well of 8 meters deep. It has a flow rate of 1 L/s and a temperature of 46 °C. Its mineral composition indicates a a sodium-chloride-rich

thermal spring. The concentrations of both major and trace elements are lower than those recorded at *Aquae Aptuccensium*. Major elements include calcium (280 mg/L), magnesium (121.60 mg/L), sodium (4300 mg/L), potassium (28 mg/L), bicarbonates (355 mg/L), sulphates (903 mg/L), chlorides (7455 mg/L), fluorides (4.4 mg/L), with traces of nitrates. The trace elements identified include SiO_2, Sr, B, Mn, Li, Fe, Rb (Office Du Thermalisme 2000, 39).

X. *Aquae Carpitanae* / Korbous

The hot springs of Korbous are well known from both ancient literary sources and archaeological as well as epigraphic evidence. *Titus Livius* (*History*, XXX, 24) mentions the presence of *Aquae Calidae*, situated opposite Carthage, near which part of the transport fleet of *Cn. Octavius* was lost. Strabo (*Geography*, XVII, 3, 16) also refers to *Thermae* located along the Cap Bon coast, between the town of Tunis and the *Latomiae*. The *Stadiasmus Maris Magni* (*Stadiasmus* 1855, 120, 1) places *Thermae* between *Karpis* and a northern city, probably *Missua*. An inscription dating from 44–43 BC, discovered during construction work near the thermal hotel in 1907 (Belhadj Aissa 1982, 27), reveals that the *quaestor* and *pro-praetor Decimus Laelius Balbus* financed the construction of a thermal complex comprising steam rooms, an area for cleansing and massage with the strigil, and an open solarium. The inscription reads:

> *D(ecimus) Laelius D(ecimi) F(ilius)/Balbus q(uaestor) pro/pr(aetore), assa destrictar(ium) solariumque / facieundu(m) coerav(it)* (CIL VIII, 24106).

Archaeological excavations conducted by J. Renault between 1906 and 1908 uncovered the remains of the Roman thermal complex, including elongated basins with rounded ends, water conduits, statues, artifacts, and fragments of Roman ceramic (Renault 1908, t. 1,12-34). At present, seven hot springs are known in the Korbous area, four of which are the most significant: Ain el-Atrous, Ain Echifa, Ain Kalassira, and Ain Sbia [Fig. 9]. Their flow rates range from 0.70 L/s to 39 L/s, with temperatures between 44 °C and 59 °C. The waters are classified as sodium-chloride type (Office Du Thermalisme 2000, 75-83; Belhadj Aissa 1982, 36-45). Currently, the most frequented spring is Ain el-Atrous, owing to both its favourable location and mineral composition. It has a flow rate of 39 L/s and a temperature of 58.6 °C. Its mineral characteristics indicate a highly sodium-chloride composition. The concentrations of both major and trace elements are comparable to those of *Aquae Persianae*. Major elements include calcium (800 mg/L), magnesium (240.76 mg/L), sodium (2953.20 mg/L), potassium (89.70 mg/L), bicarbonates (536.80 mg/L), sulphates (2110.13 mg/L), chlorides (4970 mg/L), fluorides (3.20 mg/L), and no nitrates. Trace elements identified are SiO_2, Sr, Rb, B, Mn, Li, Fe, Zn, Cu, and Pb (Office Du Thermalisme 2000, 82).

XI. *Aqua calida* of Wadi Mellègue / Thermal spring of Wadi Mellègue / Hammam Wadi Mellègue

The thermal spring is located near Wadi Mellègue, approximately 12 km west of the town of Le Kef (ancient *Sicca Veneria*). The spring is indicated in the *Topographic Map 1956, Sheet*

Le Kef n° 44, as "Roman Ruins" (RR) and in the *Archaeological Atlas of Tunisia (AAT)1892, Sheet n°62*, *the surroundings of Le Kef*, at site 18. However, the site was not mentioned in the accounts of travellers and archaeologists from the 18th to 20th centuries. During the Roman period, the spring water was exploited for bathing properties. Today, although these baths are threatened by the expansion of the Wadi Mellègue dam, they remain relatively well preserved [Fig. 10]. The complex covers an approximate area of 875 m². Local inhabitants still frequent the site for bathing. A small Roman settlement developed around the thermal complex, covering about 3.4 hectares. In addition to the baths, visible remains include portions of structures, pavements, elements of ancient olive presses, and sherds of ancient ceramic. Future surveys and archaeological surveys should provide further data on the occupation of the site, which was most likely connected to the Roman town of *Sicca Veneria*. The spring that supplies the modern hammam has a flow rate of 2.5 L/s and a temperature of 42 °C. Its mineral composition indicates a strongly sodium-chloride type water. The concentrations of both major and trace elements differ from those of the previous spring. The major elements are: calcium (327.50 mg/L), magnesium (91 mg/L), sodium (2783 mg/L), potassium (48.80 mg/L), bicarbonates (639.28 mg/L), sulphates (363.50 mg/L), chlorides (4527.50 mg/L), and fluorides (2.05 mg/L). Trace elements include SiO2, Ni, Rb, B, Sc, Li, Fe, Zn, Cu, Se, As (Office Du Thermalisme 2000, 129).

XII. *Aqua calida* of Jebel el Oust / The thermal spring of Jebel el Oust

The Roman thermal station of Jebel el Oust is situated approximately 15 km north of Zaghouan (*Ziqua*) and 14 km southwest of Oudhna (*Uthina*), encompassing an area of about 7 hectares. The Roman name of this notable thermal station remains unknown. Excavations conducted during the 20th and 21st centuries have revealed several structures, including a temple, a thermal complex, a residence, and other monuments such as a large door, terracotta kilns, and a small necropolis (Carton 1914, 247-263; Fendri 1965, 157-171; Ben Abed, Scheid 2005, 321-349; Broise *et al.* 2011, 328-336; Ben Abed *et al.* 2011, 10-14). The three major monuments are summarized below: the temple was initially erected in the 1st century AD, and subsequently expanded during the early Empire period and the Antonine era. From the 4th century onwards, it was reused by Christians, who introduced structural and functional modifications. Statues of *Aesculapius* and *Hygieia* were discovered in the central *cella*, indicating its original cultic purpose. The thermal complex [Fig. 11] consists of two primary sections: one dedicated to bathing and associated hygienic practices, and the other serving as a lodging, rest, and healing area. The complex is believed to have been constructed in the mid-2nd century AD and remained in use until the Byzantine period. Over this long period (approximately four centuries), the complex underwent multiple architectural modifications. The residence dating to Late Antiquity, covers an area of approximately 1700 m² and is connected to the thermal complex via a long central corridor. Currently, the hot water spring is captured in a natural cave at the end of a gallery and supplies the modern thermal station of Jebel el Oust. Its flow rate is 3 L/s under gravity and 15 L/s when pumped, with a temperature of 54°C. Its mineral composition indicates a strongly sodium-chloride type water. The concentrations

of both major and trace elements differ from those of the Hammam Wadi Mellègue spring. The major elements are: calcium (992 mg/L), magnesium (167.80 mg/L), sodium (4991 mg/L), potassium (167.70 mg/L), bicarbonates (536.80 mg/L), sulphates (2814 mg/L)), chlorides (8094 mg/L), and fluorides (2.30 mg/L). Trace elements include SiO_2, Sr, Rb, Ba, B, Li, Fe, Zn, Ag, Mn (Office Du Thermalisme 2000, 95-96). This is a significant Roman thermal station that operated from the 2nd century AD until the Byzantine period, and it likely depended on the Roman city of *Ziqua* or that of *Uthina*.

XIII. *Aqua calida* of Zriba / Zriba thermal spring / Hammam Zriba

The thermal spring, emerging in Wadi el-Hammam, is located approximately 8 km east-southeast of the Roman city of *Ziqua* (Zaghouan) and 23 km west-southwest of *Segerme*s (Henchir el Harrat). It is marked on the *Topographic Map 1951, Sheet Bou Ficha n° 36, as Hammam Zriba*, as well as in the Archaeological Atlas of Tunisia (AAT) 1892, Sheet n°36, Sheet Bou Ficha, as site 181. The ancient spring is known from 19th-century travellers and archaeological documentation. Victor Guerin (1862, t. 4, ch. VI) identified visible remains of the baths, including a square basin in *opus quadratum*, a structure adorned with arcades, and a large vaulted building subdivided into several parallel compartments. P. Gauckler (1902, t. 2, pp. 144-145) provided a more complete and detailed description of the large cisterns and the thermal complex: an important Roman rainwater cistern divided into 12 compartments, an aqueduct carrying water from the cistern to the baths (?), a hot-water pool (!), two rectangular cisterns, and remains of the substructures of the complex. G.-Ch. Picard (1941, 321) identified a statuette of *Aesculapius* found near the baths. The thermal complex most likely depended on the Roman city of *Ziqua*. Future archaeological investigations are expected to reveal additional remains of the Roman thermal complex, thereby enriching the available data concerning this monument. Today, the spring supplies the modern Hammam Zriba. Its flow rate ranges from 8 to 60 L/s, and its temperature is 44 °C. Its mineral compositions confirm a strongly sodium-chloride type water. The concentrations of most major elements are lower than those found in the Jebel Oust thermal spring: calcium (640 mg/L), magnesium (145.92 mg/L), sodium (1132.74 mg/L), potassium (24.40 mg/L), bicarbonates (256.20 mg/L), sulphates (1770.09 mg/L), chlorides (1924.57 mg/L), fluorides (2.30 mg/L), and nitrates (1.41 mg/L). Trace elements include SiO_2, Sr, B, Li, Fe, Zn, Mn, Pb, Co, Rb, Ag, Ni, As, Cu (Office Du Thermalisme 2000, 93).

XIV. *Aqua calida* of Jedidi / The thermal spring of Jedidi / Hammam Jedidi

The spring is located approximately 6 km west of the Roman town of *Segermes* (Henchir el Harrat) and 22 km east of *Ziqua* (Zaghouan). Its Latin name remains unknown. It is indicated on the *Topographic Map 1951, Sheet Bou Ficha n° 36*, as “Roman Ruins” (RR), and in the *Archaeological Atlas of Tunisia (AAT) 1892, Sheet n°36, Sheet Bou Ficha*, as site 94. The ancient thermal spring is known through archaeological remains. Excavations of a Roman cistern near the spring revealed a collection of statuettes, some representing *Asclepius* and *Hygieia* (Merlin 1913, 215- 234). These are likely ex-votos offered by bathers to the healing deities

Asclepius and *Hygieia* (Ben Seddik 2010, t. 2, 47). The thermal spring is very likely associated with the Roman city of *Segermes*. Today, the hot water is conducted to the modern baths of Hammam Jedidi [Fig. 12]. Electrical system and magnetic surveys, along with excavations around the modern hammam will help enrich the currently scarce data concerning the Roman baths. The spring has a flow rate of 15 L/s (pumped) and a temperature of 60 °C. Its mineral characteristics reveal a strongly sodium-chloride type water. The concentrations of both major and trace elements differ only slightly from those of the Jebel Oust spring. The major elements are: calcium (829.46 mg/L), magnesium (120.40 mg/L), sodium (5520 mg/L), potassium (179.40 mg/L), bicarbonates (414.80 mg/L), sulphates (1700 mg/L), chlorides (9585 mg/L), fluorides (1.50 mg/L), and nitrates (1.77 mg/L). Trace elements include SiO2, Sr, Sb, Ba, B, Li, Fe, Zn, Mn, Pb, Se, Ni, As, Cu (Office Du Thermalisme 2000, 86-87).

XV. *Aqua calida* of Maamar / Ain Maamar / Hammam Salhine / Hammam sidi Maamar

The hot spring is located near Wadi Zroud, approximately 26 km south-southeast of the town of Haffouz (*Aquae Regiae*). It is indicated on the *Topographic Map 1957, Sheet Hadjeb el-Aioun, n° 78*, as "Sulphurous Springs", along with the presence of constructions. The spring was unknown to travellers and archaeologists of the 18th–20th centuries. Today, the spring water is conducted into a circular basin associated with the marabout Sidi Maamar, where visitors bathe [Fig. 13]. It is likely that the spring was connected to the Roman town of *Aquae Regiae*. Archaeological surveys and excavations would help determine whether an ancient thermal structure once existed at the site where the marabout was later built, as has been observed at other sites such as Hammams sidi Abdelkader, Hammam sidi Ali Daoua, Hammam sidi Haraket, etc. The spring of Hammam Sidi Maamar has a low flow rate of 0.5 L/s and a moderately warm temperature of 34 °C. Its water is strongly sodium-chloride in character. The concentrations of both major and trace elements are higher than those of the Jebel el Oust thermal spring. The major elements are: calcium (1440 mg/L), magnesium (364.80 mg/L), sodium (7360 mg/L), potassium (351 mg/L), bicarbonates (500 mg/L), sulphates (1607.60 mg/L), chlorides (15549 mg/L), and fluorides (2.10 mg/L). Trace elements include SiO_2, Sr, Ba, B, Li, Fe, Zn, Cu, Mo (Office Du Thermalisme 2000, 116).

XVI. *Vaporium* of Jebel Trozza / The thermal spring of Jebel Trozza / Hammam Jebel Trozza

The thermal spring is located approximately 6.5 km south-southwest of the town of Haffouz (*Aquae Regiae*) and 21 km north of Ain Maamar spring. It is identified on the *Topographic Map 1957, Sheet Jebel Trozza n° 70*, as "Roman Ruins" (RR) and "thermal spring". The spring is a natural sulphurous *vaporium*, emitting hot water vapor. Steam escapes through fissures in the flank of Jebel Trozza and spreads into a small, partially arranged cave, where bathers sit to enjoy hot sulphurous steam baths. A few dozen meters from the vaporium, a hot spring allows visitors to wash after their steam bath. Several archaeological sites are located in the vicinity of the thermal springs, marked as "Roman Ruins" (RR) on the *Topographic map 1957, Sheet Jebel Trozza n° 70*. Further archaeological surveys are expected to provide additional information regarding their occupation during Antiquity.

SITES		T(°C)	Q (L/s)	Concentrations of the major elements (mg/L)								
				Ca	Mg	Na	K	HCO_3	SO_4	Cl	F	NO_3
1.Aqua calida of Utica		38.5	1	54	35	215	16.7	348	60	270	-	-
2.Aquae Perrianae	*Ain Dar el-Bey*	43	2	960	162.94	3776.60	124.02	622	1056	7268	2.80	7.17
	Ain el-Aryan	46	2.5	960	182.40	3776.60	124.02	597	1116	7963	2.70	1.94
3.Aquae calidae of Capsa *(Ain Dar el Bey)*		28	36	760	170.24	3460	170	390.40	1817	6514.25	1.14	-
4.Aquae Tacapitanae (Ain el Beef)		40	-	424.65	74.20	586.57	99.13	183	1187.05	883.83	0.55	2.64
5.Aquae (Ain Sidi Harshet)		>50	-	-	-	-	-	-	-	-	-	-
6.Aquae calidae of Theudalis	*Sidi Abdelkader*	43	-	1120	182.40	3000	78	353	2253.36	5502.50	1	Traces
	Sidi Ben Abbès	42	-	1240	121.60	3160	74	366	2200.50	5573.50	1	Traces
	Hammam Djerah	45	0.3	900	668.80	2600	69	353.80	952.50	4686	1.55	Traces
7.Ad Aquas (Hammam Ali Bacoua)		40	0.5	986	249.28	17128	3.90	707.60	3456	25915	1.90	-
8.Aquae Aptuccensium (Hammam Biedha)		45	3	1540	644.50	19056	248.68	1647	3778	33815	0.84	Traces
9.Aquae Traianae (Hammam Sidi Saleh)		46	1	280	121.60	4300	28	355	903	7455	4.40	Traces
10.Aquae Carpitanae (Ain el-Atrous)		58.6	39	800	240.76	2953.20	89.70	536.80	2110.13	4970.00	3.20	-
11.*Aqua calide* of Wadi Mellègue		42	2.5	327.50	91	2785	48.80	639.28	363.50	4527.50	2.05	-
12.*Aqua calide* of Jebel Oust		54	3/15	992	167.80	4991	167.70	536.80	2814	8094	2.30	-
13.*Aqua calide* of Zriba		44	8-60	640	145.92	1132.74	24.40	256.20	1770.89	1924.57	2.30	1.41
14.*Aqua calide* of Jedidi		60	15	829.46	120.40	5520	179.40	414.80	1700	9585	1.50	1.77
15.*Aqua calide* of Maamar *(Ain Maamar)*		34	0.5	1440	364.80	7360	351	580	1607.60	15549	2.10	-
16.*Vaporium* of Jebel Trozza		-	-	-	-	-	-	-	-	-	-	-

Table | Concentration of the major elements in the studied *aquae calidae* and thermal constructions

Archaeological and mineral characteristics, religious and curative functions of the thermal springs

A total of sixteen (16) thermal springs have been recorded in Tunisia to date. They are unevenly distributed, with approximately two-thirds (2/3) located in the northern regions. This figure remains provisional and may increase with further field surveys in areas where hot springs occur, particularly in central and southern Tunisia. The springs exhibit diverse archaeological, mineralogical, and functional characteristics, reflecting both cultic and therapeutic uses over time.

I. Archaeological and mineral characteristics

The identified hot springs and associated thermal structures allow for the development of a typology that, while incomplete, is informative. Thermal springs are found either within Roman towns or in their surrounding territories. Springs located within towns are relatively few, inclu-

ding the *Aqua calida* of *Utica*, *Aquae Persianae*, *Aquae calidae* of *Capsa*, *Aquae Tacapitanae*, and *Aquae*. It is highly plausible that towns such as *Aquae Persianae*, *Aquae Tacapitanae*, and *Aquae* developed around these springs.

In contrast, thermal springs in the surrounding territories are more numerous. These include *Aquae calidae* of Theudalis, *Ad Aquas*, *Aquae Aptuccensium*, *Aquae Traianae*, *Aquae Carpitanae*, *Aqua calida* of Wadi Mellègue, *Aqua calida* of Jebel el Oust, *Aqua calida* of Zriba, *Aqua calida* of Jedidi, *Aqua calida* of Maamar and the *Vaporium* of Jebel Trozza.

The preserved Roman thermal constructions range from modest-sized baths (e.g., *Ad Aquas*, *Aquae Traianae*, Hammam Wadi Mellègue, *Aqua calida* of Maamar and the Vaporium of Jebel Trozza) to more elaborate thermal complexes (e.g., the Thermal Station of Jebel el Oust). Future archaeological surveys and excavations at these sites will undoubtedly enrich the existing data, and thereby help refine their typology. Physicochemical and mineral analyses indicate that spring waters are generally strongly sodium-chloride or calcium-sulphate in types, sometimes enriched in manganese. Their temperatures typically exceed 40 °C, while their flow rates vary considerably from 0.5 to 29 L/s. [Table].

II. Religious and curative functions

Thermal waters in Tunisia have been associated with both cultic and therapeutic uses since the Punic period. Archaeological evidence of such practices during this period is currently known only at *Utica*, where the hot spring was directed into a basin within a temple of Phoenician-Punic tradition, dating from the 7th century BC to the end of the 2nd/early 1st century BC. The deity associated with the temple, who blessed the thermal spring, remains unknown. Visitors to the temple would immerse themselves in the hot, sodium chloride-rich waters, blessed by the temple's deity, in hopes of treating certain rheumatological diseases. During the Roman period, evidence of cultic and therapeutic practices becomes more abundant through archaeological, epigraphic, and literary sources. Roman thermal complexes often included temples or dedicated rooms for the healing deities *Aesculapius* and *Hygieia*, as observed at Jebel el Oust, *Aquae Persianae*, *Aquae Aptuccensium*, Hammam Jedidi, and Hammam Zriba (Ben Seddik 2010, 25, 26, 37, 47, 49, 50). Visitors used the strongly sodium-chloride-rich waters, blessed by these Roman-African healing deities, in the hope of curing rheumatological diseases. Notably, *Apuleius* (*Florides, XVI*) travelled to the town of *Aquae Persianae* to treat a sprain using the thermal waters of the spring at Ain Dar el Bey. In addition to therapeutic baths with hot spring waters, the *vaporium* provided curative steam baths, in which visitors benefited from hot water vapor.

Conclusions

Sixteen (16) *Aquae calidae antiquae* have so far been identified in Tunisia, although this number should be regarded as provisional. Ongoing and future archaeological field surveys are likely to reveal additional sites. The known thermal springs are unevenly distributed across the Tunisian territory, with the highest concentration found in the northern regions. Approxi-

mately one-third (1/3) of these springs are located within ancient cities, while the remaining two-thirds (2/3) lie in their surrounding territories. Since the Punic period, hot spring waters have been continuously exploited by local populations for therapeutic properties. They were often integrated into temples and/or bathing facilities, reflecting a dual cultic and medicinal purpose. The plans of most Roman thermal complexes identified to date remain only partially known, owing to the limited extent of archaeological investigation. Nevertheless, the available evidence indicates that most of these baths were of modest dimensions. These sites were frequented by visitors seeking healing under the protection of the deities *Aesculapius* and *Hygieia*, particularly for rheumatological diseases. *Apuleius* provides unambiguous testimony to the curative role of the *Aquae calidae Persianae*, blessed by *Aesculapius* and *Hygieia*, during the 2nd century AD. Today, some of these ancient thermal complexes continue to welcome visitors, while others have been architecturally modified and are now associated with marabouts (Muslim saints) or have been abandoned due to the drying of their hot springs. Contemporary users, much like those in Antiquity, bathe in strongly sodium-chloride-rich hot waters blessed by a marabout, seeking relief from rheumatological, dermatological, and occasionally respiratory illnesses. These therapeutic uses are corroborated by the results of modern physicochemical and mineral analyses confirming the curative properties of these waters. These enduring practices illustrate the remarkable continuity of hydrothermal traditions in Tunisia from Antiquity to the present-day, highlighting their lasting cultural, therapeutic, and archaeological significance.

Figures in order | 2a-b: Ain and Hammam Dar el-Bey (photo by the author); 4: Vestiges of the ancient baths incorporated into hammam el Borj / Hammet Gabès; 5a: The baths of the Marabout Sidi Haraket built over Roman thermal structures (Chtioui and Sila 2021, 69); 5b: The baths of the Marabout Sidi Haraket built over Roman thermal structures (photo by the author); 6: Hammam Ali Daoua (Office Du Thermalisme 2000, 49); 7: Hammam Biadha (photo by the author); 8: Hammam Saiala (photo by the author); 9: Ain el-Atrous (Korbous) (photo by the author); 10: Hammam Wadi Mellègue; 11: Thermal complex of Jebel el Oust ; 12: Hammam Jedidi; 13: Ain Maamar basin (photo by the author).

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Abstract

Water management was a central concern of cities in *Africa Proconsularis*, where a significant proportion of water resources was devoted to bathing facilities. Alongside urban baths, hot springs (*aquae calidae*) played an important role, valued for their therapeutic properties and often equipped with dedicated thermal installations. Despite their significance, these sites have received far less scholarly attention than monumental urban baths, and previous studies have relied mainly on literary and epigraphic evidence. Focusing exclusively on ancient Tunisia, this paper examines sixteen identified hot springs and associated thermal structures, many of which exceed those recorded in ancient texts. Drawing on archaeological remains as well as physicochemical, mineral, and therapeutic data, the study offers a synthesis of their geographical distribution, architectural characteristics, and modes of exploitation. Particular attention is paid to the relationship between hot springs, healing practices, and water cults, contributing to a more comprehensive understanding of thermalism in Roman Africa Proconsularis.

keywords | *Africa Proconsularis*; water management; *aquae calidae*; thermal constructions; water cults; *Aesculapius*; *Hygieia*; physicochemical data; mineral; therapeutic.

Clay as Cure

Medicinal and Ritual Uses of Earths in Classical Antiquity

Mila Cvetkovic

I. Introduction

Among the many curious and even controversial aspects of daily life in classical antiquity, perhaps one of the least known – yet surprising – is the story of geophagy. Geophagy can be defined as a deliberate consumption of earth and clay, although its actual underlying reasons are still under scrutiny and not completely understood yet. Several types of clay were known at these times, and believed to have therapeutic properties; thus, sometimes they would be carefully selected, processed and used to treat different health issues. The earth of Lemnos, for example, according to Dioscorides (*De Materia Medica*, V, 113), was mixed with goat blood, and formed into tablets; then consumed to treat various health conditions. For the purpose of easier recognition, the healing tablets of Lemnos, also referred to as the medicinal *Terra Sigillata*, carried a stamped image on them [Fig. 1]. Although it can be recognised as an unusual and somewhat controversial practice, one could also easily associate it to what we may find in our own cupboards today, where supplement tablets are stored on shelves, usually separated by colour, and often consumed with water or milk.

1 | Collection catalogue of *Terrae Sigillate*. Source: Michael Bernhard Valentini, *Museum Museorum, oder vollständige Schau-Bühne aller Materialien und Specereyen*, Volume II (1714) tab. 1.

A great part of information on various types of *Terrae Sigillatae*, among them medicinal ones of Lemnos, was passed on to us through medieval sources. These specific fonts were especially of the rise during 16th and 17th centuries many of which included illustrated catalogues – with one of the examples depicted in the figure 1. The stamps collected were deeply valued not only for their reputed powers but also for their, to a certain extent, heraldic designs, making the possession of samples from the most famous sources a recognized badge of distinction.

Today, modern medicine classifies geophagy as a form of *Pica* — a mental, behavioural, or neurodevelopmental disorder (World Health Organisation 2018: Pica is recognised as persistent consumption of non-food substances — things that are not nutritionally appropriate and

not culturally accepted as food). However, the practice of geophagy has been observed throughout human history and, moreover, is not unique to our species but is documented across a wide range of animal species as well (Abrahams 2012; Panichev *et al.* 2013; Pebsworth *et al.* 2019).

Within animal species, earth consumption seems to be a mechanism of ion exchange and selective adsorption, helping supplementation of deficient elements and removal of excess ones. Studying its roots in human species is a challenging task, as prehistoric behaviour needs to be inferred without the support of written records. While some scholars have proposed that geophagy already occurred in prehistoric and preclassical sites (Young *et al*. 2011; Brady and Rissolo 2006; Root-Bernstein and Root-Bernstein 2000; Abrahams 2012) such hypotheses require cautious interpretation. It was not until the emergence of structured societies and advancement of medical knowledge that geophagy took on a more systematic and widespread role. The earliest known to us documented instances of intentional soil consumption date back to Ancient Greece and Rome, where recipes and prescriptions involving specific types of earth began to appear in written texts (Celsus, *De Medicina medica* (*med*.); Dioscorides, *De materia medica* (*mat. med*.); Pliny the Older, *Naturalis Historia* (*nat*.); and others). These records offer a glimpse into a more formalized understanding of geophagy and its perceived health benefits.

II. The elemental earth

From the scientific perspective, earth can be described as a natural heterogeneous mixture composed of minerals, organic matter, water and air. Within this matrix, clay refers to a naturally occurring fine-grained material of mineral origin. The specific mineral composition varies with parent material, climate, and geological history, influencing soil fertility, texture, and function (Velde 1995). Formation of clays in hydrothermal systems depends on various factors including the composition of the parent material, pH conditions, or temperature. Kaolinite groups, for example, are often found in moderately acidic systems (pH 4.5-6) and temperatures (150-200 °C) while many magnesium rich clay minerals such as biotite or talc will form under alkaline conditions in combination to temperatures between 200-350 °C (Fulignati 2020).

The mineralogical character of clays formed within hydrothermal systems is governed by a complex interplay of impacts, including the mineralogical composition of parent material, the temperature–pressure regime, or the prevailing pH of the circulating fluids. For instance, kaolinite-group minerals characteristically form under moderately acidic conditions (approximately pH 4.5-6), where elevated hydrogen ion activity promotes extensive hydrolysis of feldspars and other aluminosilicates. These phases are typical of low- to intermediate-temperature hydrothermal regimes, generally <200 °C. Conversely, magnesium-rich phyllosilicates exhibit markedly different stability requirements. Minerals such as talc, saponite, or even Mg-enriched biotite compositions tend to form under alkaline to mildly alkaline conditions, typically associated with intermediate to high hydrothermal temperatures, commonly within the range

of ~200-350 °C. And, as we will see later on, it is specifically clays that emerge as the preferred substance in geophagy practices (Abrahams 2012). Their selection is not random, as we will see, as different earths (thus different clay matters) are often referenced as remedy ingredients, and they are clearly separated by their colour or geographic origin.

In modern times, while the direct ingestion of raw soil or clay has become less common, the underlying impulse remains. Today, humans frequently consume isolated and purified mineral supplements, such as calcium, magnesium, or iron, processed into tablets and taken with water, milk, or honey. This shift from natural to refined sources could represent a form of continuation of the ancient practice, now recontextualized within the framework of contemporary health and nutrition.

III. Insights from written sources

The use of clay-based materials in classical antiquity has been documented in several classical texts, and encompasses a broad range of practices, including oral ingestion, external application for therapeutic or cosmetic purposes, and mixed uses in medicinal, ritual, and technological contexts. Only a subset of the earth and clay names recorded might be directly correlated to the geographical locations of their probable provenance. Although no original writings are known to have survived to the present day, many were recopied over the centuries, and several late antique palimpsests and medieval copies and are still known to us today (Licht 2000; Reeve 2007; Granados 1978). Among the most significant sources are the writings of Pliny the Elder, Pedanius Dioscorides, Aulus Cornelius Celsus, Theophrastus, and others, whose works serve as rare windows into ancient practices and customs, offering us a glimpse into the ancient ways. Figure 2 for example represents an image taken from *Vienna Dioscorides* – a preserved manuscript from 512 AD. The image itself is depicting seven famous ancient physicians, identified in (Rothenhöfer 2018) as Cheiron and Machaon – mythological figures known for their expertise in medicine and healing; Pamphilus of Alexandria, physicians Xenocrates of Aphrodisias, Heracleides of Tarentum and Mantias; and finally, pharmacologist Sextius Niger. Same are known as first authors on Greek medicinal and pharmaceutical writings.

2 | Ancient medical experts, Vienna Dioscurides. Cited after (Tomaselli 2021).

Perhaps a good way to start the story could be with the character of Philoctetes, built from early pre-Homeric times to Sophocles' version (Mackie 2009). His physical agony was derived from a poisonous snake wound, and his emotional one was emerging from the loneliness of being abandoned by the Greek army at the island of Lemnos. In Sophocles' play (649f., 696-698f.) we can see that, to ease his agony, although without success, he used special herbs found on the island itself. Philostratus Flavius mentions the healing of Philoctetes'

wound by the priests of Hephaistos who used *Lemnian bole* (bolos-lamp) (Photos-Jones, Hall 2014) e.g. the earth of Lemnos Island "onto which Hephaistos is said to have fallen" (*Heroikos*, XXVIII, 1-14). We cannot, thus, help but wonder about the link between Philoctetes' poisoned snake bite on the island of Lemnos and one of the most intriguing ancient healing recipes, that of goat blood mixed with Lemnian earth (*mat. med.*, V 113; *nat.,* XXXV, 14). The medicine was well studied and described by (Thompson 1913), where he argues that the medicinal recipe of the *Terra Sigillata* seals of Lemnian earth have survived through medieval times and were documented in some medieval manuscripts [Fig. 1]. He presents further the findings of his mineralogical composition analysis of Lemnian earth samples: high silica percentage with iron, calcium and aluminium oxides (Thompson 1913).

Lemnian earth, however, is not unique. Many other types of earths, clays and inorganic mixtures have been studied and described in classical texts, of which some will be mentioned here (Table in Fig. 6). What is interesting perhaps is that majority of recipes is quoted as remedies for wounds, whether in the form of ulcers (*med*. IV 28; *nat.*, XXXIV, 22; *nat.* XXXIV, 2; *mat. med.,* 5-84), mouth bleeding (*nat.* XXXV, 14; *nat.,* XXXV, 53) or wound disinfection (*mat. med.,* 5-171; *mat. med.,* 5-108).

On Samian earth, for example, Dioscorides writes (*mat. med.,* V 154, 2):

> ἵστησι δὲ αἵματος ἀναγωγὴν, καὶ ῥοϊκαῖς δίδοται γυναιξὶ σὺν βαλαυστίῳ · καὶ ὄρχεων καὶ μαστῶν φλεγμονὰς καταχριομένη σὺν ὕδατι καὶ ῥοδίνῳ παύει· στέλλει καὶ ἱδρῶτας· καὶ θηριοδήκτοις καὶ θανασίμοις ἀρήγει, σὺν ὕδατι πινομένη.
>
> It stops blood from being spat up, and is given to women with a flux, accompanied by pomegranate blossoms. When smeared with water and rose essence, it stops inflammation of the ovaries and breasts; it also reduces sweating; when taken in a drink of water, it helps against wild animal bites and poisons.

We can understand from the text that it was a verry precious medicinal earth used for various conditions. Combined with the flowers of wild pomegranate, for example, for regulating women's menstrual flows when drank. Applied as a paste with water, it soothed inflammation caused by stones (urinary or kidney) and eased breast inflammation. When taken instead with a drink of water, it was believed to reduce excessive sweating and to serve as an antidote for venomous bites or the ingestion of "deadly medicines".

Cadmium Earth was another classical remedy, said to be particularly effective in the treatment of ulcers, wounds, and skin ailments. Its name could refer to Cadmus, the legendary Phoenician founder of Thebes in Boeotia (Beekes and Beek 2010). Both Dioscorides and Pliny describe it in detail. Dioscorides distinguishes several types of *kadmeia*, as *botryitis*, *zonitis*, and *ostracitis*, each differing in colour and properties (*Mat. Med. V 114*). He further explains that *kadmeia* could be obtained artificially by heating brass in a furnace, as the resulting soot adhered to the walls of the chamber.

Pliny also mentions Cadmium Earth on two occasions. First, he identifies it as a natural form of copper ore (*nat.,* XXXIV, 2), and afterward he describes the artificial variety produced through the same process outlined by Dioscorides – the burning of copper ores and collection of the metallic deposits (*nat.,* XXXIV, *22*). He writes *Metalla aeris multis modis instruunt medicinam, utpote cum ulcera omnia ibi ocissime sanentur, maxime tamen prosunt cadmea*, indicating that copper metals (ores or perhaps earths) are all potent in medicine, but cadmium is the most useful.

3 | Red figure lekythos depicting Philoctetes on the island of Lemnos with his wounded leg. Location: Metropolitan Museum of Art, USA.

On Eretrian Earth Celsus writes (*med.* VI 3):

> *Super utrumque (ulcera) oportet inponere elaterium aut lini semen contritum et aqua coactum aut ficum in aqua decoctam aut emplastrum tetrapharmacum ex aceto subactum; terra quoque Eretria ex aceto liquata recte inlinitur*.
>
> In both (ulcers) it is good to apply elaterium, or pounded linseed worked up in water, or a fig boiled in water, or the plaster tetrapharmacum moistened with vinegar; also Eretrian earth dissolved in vinegar is suitable for smearing on.

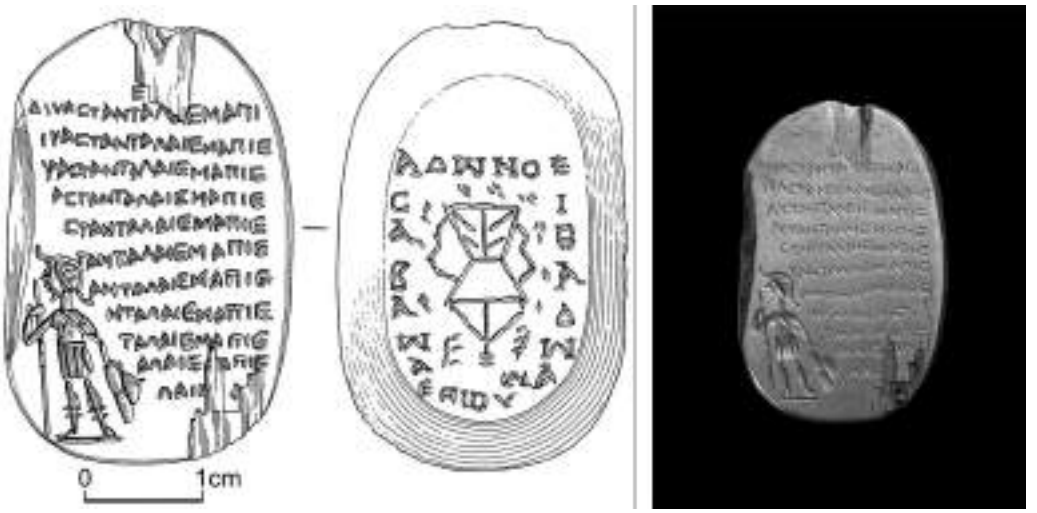
He talks in fact about the special type of ulcer growing usually on the head, on which he claims Eretrian earth diluted in vinegar, as one of the effective medicines, should be applied. Beside as ulcer balm, Eretreian Earth was believed to be a powerful and universal wound-healing remedy as well (*med.,* V 19/VI 3; *nat*. IV, 21; *mat. med*. V, 171). Pliny unveils its origin as that of the ancient city of Eretria in the island of Euobea (*nat.,* IV, 21). On the use of Earth of Sinope, Pliny writes (*nat.,* XXXV, 13):

> *… (Sinopsis) sive sicca compositione sive liquida facilis, contra ulcera in umore sita, velut oris, sedi.*
>
> It admits of being easily used, whether in the form of a dry or of a liquid composition, for the cure of ulcers situate in the humid parts of the body, the mouth and the rectum, for instance.

Claiming that it can be used in the form of a dry or of a liquid composition, for the cure of ulcers, such as ones growing in the mouth and the rectum. He further adds:

> *Alvum sistit infusa, feminarum profluvia pota denarii pondere. eadem adusta siccat scabritias oculorum, e vino maxim.*
>
> Used as an injection, it arrests looseness of the bowels, and, taken in doses of one denarius, it acts as a check upon female discharges. Applied in a burnt state, with wine in particular, it has a desiccative effect upon granulations of the eyelids.

Suggesting that it can be used for diarrhoea, or discharges – depending on the method of use and amount. He adds that if applied in a burnt state, with wine in particular, it has a desiccati-



4 | Late Roman medicinal gem made of hematite, building mineral of red *ochra*, with inscription *When you are thirsty, Tantalos, drink blood*. The British museum, artefact code: 1928,0520.1.

ve effect upon granulations of the eyelids (*nat.,* XXXV, 13). We have to note that the word that Pliny uses is *infusa* – eng. *infused*. The needle injection was not available in classical times and thus, this particular medicine was most probably drunk or applied directly to the ill spot. Dioscorides, on the other hand, suggests it mixed with egg to stops the bowels (diarrhoea), or for liver disorders (*mat. med.,* V 111). He uses the term *infused* as well – [...] *tum etiam clystere infusa* – indicating similar application (Lat. *Infusio ~ onis*: the pouring in or on (the medications): Lexicon Universale *Latinitatis* (1968) Oxford, at the Clarendon Press).

Another powerful remedy exploited in classical times is Cimolian Earth. Two forms of *Kimolia* are described by Pliny, without a detailed clarification on their composition or provenance. *Kimolia – the earth* (*nat.,* XXXV, 57) – is good, he states, taken with vinegar to calm inflammations, parotid gland issues or problems with liver. It could be applied externally as well, he continues, when mixed with aphronitrum, oil of cypros and vinegar, to reduce the swelling or used as sun lotion (there are some indications that this name could refer to hydro-carbonate of soda: Healy 2000). *Kimolia – the chalk* – according to his writings can serve to disinfect the wounds (*nat.,* XXVIII, 46), the property that was indicated by Aulus Cornelius Celsus as well (*med.,* V 26). *Kimolia* seems to provenance from various sources – Sardinia, Umbria, Lycia (*nat.,* XXXV, 57).

Clay *ochra* is frequently mentioned in ancient sources as well (Diosc., *mat. med.,* V, 108; *mat. med.,* V, 111; Cels., *med.,* V, 14). It has been valued for its antiseptic qualities, and both Dioscorides and Celsus describe its use for reducing inflammation and disinfecting open wounds (Diosc., *mat. med.,* V, 108; *mat. med.,* V, 111; Cels., *med.,* V, 14). Red earths, commonly referred to as ochres, comprise clay-rich materials exhibiting warm yellow to brown chromatic

tones whose coloration derives principally from the presence and amount a of iron-bearing accessory phases, most notably the ferric oxide hematite and the ferric oxyhydroxide goethite. Hematite, which derives its name from Greek word αίμα – meaning *blood*, was often used for the production of medicinal gems. One example was shown in the figure 4 – the amulet depicting Tantalos, and bearing a disappearing inscription "Tantalus drink blood…", whose meaning and use have long been a product of discussion. The words inscribed have been interpreted in various ways, as those associated with cessation of bleeding and connections to the waters of Hades, retreating whenever Tantalus attempts to drink; to ones perceived as having the potential to alleviate Tantalus's curse, and allowing the bleeding in the cases when it is beneficial, as for example menstrual bleeding is (Faraone 2009). Finally, Dioscorides mentions as well the medical use of calcium carbonate (*chalkitis*) (*mat. med.,* V, 99, 2). He writes:

> ποιεῖ δὲ καὶ πρὸς ἐρυσιπέλατα, ἕρπητας, αἱμορραγίας τὰς ἐξ ὑστέρας καὶ μυκτήρων σὺν πράσου χυλῷ· ξηρὰ δὲ πρός τε ἐπουλίδας καὶ νομὰς καὶ παρίσθμια· κεκαυμένη δὲ πρὸς τὰ ὀφθαλμικὰ μᾶλλον χρησιμεύει λεία σὺν μέλιτι· τετυλωμένα μὲν βλέφαρα καὶ τραχέα ἀποτήκει καὶ σμήχει.
>
> With leek juice, it is effective for erysipelas, herpes, and discharges of blood from the womb and nostrils. Its powder is effective in treating growths on the gums, spreading ulcers, and inflammation of the tonsils. If burnt, it is far more effective for eye diseases when finely ground and mixed with honey; it reduces and wipes hardened and rough eyelids.

arguing that in combination with leek juice it can help cure skin infections, herpes or blood discharges (from womb for example), or mixed with honey for eye infections. What is interesting is that this particular material might be present in other writings as well, but in another form – as *creta Cimolia* or Cimolian chalk (Plin., *nat.,* XXIX, 35; Cels. *med.,* V, XXVII). Celsus talks about mixture of Cimolian chalk with frankincense in water to treat skin irritations, while Pliny mentions it for treating scalp ulcers in combination with sheep's gall. Dioscorides refers to *psōrikon* (*mat. med.*, V, 99,3), a preparation composed of calcium carbonate and Cimolian earth, which is said to be used for the same purposes as *chalkitis*. He provides a detailed recipe:

> Σκευάζεται δὲ ἐξ αὐτῆς τὸ καλούμενον ψωρικὸν, διπλασίονος χαλκίτεως πρὸς ἁπλὴν καδμείαν μιγνυμένου, καὶ σὺν ὄξει λεαινομένου· δεῖ δὲ ἐν· κεραμέῳ ἀγγείῳ κατορύσσειν ἐν κοπρίᾳ ἐν τοῖς ὑπὸ κύνα καύμασιν ἡμέρας μ΄.
>
> So-called psoricum is made from it, with two parts calcitis and one part cadmia mixed together and finely ground and then mixed with vinegar. The mixture must then be tightly sealed in a ceramic jar buried in dung and left for forty days during the hottest period of the year.

In this process, he explains, two parts of calcium carbonate are mixed with one part of *kadmeia* and ground together with vinegar until smooth. The mixture is then placed in a ceramic vessel and buried in dung, where it is left to mature for forty days under the heat of the summer sun.

IV. Provenance of medicinal earths and their relationship to hydrothermal sources

Little is known about the precise mineralogical composition and formation process of medicinal clays described in classical sources. Although many are associated with specific topographic names, such as Lemnian, Samian, or Cimolian earth — the name could all the same refer to clays extracted from multiple localities, likely resulting in variations in chemical and physical properties. Such nomenclatural conventions can, however, be misleading, as illustrated by the case of the so-called *earth of Sinope*. Although *Sinopia* is geologically derived from deposits in Cappadocia (Becker 2022), it acquired its name from the Black Sea port of Sinope, the principal node through which it entered Mediterranean trade networks. Pliny nonetheless refers to it as *Sinopica* (*nat.,* XXXV, 13), and whether he was familiar with its true provenance cannot be established with certainty. Dioscorides, by contrast, demonstrates a clearer awareness of its geographic origin: in *De Materia Medica* (V, 111), he refers to the substance as *miltos (rubrica) Sinopike*, while explicitly acknowledging its Cappadocian source.

The island of Lemnos was in Classical times well-known for its *Lemnian fire* (τὸ Λήμνιον πῦρ) and as the place of workshop traditions of Ephesus (Marchiandi 2016). Although geological investigations have excluded the presence of volcanic activity that could have given rise to the myths associated with the Lemnian fire, it remains plausible that the region was characterised by natural methane emissions – highly flammable gas seeps (Etiope 2015), comparable to those documented at Yanar Dağ in Azerbaijan or the eternal flames of the Chimaera at Olympos. During his travels on the island, Galen provides a detailed description of the *Lemnia* extraction locations. He writes: “This earth comes from Lemnos, the island otherwise called Stalimene, and is found close to a town called Hephestias, on the top of a red-stained hill, barren of plants and with the appearance of having been burnt”(cited after: Thompson 1913) This account aligns closely with the environmental characteristics of natural gas seeps, which, owing to elevated soil temperatures, shifts in soil pH, and oxygen displacement, typically exhibit an absence of vegetation and soils altered to a burnt or baked appearance.

In 1913, Thompson publishes a first analysis on the mineralogical composition of *Lemnia*, based on, as he stated, the 16th century sample he was fortunate to obtain (Thompson 1913). His results show well anticipated mineralogical composition, commonly found in clays – high amounts of silicates, accompanied by ferric, aluminium and calcium oxides as well, along with some minor quantities of magnesium and alkalis (Thompson 1913). Some contemporary analysis on Lemnian Earth define it as an aluminium-silicate clay (Photos-Jones, Hall 2014), occasionally enriched with sodium and calcium; or containing alunite, an insoluble potassium aluminium sulphate mineral. Notably, aluminosilicate clays associated with alunite are well known to form under medium-temperature (≤ 200 °C) acid-sulphate hydrothermal conditions, typically involving the alteration of igneous substrates (Şener *et al*. 2017; Photos-Jones, Hall 2014; Fulignati 2020).

In addition, several Aegean islands with hydrothermally altered volcanic rocks were recognized in antiquity as sources of medicinal clays, including Samos and Kimolos (Photos-Jones *et*

5 | Provenance of medicinal earths.

al. 2015) [Fig. 5]. Major hydrothermal systems of this area is found along the volcanic chain stretching out from Milos to Kos (Dando *et al.* 2000). The ferrous and non-ferrous building elements in the Aegean hydrothermal sediments have been identified as those of iron, magnesium, zinc, manganese, copper and aluminium (Megalovasilis 2014).

Samian earth might be related to kaolinite-rich clay or bentonitic clays, often found in association with local borate minerals (Photos-Jones *et al.* 2015). Both kaolinite and bentonite are known as well to form in areas of hydrothermal alteration of lavas and tuffs. A comparable composition is observed in Cimolian Earth from Kimolos, characterized as a thermally altered aluminium-rich bentonite ($Al_2O_3{\cdot}4SiO_2{\cdot}H_2O$) with notably high aluminium oxide content (Christidis 1998).

6 |Some of the earths mentioned in ancient text and considered in this article.

Classical authors also reference various geographical provenances of Cadmium Earth, as those of Cyprus, Macedonia, Thrace or Spain (Diosc., *mat. med.,* V, 84; Plin., *nat*., XXXIV, 22). Some more recent studies argue about its mineralogical provenance, as that of calamine (De Vos 2010), a zinc-bearing mineral well-known in classical times; or that of cobalt minerals as suggested by Endlich in 1888 (see historical sources listed). Although the term *cadmeia* has etymological affinity with cadmium (Cd), cadmium pigments were only isolated and identified in the nineteenth century. Nevertheless, it may be important to notice that cadmium traces are naturally occurring in some non-ferrous and ferrous metal ores such as galena (PbS), chalcopyrite (CuFeS) or sphalerite (ZnS) (Bao *et al.* 2022, Sattar *et al.* 2025), of which the last is zinc sulphide. Calamine and sphalerite are both zinc-bearing minerals, but they represent different forms of zinc in the natural oxidation cycle of ore deposits. Sphalerite (ZnS) presents what may be defined as a primary zinc sulphide phase, from which smithsonite, hemimorphite and hydrozincite can be formed through weathering (Boni, Mondillo 2015). In addition, studies have indicated that all three of these secondary phases might be considered a building minerals of what was known as *calamine* in classical times (Aversa *et al.* 2002, Merkel 2021). In classical and early modern metallurgy for example, calamine was considered any zinc-rich carbonate/silicate used to make brass by cementation with copper, as ancient metallurgists did not distinguish between its different building phases (Merkel 2021).

Existing research on Eretrian Earth is comparatively scarce: however, there are some indications that it may be related to aluminium-rich clays, with high percentage of iron oxide hematite (Fe_2O_3), and some presence of magnesium and sodium oxides (Charalambidou *et al.* 2016, 2018). By contrast, ochre is well-known, composed predominantly of hematite and goethite (α-FeOOH) and abundantly found in nature. In aqueous systems for example, it can be formed through hydrothermal precipitation as the fluids through their flow interact with the surrounding rocks (Cornell, Schwertmann 2003). Goethite, a common iron-bearing mineral primarily composed of iron (III) oxide-hydroxide, forms in aqueous environments by precipitation of soluble Fe^{III} and hematite from Fe^{III} species at temperatures higher that 100 °C, in aqueous media and at neutral pH (≅7) (Cornell, Schwertmann 2003).

Among the notable studies linking ochre to the earliest therapeutic or ritualised practices is the well-documented burial from the Late Mesolithic site of Bad Dürrenberg, interpreted as that of a healer or shaman. The burial of an elderly woman accompanied by a child was entirely enveloped in a fine-grained ochre layer consisting of almost pure hematite (Porr, Alt 2006) reinforcing the symbolic and functional link between healing practices and iron-rich earths.

It is important to note however, that ochres in classical times referred to a yellow clay, while red ochres were known are *rubrica* (Becker 2022). Earth of Sinope – *rubrica Sinopica* (*mat. med.,* V, 111), for example, was one of the most valuable red ochre earths. Geochemical investigations of the hydrothermal terrains of Cappadocia, the true provenance of *sinopia*, reveal iron-rich lithologies and alteration products consistent with hematite-dominated assemblages, which might confirm the mineralogical origin of *rubrica Sinopica* as that of red ochre i.e. hematite rich clay.

The mineralogical patterns emerging from the analyses presented above indicate that many of the clay and oxide phases characteristic of the investigated medicinal earths exhibit diagnostic signatures of hydrothermal alteration. This observation might suggest that hydrothermal processes played a significant role not only in the genesis of the constituent clay and oxide minerals, and by extension origin of extraction, but also in shaping the broader cultural and therapeutic frameworks within which these materials were employed. In this sense, hydrothermal systems may be understood as holistic geological environments in which water, heat, and mineral-rich substrates interacted to produce naturally occurring assemblages gifted with distinctive physical and chemical properties. Such settings would have offered ancient communities a convergence of therapeutic waters and clays – resources that were readily integrated into medicinal, hygienic, and ritual practices.

V. Modern insights

All the earths mentioned in classical texts may have been modified by human intervention, through processing or treatment of natural clay and ore deposits. However, more scholarly attention has been given recently to the medicinal properties of clays, as a more sustainable way to treat a variety of medical issues.

Beside clays, other secondary products within hydrothermal sites found their application in classical antiquity (Cataldi 2005; Bassani 2024, 2021). Greeks extracted sulphur from thermal springs, a substance to them *divine* (θεῖος), and they used it in healing and purification rituals (*mat. med.,* V, 124). Waters rich in sodium, potassium or iron found their therapeutic use within healing structures as well (Bassani 2014). In Hamat-Gader thermal baths refined clay lumps have been found (Dvorjetski 2007), indicating the potential clay use in curative hydrothermal rituals. Taking this into account, it is important to evaluate whether recent understandings of clay-based therapeutics can substantiate the inferred medicinal applications observed in classical contexts.

Lemnian Earth is well studied, and some results showed antibacterial and microbiome properties (Photos-Jones *et al.* 2015) and beneficials for gut health (Milling *et al.* 2024). Potential antibacterial activity is observed in Samian Earth as well, where findings suggest that this earth, when mixed with specific minerals, can exhibit exhibits antibacterial effects, supporting, for example, its historical use in treating eye infections (Photos-Jones *et al.* 2015). The obtained results may be related to some contemporary observations on therapeutic properties of aluminosilicates especially those of kaolinite which might exhibit anti-inflammatory, anal-

gesic effects; and have demonstrated as gastrointestinal protector and antidiarrhoeic (Awad *et al.* 2017, Carretero 2002), those of bentonites which indicate some anti-inflammatory properties as well (Cervini-Silva *et al.* 2015), or perhaps even of zeolites possibly demonstrating some detoxifying, antioxidant, and anti-inflammatory effects (Oggiano *et al.* 2023).

The medicinal properties of ochre are well studied as well, with some indications of antiseptic benefits in wound sterilization (Tributsch 2016). In addition, iron oxide nanoparticles found their application in modern medicine for various purposes, including their use as antiviral and antimicrobial agents (Attia *et al.* 2022).

Exposure to earths rich in cadmium, on the other side, emphasized the toxicity risks (Charkiewicz *et al.* 2023). However, as discussed earlier, the mineralogical origin of Cadmium earth may be traced to zinc bearing ores, with the possibility that cadmium as metal in ancient clays used in therapeutic rituals was only present in traces. Zinc has indeed shown some medical benefits, as those of wound healing (Xiao *et al.* 2025) or antimicrobial effects (Pino *et al.* 2023). These properties could be related to the applications of *Kadmia* for ulcer and wound treatment, reported, as we saw earlier, in the ancient sources (see Table in Fig. 6).

Contemporary scientific literature does not yet provide specific medicinal or pharmacological studies on Cimolian and Eretrian earths. However, the elevated concentrations of aluminium oxides documented in these clays may be relevant, given that aluminium-rich mineral phases have been associated with pronounced antimicrobial activity, including inhibitory effects against *E. coli* and *S. epidermidis*, as well as photothermal bactericidal responses (cited after Hassanpour *et al.* 2018). In addition, investigations conducted on natural clays containing varying proportions of aluminium, iron and magnesium oxide percentages, similar to what is observed in the samples of Lemnian Earth, have revealed a shared capacity to promote epithelial wound healing (Incledion *et al.* 2021). This effect appears to be mediated, at least in part, by the intrinsic antibacterial properties of these mineral assemblages.

Finally, in addition to antibacterial properties observed in calcium carbonate and calcium magnesium carbonate (Yamamoto *et al*. 2010), the general role of calcium ions on preserving skin barrier is recognised (Nopriyati *et al.* 2022), and it might have been a reason for such widely use of calcium carbonate in treating skin-related issues in classical activity.

VI. Conclusions

Several classical medicinal earths, described in ancient sources, may possess complex mineral compositions that closely reflect the therapeutic effects historically attributed to them. As modern science increasingly turns toward natural and sustainable solutions, and continues to investigate the properties of natural materials such as clays, there may be a growing potential to explore these earths in greater depth in future studies. By considering their mineral content through the lens of contemporary understandings of clay composition and genesis, meaningful connections emerge between ancient practices and modern scientific knowledge. Many of

these earths appear to originate from hydrothermal environments, where natural conditions favor the formation of specific mineral assemblages.

Rather than interpreting the use of thermal waters and medicinal clays as sequential or causally hierarchical phenomena, hydrothermal sites may be more appropriately understood as integrated sacred environments, in which waters, gases, minerals, and earth materials collectively derived their therapeutic and symbolic value from the perceived potency of place. Within such landscapes, healing practices likely emerged from a holistic engagement with the environment, in which mineral-rich waters and locally available clays were experienced as interconnected expressions of the same natural agency. These observations might underscore a deliberate selection of materials associated with naturally occurring geothermal phenomena, rising intriguing questions about the role of hydrothermal sites and sanctuaries in ancient healing practices. Did the extraction and use of clays as a direct response to the presence of these sacred sites, or were thermal waters the primary driver, subsequently supplemented by the collection of locally occurring clays? In other words, which came first — the recognition of the healing properties of the mineral-rich waters, or the deliberate sourcing and use of clays from these hydrothermal environments? Understanding this dynamic might be essential for reconstructing the interplay between natural resources and ritualized healing in classical antiquity.

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Abstract

Clays represent one of the earliest exploited natural materials in human history. Their significance extends far beyond the realms of craft production and artistic practice, and, as we will see later on, they have played a central role in therapeutic, medicinal, and ritual activities throughout classical antiquity. Many of the most valued clays originate in hydrothermal environments, where elevated temperatures, mineral–rich waters, and active water–rock interaction create ideal conditions for their creation. In addition, therapeutic and ritualistic uses of hydrothermal mineral–rich waters during the classical period have been well studied (Annibaletto, Bassani, and Ghedini 2014; González Soutelo 2024; Bassani 2023, 2024), and many of the minerals extracted from these waters seem to have had their deep curative application (Mantovanelli 2014; Bassani 2014). This article examines several of the most prominent and widely employed medicinal clays described in classical texts. Through the lens of contemporary mineralogical and geological knowledge regarding their probable provenance and genesis, the study investigates the historical foundations of the therapeutic properties attributed to these materials and evaluates the extent to which such claims find support in modern scientific understanding. The accent was placed on potential origin of these clays in hydrothermal environments known and utilised in antiquity for therapeutic purposes, considering how such geological settings may have shaped the ritual practices and cultural meanings associated with their use.

keywords | Medicinal clay; Hydrothermal source; Classical practices.

Waters in Modern Age

Defining Hybrid Spaces for a Medieval Thermal Spa

The Case of the 'Caldanelle di Petriolo' (Italy)

Edoardo Vanni

Thermal Landscapes and Hybrid Architectures

From the *balneum* of Rome to the late-medieval public bath, thermal architecture can be approached as an interface of mediation between nature, technology and society — a laboratory of transformation in which the fluid matter of water becomes structure, and technique unfolds as a form of ecology. Water — hot and mineral — is not a passive substance but a generative principle: it orders dwelling, articulates space, and regulates the rhythms of collective life. Within it resides the *thermal intelligence* of the societies that harnessed it — a constructive and symbolic knowledge that translates natural flux into architectural order. Far from being simple curative enclosures, ancient and medieval baths may be described, in analytical terms, as hydraulic organisms — architectures of circulation where the domestication of water produced not only health but order, turning movement itself into a spatial and social grammar (Annibaletto, Bassani, Ghedini 2014; Bassani, Bolder-Boss, Fusco 2019; Bassani, Tabolli 2024; Becker, Turfa 2017; Chellini 2002; Gonzalez Soutelo 2024; Guérin-Beauvois, Martin 2007; Matilla Séiquer, González Soutelo 2017; Scheid *et al.* 2015; Routh et al. 1996; Yegül 1992).

1 | Map showing the main medieval thermal sites of southern Tuscany (elab. E. Vanni).

In medieval settings, springs and rivers formed a political ecology — a medium where matter, ritual, and power converged. Their therapeutic and symbolic values were inseparable from economic and jurisdictional functions, turning the governance of thermal waters into a technology of place production. In Tuscany, the constellation of thermo-mineral waters along the Farma and Merse valleys produced not simply a geography of baths but an infrastructure of control: a stratified hydro-territory in which the modulation of water mirrored shifts in authority. Managing water here meant calibrating the landscape's permeability and the circulation of bodies — human and non-human alike — within it. The spring, the conduit, and the bath thus formed a spatial configuration closely tied to jurisdictional practice, an early hydraulic governmentality in which bodily care and territorial administration became indistinguishable (Gelli, Guarducci 2023; Ascheri 1993, 62–66; Boisseuil 2002, 45–52; Farinelli 2007, 73–90).

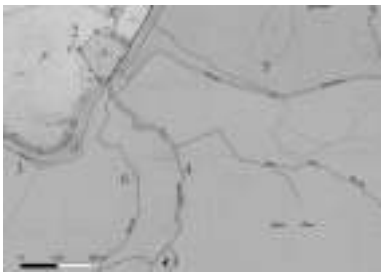
Across this diffuse hydrographic field, the 'Caldanelle di Petriolo' may be regarded as a particularly instructive synthesis of form and function. Situated along the course of the Farma, on the shifting threshold between the Sienese *contado* and the Maremma, the site represents one tangible expression of the Republic of Siena's efforts to stabilise and administer thermal resources within a wider territorial order [Fig. 1]. Rather than a mere bathhouse, it operated as a *hospitium thermale* — a composite layout equipped with pools, lodgings, and service areas. Here, the thermal water entered the very economy of the landscape, sustaining activities such as textile maceration and animal care — practices through which matter, labour, and healing converged (Bellotti *et al*. 2018, 11–15; Vanni *et al*. 2022; Vanni *et al*. 2023; Vanni, Quaglia 2024).

Archaeological and documentary evidence situates the Caldanelle within a broader Sienese hydro-territorial framework — a network of waters, infrastructures, and routes interweaving health, economy, and fiscal taxation (Guarducci 2021, 145–152; Cristoferi 2021, 111–130; Farinelli 2007, 85–88). Along the Farma valley, the relationship between Petriolo, the Caldanelle, and Macereto defines a coordinated thermal micro-system rather than a hierarchy of isolated sites. While Petriolo functioned as a fortified and fiscally controlled centre, and Macereto as a minor node connected to routes and rural activities (Campana 2001, 38, 121–122), the Caldanelle occupied an intermediate position, combining therapeutic, productive, and service-oriented functions. This complementarity suggests a differentiated but coordinated management of hydrothermal assets at regional scale (Arrighetti, Leporini 2023, 253; Arrighetti, Bianchi 2023, 275).

The Caldanelle therefore invites a reading of thermal architecture not as a fixed typology but as an ecological device: a built articulation that turns flow into structure, temperature into language, and pressure into spatial order. Here this logic is legible in the engineered gradients, basins, and drainage features that regulate circulation and sedimentation. In this sense, the bath compound belongs to a long hydraulic continuum in which water operates as a historical agent, shaping built form through routines of movement, maintenance, and mineral deposition.

Historical and Archaeological Framework

The 'Caldanelle di Petriolo' lies in the territory of Civitella Paganico, near the medieval castle of Pari, on the fluctuating boundary between the Sienese *contado* and the Maremma plain. This border zone — traversed by rivers, routes of transhumance, and axes of exchange — formed a mobile landscape, continually reconfigured between the thirteenth and fifteenth centuries by the consolidation of Siena's territorial state (Dani 2011).



2 | Historical map showing the micro-territorial system centred on the Farma and Merse rivers: no. 1 Caldanelle; no. 2 Petriolo; no. 3 Farma River; no. 4 Caldanelle Stream; no. 5 Road to Grosseto; no. 6 Road to Petriolo (elab. E. Vanni).

Within this process of civic expansion and administrative rationalization, the control of water — both thermal and fluvial — emerged as a strategic component of policy: not merely for its therapeutic or productive value, but for its capacity to impose form upon the landscape according to fiscal and military logics (Boisseuil 2002, 45–49). Bridges, mills, baths, and springs composed an infrastructural syntax in which healing and profit converged within a single ecology of power.

The earliest record of the thermal spa complex dates to the early fourteenth century, when Donosdeo Malavolti, bishop of Siena, obtained from the Commune permission *muris circumponere balnea* — "to enclose the baths with walls" — provided that access remained public (Cecchini 1931-1940; Cecchini *et al*. 1984-1991; Ascheri 1993, 63–65). Behind this administrative clause stands a structural tension between private appropriation and civic regulation. As Boisseuil (2002, 50–54) observes, comparable ordinances were issued across Tuscany to supervise the use of baths and fountains, ensuring both maintenance and taxation.

The Malavolti intervention at the Caldanelle thus prefigures a hydraulic architecture of enclosure, in which construction and administration coincide: masonry becomes an instrument of governance, the wall a device of fiscal measurement. This pattern recurs from the Val di Merse to San Giuliano, where hydraulic protection and social regulation form a single territorial grammar (Boisseuil 2002, 78–82; Gelli, Guarducci 2023, 69-70).

During the fourteenth and fifteenth centuries, the foundation of the *Dogana dei Paschi* institutionalized this hydraulic rationality, integrating the management of pastures, transhumance, and thermal waters into a unified apparatus of environmental administration (Cristoferi 2021, 111–130; Vanni, Cristoferi 2015; Vanni 2019; Vanni 2025, 253). Situated along the route connecting Pari, Petriolo, and the Farma valley, the Caldanelle occupied a strategic hinge within this system — a thermal and fiscal station where the distribution of water overlapped with the movement of goods, animals, and people. The multiple use of the springs — for human therapy and for animal prophylaxis — situates the Caldanelle at the intersection of civic medicine and pastoral economy, a mixed hygienic–zootechnical regime characteristic of the Sienese hinterland (Cristoferi 2021, 120–123).

Archaeological evidence corroborates this administrative framework. Excavations reveal two principal phases: a fourteenth-century nucleus of service rooms in roughly coursed local limestone bound with lime mortar; and a late-fifteenth-century reconstruction of regular masonry, brick vaults, and a consistent system of drainage and distribution (Bellotti *et al.* 2018, 15–19). The proximity to the fortified baths of Petriolo, rebuilt after the Malavolti–Siena conflict, suggests a shared typology of thermal fortification (Boisseuil 2002, 78–84; Arrighetti, Leporini 2023, 257). At Petriolo, polygonal walls and guarded gates regulated access to the springs and secured republican revenues; at the Caldanelle, though lacking fortifications, the perimeter wall performed a similar administrative role — delimiting, ordering, and governing the use of water [Fig. 2].

Taken together, textual and material evidence cast the Caldanelle as a strategic node within a wider territorial framework shaped by water infrastructures, where economic, medical, and political logics coalesced into a single apparatus of control. Its architecture embodies the adaptive intelligence of Sienese hydraulic culture, an embodiment of governmentality in which function generates form and form reflects authority. The Caldanelle site is thus not a peripheral episode but a paradigm of the politics of flow: a built negotiation between architecture and power in the thermal ecologies of medieval central Italy.

The Ecology of Architecture

The architectural evolution of the 'Caldanelle di Petriolo' encapsulates the complex interaction between natural resources, building practices, and social functions within the landscape of southern Tuscany between the fourteenth and seventeenth centuries. Far from representing a secondary dependency of the nearby baths of Petriolo, the Caldanelle constituted an autonomous and functional organism, conceived to combine hydrothermal exploitation, hospitality, and productive activity.

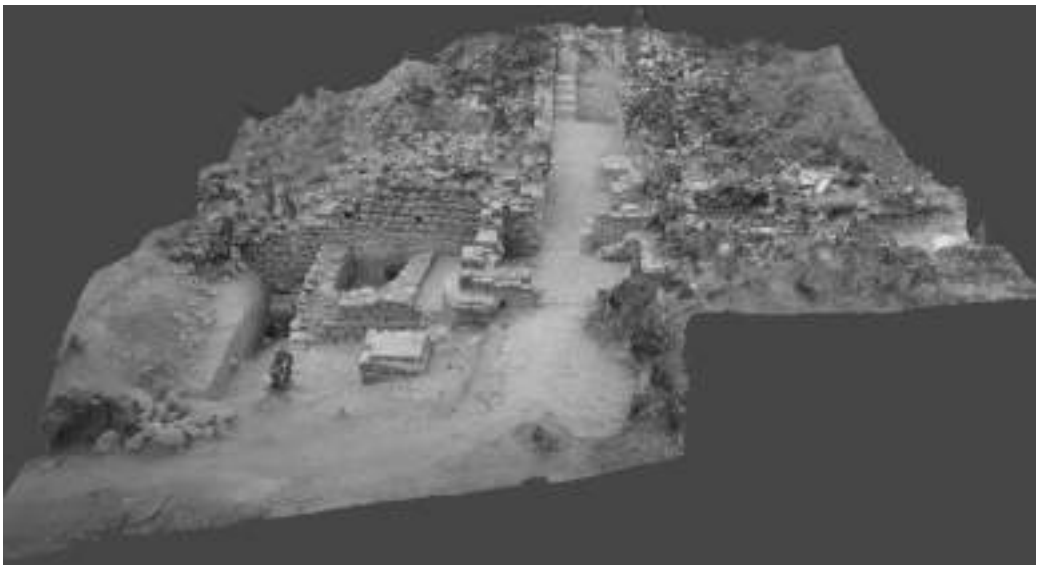
Archaeological traces point to an even earlier phase preceding the fourteenth century: modest wall remains and primitive drainage alignments adapted to the natural slope of the hill. This proto-architectural nucleus — perhaps an open collecting basin — was later monumentalized through the walled enclosure granted to Donosdeo Malavolti, when the act of *muris circumponere balnea* translated hydraulic management into architectural form. The enclosure itself materialised a shift from open use to regulated access, turning the bath into an infrastructural mechanism of control and maintenance [Fig. 3].

The early fourteenth-century structures were built in local limestone laid in irregular courses with lime mortar — a vernacular technology already hybridized by hydraulic intent. Inclined pavements sloped toward the stream, covered with waterproof plasters of lime, sand, and crushed pottery, reveal a deliberate grammar of flow control and mineral management, analogous to that observed at San Filippo and Radicondoli. Between the late fifteenth and early sixteenth centuries, the compound was restructured under the influence of the Malavolti family and of Pandolfo Petrucci's Sienese renewal. The Caldanelle was reconceived as a compact *structured ensemble* — a hybrid assemblage of curative, domestic, and productive functions.

3 | Plan of the excavated area of the thermal site of the Caldanelle di Petriolo (elab. E. Vanni).
4 | View of the corridor with the staircase leading to the upper floors (drone photo by the author).

The masonry of this phase, alternating squared limestone and brick ribs in *opus latericium mixtum*, echoes the syntax of Sienese urban palaces (Balestracci 2003; Arrighetti, Bianchi 2023, 280). The internal articulation of this phase further reveals a conscious reorganization of circulation and access. The presence of a corridor aligned along the longitudinal axis, together with the remains of a staircase leading to an upper level, indicates a deliberate attempt to structure the complex vertically, transforming the bath into a multi-level organism where water, heat, and movement were hierarchically distributed [Fig. 4]. The obliteration of the main entrance and the raising of the interior floors — perhaps following an unforeseen event such as an earthquake or a flood — suggest an adaptive response to environmental instability, in which repair and reconfiguration became part of the site's ecological metabolism. In this sense, the complex of the Caldanelle does not merely endure natural perturbations; it can be interpreted as a self-correcting system, capable of absorbing instability and converting disturbance and crisis into spatial reconfiguration. The convergence of these domains within a unified constructive scheme confirms the thermal complex as a hybrid organism (Bellotti *et al.* 2018, 15–22; Vanni 2025, 256).

The seventeenth century marked a new phase of adaptation following the fall of the Republic of Siena and the establishment of Medicean administration. Structural repairs using spolia of stone, brick, and ceramic record a ruralization of the thermal space, its conversion from *hospitium* to storage and shelter. Analogous processes occurred at San Giovanni in Val d'Orcia and at minor baths in Languedoc and Provence, gradually reabsorbed into agrarian economies after the sixteenth century (Boisseuil 2002, 117–121; Perez Agorreta, Alaix i Miró 2017). Yet the Caldanelle preserved the integrity of its hydro-architectural system: vaults, plasters, and conduits endure as the anatomical traces of a resilient environmental design.



5 | View of the 3D model of the site from the south, showing the entrance and the multi-level layout adapting to the slope of the hillside (elab. E. Vanni).

Ultimately, the 'Caldanelle di Petriolo' articulates a genuine ecology of architecture, where matter, energy, and human practice cohere within a continuous cycle of transformation. Across three centuries, the complex evolved from a utilitarian ensemble into a sophisticated spatial metabolism guided by environmental intelligence. The correspondence between hydraulic technique, architectural configuration, and social function reveals how medieval and Renaissance builders conceived the bath not as a monument but as a dynamic architectural apparatus — a spatial configuration emerges from the negotiation between geological energy, material resistance, and social function. In this sense, the Caldanelle offers a compelling case of adaptive thermal architecture, where the flow of water is not merely contained but converted into a generative principle of architectural thought itself [Fig. 5].

Comparable adaptive strategies can be observed across a broader European horizon. Comparison is used as an interpretative device to isolate recurrent constraints—hydrothermal resources, mobility, governance, and patterns of use—and to assess how different sites translated them into spatial organisation, building solutions, and regimes of access. The Caldanelle is therefore brought into selective dialogue with contexts that either share close geo-historical conditions or foreground comparable functional problems, while longer-range parallels are invoked only to clarify specific architectural or technical choices.

Within central Italy, Bagno Vignoni offers a particularly useful reference for the spatial coupling of bathing and hospitality, whereas Viterbo provides a comparative lens for access regulation and the articulation of thermal infrastructures as part of a broader urban and territorial fra-

mework. San Casciano dei Bagni, in turn, highlights the persistence and reconfiguration of thermal practices over the longue durée, showing how bathing spaces could be reoccupied, redefined, and materially renegotiated from Antiquity through the medieval and early modern periods (Mariotti, Salvi, Tabolli 2023; Mariotti, Salvi, Tabolli 2025). Beyond Italy, the multilayered residential bath typologies of Buda (Pintér *et al.* 2011) and the progressive domestication of the springs at Bath (Borsay 2000, 17–25) are mobilised as functional points of comparison, rather than as genealogical models. Likewise, selected cases from Catalonia and Provence (Cifuentes, Carré 2007; Gordon 2012) help frame specific constructional and hydraulic solutions—mixed masonry, lime-lined conduits, and maintenance regimes — within a wider technical repertoire that remained available well beyond its Roman and Late Antique antecedents (*Les thermes romains* 1991; Adam 1994, 211–215; Ginouvès *et al.* 1994; Guérin-Beauvois 2015).

What emerges is not a typology of thermal sites, but a range of mixed-use configurations, in which bathing, hospitality, labour, and governance intersect in different proportions. Read against this range, the Caldanelle appears as a locally specific solution — shaped by the Farma valley setting and by Sienese territorial administration — rather than as an exceptional or marginal anomaly.

Material Culture and Hydraulic Habitus

The material culture unearthed at the 'Caldanelle di Petriolo' reveals the intricate weave binding architecture, function, and water use. The distribution of ceramics, glass, metal, and bio-archaeological remains mirrors the vertical articulation of the complex, allowing the Caldanelle to be reconstructed as a dynamic environment in which water, matter, and human practice were structurally entangled. Ceramics — abundant and functionally eloquent — span a chronological arc from the fourteenth to the seventeenth century. Their typology, manufacturing, and finishing techniques correspond precisely to the architectural zones in which they were found. In the lower rooms facing the watercourse, equipped with channels and plastered basins, utilitarian forms prevail: jugs, small amphorae, and bowls in local red clay, many encrusted with carbonates from prolonged contact with mineralized water. Within the same operational sphere appear small bowls, mortars, and unglazed cups — sometimes fire-altered — linked to the preparation of ointments, infusions, and medicinal clays. Comparative contexts from domestic and medical sites in central Italy confirm the coexistence of therapeutic and artisanal practices (Mariotti, Salvi, Tabolli 2023). In this sense, plastered surfaces, drains, and basins emerge not as mere constructive elements but as operative instruments through which the material culture of care was enacted and circulated.

6 | Archaic maiolica: truncated conical bowl decorated with a pattern of lanceolate leaves alternating with stylised flowers (photo by C. Barbafiera, D. Quaglia).

In the upper, drier, and more monumental sectors, the assemblage shifts. Fine tableware appears — *maiolica arcaica, graffita, ingobbiata* wares, and later Montelupo productions — adorned with vegetal and geometric motifs in blue, markers of conviviality and refined hospitality aligned with the social practices of late medieval Tuscan thermal culture (Berti 1997, 117–124; Fig. 6).

Their association with hearths, heating systems, and paved courtyards confirms the existence of spaces dedicated to dining and reception: the Caldanelle thus materialises as a multi-functional *hospitium thermale*, where medical service and domestic refinement interpenetrated in a carefully calibrated balance already defined by the fifteenth century. To this material dimension may be added the hypothesis of a cenobitic or charitable presence tied to the site's administration — perhaps small monastic or confraternal groups devoted to the care of travellers and the sick. The conjunction of table ceramics, ointment containers, and everyday utensils strengthens this reading of the Caldanelle as a micro-assistential organism, poised between devotion, healing, and labour, in continuity with the *hospitalia aquarum* that punctuated the thermal landscapes of central Italy (Boisseuil 2002, 78–84; Guèrin-Beauvois, Martin 2007).

Glass artefacts, though fewer, are equally revealing. Thin beakers, flasks, and small bottles in colourless or pale-green glass — sometimes with a milky translucence (*lattimo*) — attest to a material culture of refinement and hygiene. Their typology recalls Venetian and Tuscan productions of the fifteenth century (Guidotti 1991, 167–168). Found together with coins from the late fifteenth and early sixteenth centuries, they mark the apogee of the site's occupation and evoke an urbane clientele embedded in Sienese mercantile networks. As at Bath and Aachen, fine glassware accompanied ritualized practices of water consumption, carrying symbolic connotations of purity and social distinction (Borsay 2000, 23–27).

Metal artefacts and hydraulic fittings attest to a technical sophistication consistent with the site's environmental intelligence. Iron nails, hinges, and bronze fragments correspond to structural maintenance phases, while lead and copper-alloy pipes, recovered near conduits, reveal an advanced system of supply and drainage. Corrosion patinas and mineral deposits on their surfaces record prolonged exposure to sulphurous water, analogous to patterns observed in Roman and medieval baths across central Italy (Adam 1994, 211–215). This evidence speaks to continuous technical care: the regulation of circulation, temperature, and mineral sedimentation as architectural agents. The bioarchaeological record, in turn, restores the site's living dimension. Faunal remains reveal a predominance of ovicaprines and cattle, with butchery marks indicating both consumption and craft uses such as tanning and bone-working; marine shells and burnt bones suggest food preparation for residents and travellers alike. Pollen and plant macro-remains attest to cereals, vines, and legumes — traces of a mixed agrarian economy typical of the Sienese *contado* (Salvadori 2003).

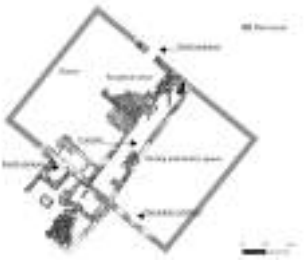
Read spatially, the stratigraphy of materials reproduces the architectural hierarchy: the damp lower sectors yield coarse ceramics, faunal debris, and iron tools linked to service and craft

areas; the vaulted residential zones concentrate fine wares, glass, and coinage associated with sociability and consumption; the upper service spaces contain utilitarian ceramics tied to storage and processing. This is not a random layering of "strata," but a functional order inscribed in climate — a logic of humidity, temperature, and access embedded in the architecture itself. Rather than a passive container, the Caldanelle operated as a hydraulic system whose spatial configuration and daily rhythms were continuously shaped by the management, maintenance, and failure of hydraulic circuits.

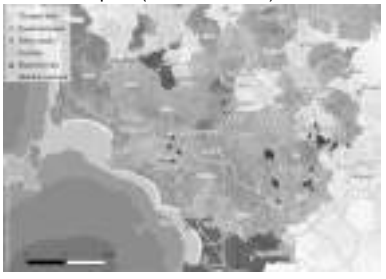
This co-productive relation between built form and material culture defines, in the fullest sense, a *hydraulic habitus* — a cultural adaptation to existence within a thermal ecosystem, where architecture does not merely host curative practice but modulates its duration, intensity, and thresholds according to the physics of water. The alternation of humid and dry, hot and temperate, public and secluded zones reproduces the rhythms of the spring itself. Matter — ceramic, glass, metal — does not simply record use; it participates in the production of hybrid space and meaning. The Caldanelle thus provides a particularly informative case for discussing medieval architectural ecology, where the boundaries between natural and artificial, functional and symbolic, dissolve into the daily negotiation of hydraulic dynamics.

The production of multiple places

The 'Caldanelle di Petriolo' emerge as a genuine instance of *environmental design ante litteram* — an experiment in the coupling of geothermal energy, everyday life, and landscape, where thermal architecture becomes not merely a response to function but a medium of social, and ecological order (Guarducci 2014). Yet the making of the Caldanelle place is not solely vertical — organized by humidity, temperature, and access — but also horizontal, extending through the landscape and the topography of the Farma valley. The alignment of the buildings along the stream mirrors a wider hydrographic rhythm in which spring, river, and mobility converge into a single continuum of movement [Fig. 7].



7 | Map showing the spatial organisation of the complex (elab. E. Vanni).



8 | Customs and fiscal organisation of the Sienese territory within the local micro-mobility network (elab. E. Vanni).

Archaeological, documentary, and environmental evidence together depict the Caldanelle as a nodal point, connecting Siena to its Maremma coastal plain through a dynamic system of mobility, fiscal control, and public health. As has been already observed (Vanni 2024, 59), this network should be understood not merely as administrative apparatus but as a living geography — an ecological infrastructure in which the circulation of waters and the mobility of bodies, human and non-human alike, actively produced innovative space and layered forms of governance. The thermal setting thus functions as an expanded architecture, where the same

hydraulic logic that organizes the distribution of rooms also regulates the courses of rivers and the mobility of flocks and travellers.

In this sense, the Caldanelle ecology operated simultaneously as architectural and territorial device: the gravitational descent of hot water within the building echoed the seasonal descent of herds and wayfarers along the transhumance routes — a hydraulic isomorphism between construction and landscape. Located along these pastoral corridors, the site was inscribed in the fiscal and ecological system of the *Dogana dei Paschi*, where thermal springs served as stations of rest and prophylaxis for livestock. Recent studies confirm the diffusion of animal bathing practices across Tuscan thermal contexts — from the Maremma to the Val di Merse and along the Paglia valley — where hot waters were harnessed for hygiene and veterinary care as well as economic purposes (Vanni 2024). This phenomenon, entwining animal mobility, empirical knowledge, and architectural adaptation, clarifies the dual vocation of the Caldanelle: a locus of healing and of labour, a node in a thermal economy uniting human medicine with agro-pastoral productivity (Vanni, Quaglia 2024).

Following the fall of the Republic of Siena and the site's absorption into the Medicean agricultural order, the Caldanelle underwent a gradual ruralization. This was not abandonment but transformation — an architectural metabolism adapting to new economic ecologies (Vanni 2024, 59-62). The thermal buildings were repurposed for agrarian use, yet the traces of their hydraulic intelligence remained legible: enduring evidence of a resilient system capable of translating social and environmental change into form.

Unlike the monumental complexes of San Casciano dei Bagni or Bagno Vignoni, the Caldanelle articulate a model of ecological adaptation, where scale and typology respond precisely to the local conditions of the Farma valley and to the interweaving of domestic life with resource management (Tabolli 2023; Mariotti, Salvi, Tabolli 2025). Given their geo- and hydrographic configuration, the Caldanelle, together with Petriolo and Macereto, must have formed a system of management and administration within the hydro-territorial landscape [Fig. 8]. In a broader European context, from Viterbo to Buda to Bath, a shared architectural grammar of thermalism emerges: the governance of water, the ritual of cure, and the control of hybrid space as instruments of distinction and social order (Ditaranto, Scardozzi 2016, 115–120; Borsay 2000, 23–29).

The Caldanelle site, though more modest in scale, embodies the same conception of thermal architecture as a medium between care, sociability, and power — an interlinked system of public health, economy, and ecology.

Ultimately, the 'Caldanelle di Petriolo' stands as a paradigm of eco-architectural hybridity, where architecture, hydrology, and society form a continuous negotiation between nature and design. Their spatial logic — vertical in construction, horizontal in landscape — allows us to recognize an early form of *environmental intelligence*, where the management of water generates form, use, and meaning.

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Abstract

The 'Caldanelle di Petriolo' is a medieval thermal site on the Farma River, part of the Mount Amiata hydrothermal district in southern Tuscany. It provides an exceptional archaeological context for examining "hybrid space" as the interplay of architectural design, hydrothermal technology, and social practice. Excavations document an articulated built ensemble whose layout and uses evolved between the fourteenth and seventeenth centuries. Rather than a marginal annex to the nearby baths of Petriolo, the Caldanelle appears as an integrated undertaking in which hot mineral water structured therapeutic practices, domestic and hospitality routines, as well as productive activities. Drawing together architectural analysis, material culture, and written evidence, the article reconstructs its development, spatial organisation, and position within a wider European repertoire of thermal architecture.

keywords | Medieval thermalism; *Caldanelle di Petriolo*; hydro-architecture; archaeology of water; hybrid spaces.

Thermalism and Agriculture

An Unusual Use of Thermal-Mineral Water in the Euganean Area for Hemp Processing during the Time of the Serenissima

Paola Zanovello

1 | Location of the Greek colony of Tanais on the Sea of Azov.

I. Cultivation and use of hemp in Antiquity: a brief Introduction

Cannabis sativa is an extremely versatile plant, known and cultivated since ancient times as a textile fiber, as a source of oil for lighting extracted from its seeds, and as a medicinal or psychoactive substance, as Herodotus recounts (*Histories*, IV, 73–75) when describing particular ceremonies practiced by the Scythian people in the 5th century BC (De Ruggiero 1900; Forbes 1964; Godwin 1967).

Around the Black Sea its cultivation spread and the port of Tanais, a Greek colony on the Sea of Azov at the mouth of the Don River, directly connected to the Black Sea [Fig. 1], became one of the main trading centers of the product as early as the Classical period. In the ancient literary sources, the area is known as Μαιώτις λίμνη (Aesch., *Prom*. 427) or *Maeotis Lacus* (Plin., *nat*., 4, 24; 6, 6). Strabo (11, 2.3) describes the city as follows:

> ἐπὶ δὲ τῷ ποταμῷ καὶ τῇ λίμνῃ πόλις ὁμώνυμος οἰκεῖται Τάναϊς, κτίσμα τῶν τὸν Βόσπορον ἐχόντων Ἑλλήνων. νεωστὶ μὲν οὖν ἐξεπόρθησεν αὐτὴν Πολέμων ὁ βασιλεὺς ἀπειθοῦσαν, ἦν δ᾽ ἐμπόριον κοινὸν τῶν τε Ἀσιανῶν καὶ τῶν Εὐρωπαίων νομάδων καὶ τῶν ἐκ τοῦ Βοσπόρου τὴν λίμνην πλεόντων, τῶν μὲν

ἀνδράποδα ἀγόντων καὶ δέρματα καὶ εἴ τι ἄλλο τῶν νομαδικῶν, τῶν δ᾽ ἐσθῆτα καὶ οἶνον καὶ τἆλλα ὅσα τῆς ἡμέρου διαίτης οἰκεῖα ἀντιφορτιζομένων.

On the river and on the lake is situated a city called Tanais, like the river; it was founded by Greeks who held the Bosporus... It was a commercial center used both by the nomads of Asia and Europe, and by the sailors who, departing from the Bosporus, traveled across the lake. The former brought slaves, furs, and other products of the nomads; the latter carried in exchange loads of clothing, wine, and other goods useful for daily life.

With the Greeks the cultivation spread throughout the Mediterranean, particularly in humid areas; among these, the French Camargue was a major production center and Marseille (ancient *Massalia*) was one of the main ports for the trade of the fiber. Evidence of this remains in the old toponym of the Canebière district, adjacent to the port area (Blès 1994). Many ancient authors, collected in an interesting work by Alfredo Buonopane (2012) on the Roman Veneto, recall the use of hemp, especially for the production of ropes and resistant fabrics; among these sources in particular Columella (*De re rustica* 2, 7) recalls its diffusion among the main crops and the peculiar cultivation methods (2, 10):

Cannabis solum pingue stercoratumque et riguum vel planum atque humidum et alte subactum deposcit. In quadratum pedem seruntur grana sex eius seminis Arcturo exoriente, quod est ultimo mense Februario circa sextum aut quintum
Kalend. Mart. Nec tamen usque in aequinoctium vernum, si sit pluvius caeli status, improbe seretur.

Hemp requires a soil that is rich and well-fertilized, and that is either level and moist and deeply tilled. Six grains of its seed are sown per square foot when the sun rises, which is in the last month of February, around the sixth or fifth of the Kalends of March. However, it should not be sown until the vernal equinox, if the weather is rainy.

However, it must not have been an easy crop, as Columella still states (2, 12):

Cannabis seritur, ut supra docuimus: sed incertum est, quantam impensam curamque desideret

Hemp is sown, as we have taught above: but it is uncertain how much effort and care it requires.

Even Pliny the Elder (*Naturalis Historia* 19, 174) recalls the importance of this plant, listing three particularly fine varieties of hemp: those from Alabanda and Miletus, cities both located in Caria, and the one grown in Rosea, in the Sabine countryside of Italy near Rieti.

Definite palynological evidence has emerged from research carried out some years ago in the area of the volcanic lakes Albano and Nemi: the crops must have been distributed across the hilly areas, while the soaking of the fibers in the lake waters has been confirmed, with activities dated mainly between the 1st and 2nd centuries AD (Mercuri *et al*. 2002). Hemp was certainly widespread, together with flax, at least from the 2nd century BC in the Po Valley, as documented in the Bologna area (Marchesini, Marvelli 2009, 315), where during Roman times it was mainly used as a textile plant, especially for producing ropes, cords, mats, and nets. To the data concerning cultivation derived from archaeobotanical analyses, more strictly

archaeological information from Roman Veneto can be added (Buonopane 2012). In addition to numerous literary sources gathered by Alfredo Buonopane, significant epigraphic evidence is also reported. The author analyzes in particular an inscription (CIL V, 3072 = ILS 8339), found most likely in the centuriated territory of Bovolenta, south of Padua, but now preserved, after various vicissitudes, in the Museo Nazionale Atestino. It is a funerary inscription that very precisely defines the boundaries established for the burial in an area adjacent to a hemp field (*canabetum*). The inscription is dated between the 2nd and 3rd centuries AD and demonstrates that even in this part of the Po Valley the cultivation of this plant was widespread, as it was in the nearby centuriated territory of Emilia.

Another epigraphic text, stamped on a small lead sheet from the territory of Altino and used as a "label" to indicate batches of goods intended for sale or processing, records a quantity of three and a half pounds of hemp (*KANN*). Based on the shape of the letters, Buonopane (2012, 539) dates it between the 1st century BC and the 1st century AD. The weight mentioned is modest, just over one kilogram, and therefore it could refer either to a small lot of fiber or, according to the scholar, to seeds intended for agricultural or medicinal use. Also interesting are the observations that the author dedicates to this agricultural practice in Roman Veneto, which, due to the scarcity of evidence, seems to have been aimed at local use and self-consumption. This would fit well within the general context described by Varro (*De re rustica* 1, 22, 1):

> *De reliquo instrumento muto, in quo sunt corbulae, dolia, sic alia, haec praecipienda. Quae nasci in fundo ac fieri a domesticis potuerunt, eorum nequid ematur… sic quae fiunt de cannabi, lino, iunco, palmo, scirpo, ut funes, restes, tegete.*
>
> As for the remaining 'mute instruments', which include baskets, jars, and the like, these must be provided for. Those that can be produced on the estate and made by household workers should not be purchased… thus those made of hemp, flax, rush, palm, or bulrush, such as ropes, cords, and mats.

Moreover, the association with a quantity of six bales (*vellera*) of wool, found on the same lead sheet from Altino, may suggest a type of cultivation complementary to the wool industry, which was widespread in the Veneto area, perhaps intended to produce mixed fabrics that were tougher and more durable (Buonopane 2012, 540). To these findings can be added the important recent discovery at Aquileia, where an exceptional system of basins used in Roman times for hemp retting was found. These were in operation between the late 2nd and early 4th centuries AD, near the river port along the eastern bank of the Natisone River (*cafoscariNEWS*, 20/09/2018).

The plant must therefore have been widely cultivated in the Roman period and its fibers processed mainly in connection with agricultural and port areas.

2 | The Arsenal of Venice, in a drawing by an unknown artist, second half of the 18th century (ASV, *Patroni e provveditori all'Arsenal*, b. 546, dis. 1, in Celetti 2007, 173, fig. 8).
3 | Perspective view of the "Officina della Corderia", commonly known as "Tana all'Arsenale", in a drawing by Andrea Tosini (engraving by Antonio Lazzari), in *Oggetti più interessanti della Città di Venezia 1833*.

II. The Spread of Hemp Cultivation and Trade between the Middle Ages and the Modern Age

Due to its versatility, hemp continued to be cultivated and traded throughout the Mediterranean world even during the Middle Ages. It is precisely in the ancient territory of Tanais, on the Sea of Azov, that the Venetian term for hemp warehouses originated (Rampazzo 2024): the river port on the Don, directly connected to the Black Sea, became during the era of the maritime Republics in the second half of the 13th century first a Genoese and later a Venetian trading post known as Tana (Wasowicz 1966; Pubblici 2005). From there during the 14th and 15th centuries numerous shipments of hemp destined for the production of ropes, an essential material for the Venetian navy, arrived in Venice along with other valuable goods.

In the area of the Arsenale in the lagoon city, a special building was constructed for the carding and spinning of textile fibers needed to meet the growing naval demand. This building was variously known as the Caxa del Canevo, the Corderia, or more commonly the Tana [Figs. 2-3]. In this district many related toponyms still survive today, such as Campo de la Tana, Calle de la Tana, Ponte de la Tana, and Rio de la Tana [Figs. 4-5].

From the Early Middle Ages onward, Venice had become a key reference point for all maritime trade between Europe and the East and its fleet experienced a steady and massive expansion. During this phase the Republic of Venice undertook, among other major projects in the Venetian territory, the widespread cultivation of hemp (Baruffaldi 1741; Pastori Bassetto 1993; Cazzola 2002, 240-241; Poni 2002; Celetti 2007), intended for the great Venetian ropeworks (*corderie*). Numerous written documents, especially from the 18th and 19th centuries, confirm this (Celetti 2007; Danieli 2021).

Andrea Gloria, in his book *Dell'Agricoltura nel Padovano* (1855), collected a series of documents attesting to the presence of extensive cultivations that included hemp and flax, particularly in the areas between Este, Montagnana, and Cologna Veneta, since the time of Ez-

4 | The Arsenal area today (Google Earth, GIS elaboration by A. Meleri).
5 | Detail of the area with toponyms linked to the "Tana" (Google Earth, GIS elaboration by A. Meleri).

zelino (13th century). This is also suggested by the Atestine toponym Canevedo (Gloria 1855, CXX) and by the widespread presence of retting pits and storage facilities, known in Venetian dialect as *tane*.

Among the documents gathered by the Paduan historian are specific regulations for farmers and prohibitions, such as the ban on hunting in fields sown with hemp (no. 212), the prohibition of retting in public waters (no. 213), and strict anti-fraud controls (no. 214).

To these can be added specialized works, such as *Il Canapajo* by Girolamo Baruffaldi, a sort of handbook in eight books written in verse, as was common at the time, published in Bologna in 1741 [Fig. 6]. The cultivation of textile plants, such as hemp and flax, was widespread everywhere (Somma 1923; Poni, Fronzoni 2005; Andreozzi 2006; Ciotti 2007; Llinares 2020), often as a supplementary activity for peasant families, within which weaving was also organized for the self-production of materials needed for daily life such as sheets, towels, tablecloths, and dishcloths (*canovacci*), the latter deriving their very name from this fiber (Dalla Libera 2004, 27-29).

Salvatore Mandruzzato, author of an extensive three-volume work on the Baths of Abano (Mandruzzato 1789-1804), in his time denounced the widespread neglect in the maintenance of ditches and canals, and even "the filling in of the same for the retting of flax or hemp," which caused the marshy stagnation of large areas in the lower part of the Euganean thermal region, between Montegrotto and the Catajo (Mandruzzato 1804, Book III, Section IX, 166).

III. Agriculture and Thermal Water between the 19th and 20th Centuries: Some Experiments

Particularly interesting is the use of thermal water in agriculture, not only because of its higher temperatures which undoubtedly accelerated certain vegetative processes, but also due to the chemical characteristics of the various springs. In the territories of Abano and Montegrotto there are reports of some experiments. Antonio Sette, author of a brief agricultural guide published in 1843, devoted considerable attention to the crops cultivated in the lands of the provinces of Padua, Rovigo, Venice, Vicenza, and Verona, including hemp and flax, which con-

6 | Cover of *Il Canapajo* by Girolamo Baruffaldi, published in Bologna in 1741.

7 | Historical image of a hemp maceration basin in the Ferrara area (Archivio Centro Documentazione Storica, Comune di Ferrara).

tinued to be grown even after the fall of the Serenissima. Of particular interest is his note about the experiments of his nephew Alessandro, well known as an inventor and innovator in agriculture, who tested at San Pietro Montagnon the increased productivity of a small rice field through the use of very hot thermal water, partially cooled in special basins (Sette 1843, 82-83).

On the opposite Euganean hillside, there is also a long tradition of exploiting thermal waters for agricultural purposes: in the Calaona Valley, now in the municipality of Baone, a fertile and flat area at the foot of the Euganean Hills, inhabited since prehistoric times, the geothermal phenomenon was exploited at least since the 17th century, both for public use for medicinal purposes (remains of basins and of a building with a hospitality function) and for the establishment of naturally heated greenhouse cultivation facilities (Zanovello, Meleri 2023). The geothermal resource thus became even more important, enabling cutting-edge cultivation practices for the time, which reduced cultivation times and increased production profitability with completely natural and zero-cost methods.

IV. Agriculture and Thermal Water: a Particular Use for Hemp Processing

Thanks to experiments conducted in the Euganean thermal area, the use of thermal water also proved useful for softening hemp fibers, since with water at about 30°C the retting time

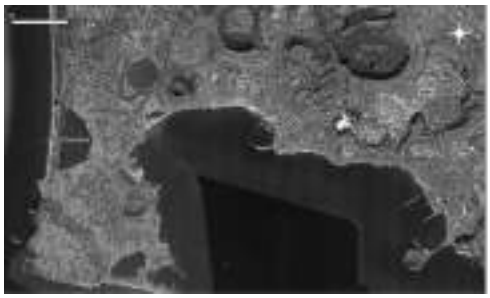
was cut in half: four days instead of the usual eight to ten (Rizzo *et al.* 1867; Zanetti 2002, 289) [Fig. 7]. Therefore, the practice of macerating hemp and textile fibres in general spread where this resource was naturally present. This recalls Mandruzzato's "denunciation" of the poor hydrogeological management of the thermal territory, influenced by the needs of cultivators: he refers to "certain private abuses" (Mandruzzato 1804, 166), namely "on one hand, the neglected excavation of ditches and canals, their filling in for the retting of flax or hemp, small embankments to prevent the drainage of water that might harm some landowners; on the other hand, the silence and inactivity of municipal laws" (Mandruzzato 1804, 166, note 1). The situation was probably not much different in other areas of Italy, as evidenced by numerous but sporadic reports that have so far only been studied at a local level.

In Val d'Ossola, in Piedmont, in the locality of Premia where a thermal spa still exists today, there are records dating back at least to the 16th century of a hot spring that was freely used for various purposes: medical treatments, laundry and hemp retting (Negri, Mosello 1989). The same practice is believed to have taken place at the thermal baths of Comano, in Trentino, according to local tradition (Gorfer 1972), and possibly also in the thermal area of Fratta, in the municipality of Bertinoro in Romagna (Bassani M. 2016, 887). Other reports on the use of thermal water for retting hemp and flax (Bassani M. 2016, 887-888) are also found at the Bullicame springs near Viterbo, at least from the mid-13th century (Bassani A. 2014, 40), and in modern times at the Terme delle Zitelle (*Termalismo antico e moderno nel Lazio* 1999, 55) and at Casa Carletti (Chellini 2002, 120; De Felice 2009, 103), within the same thermal area.

Even more interesting within this context is the volcanic Phlegraean area, not far from Naples and Pozzuoli, where between Lake Agnano and Lake Fusaro [Fig. 8] an extensive tradition of cultivation and retting of hemp is documented, which must have benefited from the particular chemical and physical characteristics of the soil and water (Russo Spena 2024). In Agnano there was a Roman thermal complex which, between the 9th and 10th centuries, was submerged due to bradyseism: a lake [Fig. 9] formed in correspondence with the crater (Sgobbo 1929, 189-190; Amalfitano, Camodeca, Medri 1990, 62-67), which was later drained and reclaimed at the end of the 19th century (Annecchino 1931).

At least since the mid-15th century, hemp cultivation has been documented here (Casoria, Scognamiglio 2006), and the lake basin, shallow and ideal for this type of process, was used for retting. Alfonso of Aragon promoted its use for this purpose, also because both Agnano and the nearby Lake Fusaro, located between Baia and the Tyrrhenian Sea, were peripheral to Naples. This helped solve a serious public health issue: in Naples several sites were used for hemp retting (Casoria, Scognamiglio 2006, 63-64), but the bad smells emanating from the processing waters heavily affected everyday life in the city.

It is worth recalling that the name of Lake Fusaro itself derives from the *fusari*, the basins where laborers gathered hemp stalks into bundles and submerged them for several days to carry out the necessary process of separating the fibers from the woody parts. The same policy of promoting this crop led to the identification of another area, slightly further north, suitable for



8 | Phlegraean Fields, with Lake Fusaro and the crater once occupied by Lake Agnano (reworked from Google Earth, GIS elaboration by A. Meleri).
9 | Lake Agnano in a 1706 watercolor engraving (Alexandre de Rogissard, *Les délices de l'Italie*, III, Leiden 1706).

retting: in the Caserta region lies the territory of the Regi Lagni, whose name derives from an important reclamation project carried out at the beginning of the 17th century at the mouth of the Clanio River (Capasso 1994). Here too, one of the most important areas for hemp cultivation and processing developed. Thus, even in the Phlegraean area, as in other regions of Italy, thermal phenomena were exploited to optimize the timing and methods of agricultural processing, albeit under complex hygienic and operational conditions, especially where production took place on an industrial scale, both in the Kingdom of Naples and in the territories of the Serenissima.

V. Hemp and Thermal Water: a Case Study at the Bagno della Crosara in the Euganean Hills

On the western side of the Euganean Hills, in the plain that extends toward Este, Montagnana, and Cologna Veneta where hemp cultivation was widespread during the time of the Serenissima (Celetti 2007) [Fig. 10] there remains evidence of the use of a thermal basin for hemp retting. In the locality of Crosara di Fontanafredda, in the municipality of Cinto Euganeo, a site still known today as "Bagno", also reported in the Napoleonic and Austrian cadastral maps, there is an architectural complex with a basin fed by a thermal spring still flowing today; it was restored about ten years ago through a private initiative [Figs. 11-13].

The spring emerges at a temperature of 27 °C, but according to local tradition, before the 1976 earthquake the moderately sulfurous water reached temperatures above 40 °C and surfaced at several points in the plain. The existence of the spring is documented at least from the early 12th century when the Bishop of Padua, Sinibaldo, bathed there for its therapeutic properties (Casarin 1976, 191, 313-314). Later it was exploited for productive purposes: around 1300 a mill with a *coppedello* (vertical wheel) was built and is still preserved today (Grandis 2001; Grandis 2005, 237-239); in 1488 it was purchased by the Venetian Contarini family, who owned land and an imposing frescoed villa in nearby Valnogaredo, another hamlet of Cinto Euganeo.

10 | Hemp cultivation in the Venetian Republic: a graphic reworking by David Celetti based on Anton von Zach's cartography (from Celetti 2007, 174, fig. 9).

The main activity was flour production, for which hydraulic energy was exploited to move the large mill wheel, but the thermal basin was also used for hemp retting, certainly benefiting from the temperature and the chemical-physical composition of the water [Figs. 14-15]. A short paved ramp, still preserved, descending to the basin was intended to facilitate the loading and unloading of the bundles of stems left to macerate. The basin is not large, but the water temperature accelerated the process, thus encouraging more frequent turnover of the raw materials. It should be noted that the practice of self-production must also have been widespread, with small facilities serving local communities and representing the entire production chain from cultivation to retting, breaking, carding, and finally weaving. In the Veneto region, as in other parts of Italy, several examples of this still remain; for instance, in the Vicenza area toward the end of the 18th century, there was one loom for every 15-20 families (Panciera 1999). Great attention is therefore also paid to basic training, tailored to family and community needs.

In the first half of the 19th century, numerous short practical texts, almost handbooks, addressed to farmers, began to appear (Scalco 2003). These included recommendations such as "make sure that every year there is a plot of land set aside for hemp and flax for family use," as reported in the *Catechismo agricolo ad uso dei contadini*, compiled by a parish priest, Don Giovanni Rizzo, and published in Padua in 1869 (Rizzo 1869, 13, 87). This reflects the sa-



11 | The “Bagno della Crosara” ancient architectural complex in Fontanafredda, Cinto Euganeo (Padua) (GIS elaboration by A. Meleri).
12 | The “Bagno della Crosara” site in a detail of the Napoleonic Land Registry of 1811.
13 | The “Bagno della Crosara” site in a detail of the Austrian Land Registry of 1845.

me agricultural context recorded by Andrea Gloria in his aforementioned *Dell’agricoltura nel Padovano* (1855).

Toward the end of the 19th century in the Padua area there were 3,426 hectares devoted to hemp cultivation, with a total production of 23,982 quintals, coming mainly from Montagnana, followed by Padua and Este (Celetti 2007, 312). Within this context fits the particular use of the thermal “Bagno” of Fontanafredda, an important example of how thermal water could facilitate certain production processes: water, therefore, not only with therapeutic value but also serving a profitable purpose in agriculture.

14 | Crosara di Fontanafredda: the “coppedello” mill and the thermal basin.
15 | Crosara di Fontanafredda: the thermal basin and the short paved ramp to the basin.

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Abstract

This study explores the historical interplay between thermalism and agriculture in the Euganean area, focusing on the use of thermal-mineral waters for hemp processing during the time of the Venetian Republic. *Cannabis sativa*, a versatile plant cultivated since antiquity for fiber, oil and medicinal purposes, was widely grown in Roman and medieval northern Italy, particularly in the Po Valley and Veneto region. Archaeological, palynological and epigraphic evidence confirms its cultivation and local use, especially for ropes, textiles and mixed fabrics. During the time of the Serenissima hemp production expanded to meet the demands of Venice's naval industry, with retting and fiber processing supported by natural water sources. In the Euganean Hills thermal springs were exploited to accelerate hemp retting, reducing processing time while benefiting from the chemical and thermal properties of the waters. Similar practices were recorded elsewhere in Italy, including Lazio, Piedmont, Trentino, Romagna and the Phlegraean area, demonstrating a broader historical pattern of using thermal waters to optimize fiber processing. The research highlights the multifaceted role of thermal water in agriculture, combining economic, technological and environmental functions, and documents the persistence of hemp cultivation and small-scale self-production in northern Italy up to the early 20th century.

keywords | Hemp (*Cannabis sativa*); Fiber processing; Thermal-mineral water; Euganean Hills; Venetian Republic.

Strategies and Projects for Thermal Sites

Mauro Marzo, Anna Veronese

1 | Ignazio Gardella, Terme Regina Isabella in Ischia (1951-1953) (from *Primizia su Ischia* 1952 and Irace 2020).
2 | Ignazio Gardella, Terme Regina Isabella in Ischia (1951–1953) (from *Ignazio Gardella. Progetti e architetture 1933–1990 1992*).

The use of thermal waters for therapeutic purposes is an age-old practice deeply rooted in Mediterranean culture. Since antiquity, water has been regarded as a symbolic, regenerative and purifying element endowed with healing and spiritual powers. In both Greek and Roman civilisations, hydrotherapy played a central role not only in medicine, but also in the social and ritual spheres. As early as in Ancient Greece, thermal springs were often associated with the cults of Asclepius, the god of medicine, and incorporated into the complexes of therapeutic sanctuaries (Alesse 2010).

From Greece, the practice spread throughout the Roman Empire, where it reached an extraordinary level of organisation: according to archaeological estimates, the city of Rome alone contained more than 800 thermal complexes (Ward-Perkins 1981). The baths, such as those of Caracalla or Diocletian, represented an early form of public healthcare, but were also places for healing, leisure, and social interaction. While in the ancient world thermal waters were initially linked to cultic and therapeutic practices, in which healing was attributed to the direct intervention of the deity through ritual, this relationship underwent a profound transformation in the Roman period. Without completely losing their religious dimension, baths gradually acquired a more secular character, becoming both an economic resource and a structured space devoted to bodily care. As a result, a new conception of thermalism emerged, oriented

not only towards healing, but also towards hygiene and physical and psychological well-being, anticipating patterns of use that remain familiar today (Zanovello *et al*. 2018).

With the fall of the Empire and the rise of Christianity, thermal culture underwent a long period of decline. Although water retained an important symbolic role within Christianity – baptismal water, in fact, cleansed from original sin (Berrino 2011) – during the Middle Ages the use of thermal baths was opposed on moral and religious grounds, being considered potentially hedonistic. Nevertheless, medical hydrology remained partially alive as a therapeutic discipline, practised within monastic or private contexts and based on empirical methods (Delitala 1998). It was the Renaissance that revived the culture of thermalism, in a climate of renewed interest in science and nature.

In the eighteenth century, thanks to the progress of experimental medicine and the systematisation of studies on mineral waters, hydrology became a genuine autonomous science. Thermal water began to be considered a natural pharmacological agent, while spa resorts gradually transformed into destinations for holidays and social life, anticipating the modern notion of health tourism (Fiorani, Ceccarelli 2007).

In Italy, beginning in the second half of the nineteenth century, thermalism became a true driving force for territorial and touristic development, thanks to the profound transformation that marked its passage from a therapeutic practice to a social and cultural phenomenon. Spas ceased to be places devoted exclusively to the treatment of illness, becoming instead spaces for leisure, recreation, and the representation of wellbeing, in keeping with a new conception of free time and the body. With the advent of the twentieth century, the thermal experience was democratised: resorts once reserved for the aristocracy gradually opened to the bourgeoisie and the middle classes, supported by the development of infrastructure and the emergence of a broader, more accessible form of tourism. Increasingly, architectural and urban design came to play a crucial role in shaping the experience.

Moreover, thermal tourism assumed a strategic role in the process of modernising the country, becoming both an economic driver and a laboratory for architectural experimentation. The year 1919 marked a turning point with the foundation of ENIT (Ente Nazionale Italiano per il Turismo, Italian National Tourist Board), charged with promoting Italy's image abroad. This was followed in 1926 by the establishment of the Aziende autonome di cura, soggiorno e turismo (Autonomous Agencies for Health, Recreation and Tourism), which encouraged the coordinated development of spa towns. During this period, the architecture of the thermal baths emerged as an expression of a new national identity, capable of uniting health-related needs with aesthetic representation and landscape value.

From the post-war period onwards began the great season of social thermalism, coinciding with the expansion of the welfare state and the foundation of the Servizio Sanitario Nazionale (National Health Service, SSN) in 1978. Thermal treatments were recognised as preventive and rehabilitative therapies, supported by medical research confirming their efficacy in the

treatment of various chronic conditions (Ministero della Salute 2015). Economic accessibility and public support allowed a broad segment of the population to benefit from these treatments, generating a widespread form of mass thermal tourism.

Within this context emerged a number of architects who interpreted the theme of thermal architecture as an opportunity for linguistic and technical experimentation: Ignazio Gardella with the Terme Regina Isabella in Ischia (1951–1953) [Figg. 1-2], Pier Luigi Nervi with the Nuove Terme di Chianciano, Gino Valle with the Terme di Arta (1962–1963), and Luigi Moretti with the renovation of the Fonti di Bonifacio (1965–1966).

To trace, in modern times, the archetypes of an architecture capable of embodying the thermal experience, one must look back to the eighteenth-century plan for the city of Bath. Its history as a resort began in the second half of the sixteenth century, following the publication of a medical treatise describing the therapeutic properties of the local waters, and thanks to the patronage of the Earl of Pembroke, who introduced part of the British aristocracy and the royal family to this locality in Somerset (Battilani 2001). If the first form of modern tourism can indeed be considered that linked to the thermal baths (Battilani 2003), it was in Bath that, for the first time, the modern concept of the spa resort took shape, giving rise to a genuine thermal city. The architectural and urban design of John Wood, which integrated Roman remains within a dialogue between the ancient and the modern, produced a city characterised by a homogeneous fabric punctuated by significant architectural episodes. The celebrated square–circus–crescent sequence spread from Bath across Britain and later throughout Europe, influencing the design of thermal cities, as well as that of new districts or urban areas developed with similar aims. Bath proposed an urban model that abandoned the concept of a rigid organism enclosed by solid walls, in favour of a fabric integrated with the surrounding landscape: streets, waterways and paths follow coherent ordering principles, while architectural elevations articulate the different roles and functions of the spaces.

Bath became a paradigm of the European thermal city for two fundamental reasons: on the one hand, its conscious reinterpretation of the classical heritage; on the other, its harmonious fusion of natural and architectural elements. The English city represents one of the first and most accomplished urban experiences in which architectural composition is founded on the interaction between the morphology of the site and the surrounding landscape where the eighteenth-century urban order engages in dialogue with the topography and the system of thermal waters, anticipating a modern and picturesque conception of the relationship between architecture and nature (Pevsner 1958). The relevance of Wood's project is at the core of the doctoral research of one of the most interesting Spanish architects of the younger generation, José María Sánchez García, who in his thesis examines the strategies, techniques and tools employed by Wood in the construction of a territorial, urban and architectural project which, starting from a reinterpretation of classical architecture, can be understood as a "manifiesto contra la dispersión" (Sánchez García 2016).

3 | Plan layout of Montecatini Terme as described by B. Secchi on an aerial photo.

Integration with the morphology of the territory, moreover, constitutes a reference model that became common in many European thermal towns between the eighteenth and nineteenth centuries, where organic urban plans for expansion and street regularisation were developed on the basis of two main elements: the *promenade* and the thermal park. The *promenade*, conceived as an axis of representation and movement, became the foundational spine of urban and social life, while the park assumed the role of therapeutic and spatial core, the privileged setting for sensory experience and contact with nature. This dual structure reflected a new urban paradigm that intertwined aesthetic, hygienic and moral concerns, anticipating the modern city as a complex and regulated organism (Choay 1965). The scale of the promenades gradually expanded, as exemplified by the Bristol–Bath route built along the Midland Railway line, extending over 20 kilometres and widely used both for daily commuting to school and work and for leisure and tourism purposes (Busi, Pezzagno 2006).

In Italy too, the impact of the thermal phenomenon has been such as to profoundly influence the morphology and development of numerous urban centres. In many cases, thermal cities have shaped their very structure around hydrothermal resources, establishing a privileged relationship with the landscape and organising their various urban components according to a system of functionally distinct yet organically interconnected spaces: areas dedicated to thermal activities, residential and hotel zones, public spaces and infrastructural connections. This gives rise to a conception of thermal urbanism as a device for balancing care, leisure and representation, in which the city itself becomes a laboratory for the experimentation of modernity. In such contexts, public health and *loisir*, the perception of the landscape and the urban form converge in an original synthesis capable of reflecting an ideal of collective wellbeing and of harmony between nature and the built environment.

Bernardo Secchi, in his paper *La tradizione del progetto urbanistico nelle città termali europee* presented at the Abano Terme conference in 1993, identified four main recurring morphological models, analysed in the doctoral thesis *I paesaggi termali. Luoghi pubblici e identità collettive* (Fiorentino 2019), which together outline a veritable typological atlas of European thermalism.

In the category “The city and the parks”, which includes towns such as Fiuggi, Chianciano, Montecatini [Fig. 3] and Salsomaggiore, the thermal core is organised as a large, recognisable urban void – largely undeveloped and designated as a public park – within which the therapeutic buildings are arranged. This configuration reflects the nineteenth-century tradition of landscape gardens and the fusion of hygiene, aesthetics and sociability (Rossi 1966).

It is followed by the configuration defined as “The city and the enclosure”, referring to Tivoli, Monticelli, Castrocaro and Castellammare, characterised by a well-defined and delimited thermal core, often coinciding with the hospitality structure itself, which tends to isolate itself from the surrounding urban context. In this model, the relationship between architecture and the city is one of separation rather than continuity, following a logic of spatial closure typical of certain modernist experiences.

In “The cities and the objects”, as exemplified by Abano and Montegrotto, recent growth has taken shape through the multiplication of independent hotel structures, conceived as “island-hotels” that deny any direct relationship with public space.

Finally, in “The city as ordering structure”, exemplified by Bagno di Romagna, the territorial morphology has constrained horizontal expansion, directing transformations towards the recovery and enhancement of the existing building stock. In this case, the spa centre integrates with the historic city, revealing a form of morphological and cultural sustainability that was ahead of its time.

From the 1980s onwards, however, the gradual reduction of public funding and the introduction of limits to healthcare provision brought about a profound crisis in the Italian thermal sector. Yet this issue concerns neither Italy alone nor merely the most recent decades. It is, in fact, a recurring condition in the development and subsequent decline that has always characterised the thermal model. The trajectory of the city of Bath itself unfolded over the course of a century, and the fate of other thermal towns followed a similar path (Battilani 2001). The welfare-based model, founded on state intervention and on the therapeutic conception of water, progressively revealed its fragility, prompting a shift in perspective: from cure to prevention, from pathology to wellbeing.

4 | The former Hotel Montecarlo, Montegrotto Terme, 2025, photo by Mauro Marzo.

This transition generated a shift from health tourism to wellness tourism, marking a genuine paradigm change in language, target audiences, and strategies of communication and marketing. Such evolution had significant repercussions also on the architectural level: contemporary thermal buildings are no longer confined to meeting functional or therapeutic requirements, but are conceived as experiential and immersive spaces, where built matter enters into dialogue with water, light, and landscape.

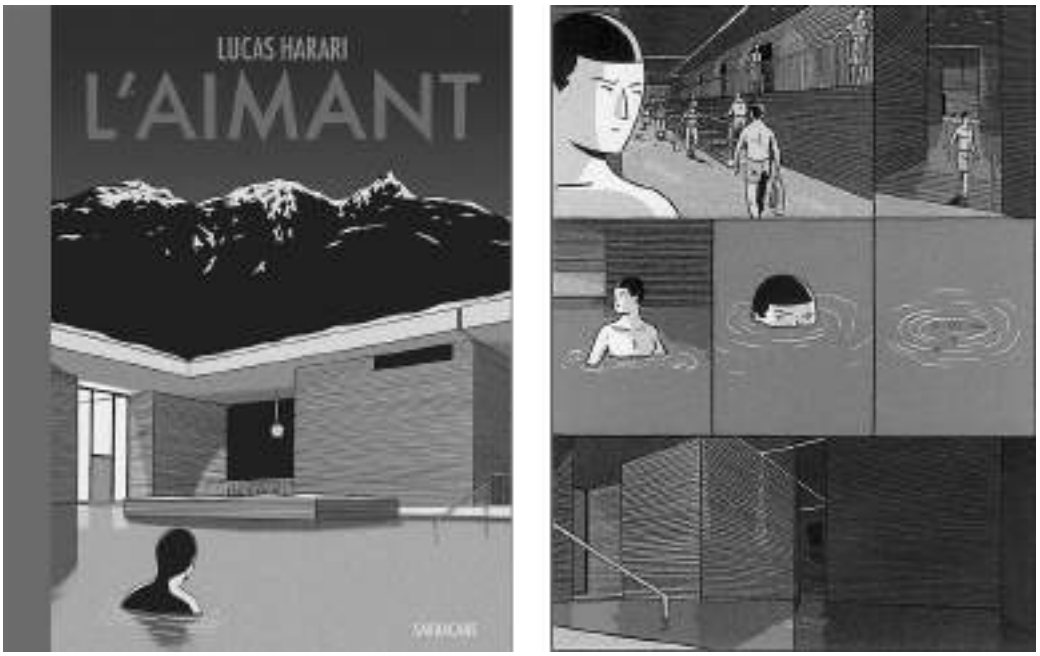
The return to nature – no longer understood as a mere scenic backdrop, but as a generative principle of architectural form – marks the rebirth of a design culture centred on sensory perception and on the harmony between body, environment, and the built. From this perspective,

thermal architecture appears as a device mediating between nature and artifice, between care and wellbeing, between matter and time. As Aldo Rossi (1966) reminds us, every architecture is an expression of memory and of the permanence of place (*locus*), and it is precisely in this relationship with the cultural and morphological identity of the context that the symbolic and experimental value of thermal architecture lies.

In Italy, the crisis of the sector led, in the final decades of the twentieth century, to the decline and abandonment of numerous thermal structures [Fig. 4]. Abroad, however – beginning in the 1990s – the landscape of thermal architecture underwent a profound transformation. In several European and international contexts, projects have been realised that establish a renewed dialogue between body, water, and landscape, emphasising the role of spas as identity-bearing and regenerative places. These new architectures are no longer conceived merely as spaces for treatment or leisure, but as engines of territorial, cultural, and economic valorisation, in which the architectural construction engages with the morphological, ecological, and symbolic specificity of its setting. Spas thus become instruments of environmental and landscape regeneration, capable of combining memory and innovation, tradition and contemporary design.

Among the most emblematic experiences of this period is the celebrated Therme Vals complex (1991–1996) in Switzerland, designed by Peter Zumthor. The work – now regarded as a manifesto of Zumthor's thought – interprets matter and light as tools of perceptual excavation. The architect himself, in an interview with "Dezeen", recalled the original communal dimension of the project: "This project was a social project, me and my wife lived there for almost 20 years with the community and it was owned by the community and was successful [...]. It now belongs to a financial figure who bought all of it and destroyed it. The bath is a landmark so nothing will happen to the bath, but this social project is dead" (Mairs 2017).

The Therme Vals represent a paradigm of physical and symbolic integration with the Alpine landscape: an architecture that seems to emerge from the mountain itself, in a dialogical relationship between construction and nature. The alternation of massive stone volumes and cavities, the sequence of grazing lights and deep shadows, evoke an initiatory path through matter, in which the body reconnects with the primordial elements. The impact of this architecture on contemporary culture is such that it has become a source of inspiration for other artistic languages. A telling example is the graphic novel *L'aimant* (2017) by Parisian author Lucas Harari, set precisely within the Therme Vals, in which Pierre, a young architecture student, becomes so fascinated – and almost obsessed – with Zumthor's work that he undertakes a journey to the thermal baths in an attempt to unveil their mysteries [Figg. 5-6]. Harari's work, poised between introspection, myth, and the representation of space, testifies to how contemporary thermal architecture has entered the collective imagination, becoming a symbol of a new sensibility towards the relationship between body, matter, and landscape. This recalls a long-standing literary tradition of narratives set within thermal contexts, dating back to the sixteenth century: one might think of Niccolò Machiavelli's comedy *La Mandragola*, set



5-6 | Cover and a page from the graphic novel *L'aimant* by Lucas Harari (from Harari 2017).

in Tuscany and later adapted for cinema by Alberto Lattuada in 1965, or of Michel de Montaigne's diary describing the Baths of Lucca.

A different yet equally intense relationship with the landscape characterises Kengo Kuma's Horai Onsen Bath House (2000-2003), located near Atami, in Japan's Shizuoka Prefecture. The project engages with a narrow, sloping site, where the architect works through the dematerialisation of the building: the walls dissolve, the pillars merge with the vegetation, while floor and roof extend as a continuation of the natural ground. In this way, Kuma translates the Japanese philosophy of *ma* – the interstitial and relational space – into an architecture of lightness and continuity, in which construction and nature merge into a perceptual continuum (Kuma 2012).

On the opposite side of the globe, the Blue Lagoon complex in Iceland (1999–2003; 2005–2007), designed by VA Arkitektar, is powerfully rooted in the volcanic landscape of the Reykjanes Peninsula. The project unfolds according to a dual register: on one side, the interior spaces open directly onto the geothermal lagoon; on the other, the architectural language establishes a material dialogue with the black lava rock of the Lava Fields. The result is an artificial landscape of great expressive intensity, where the thermal experience takes on a contemplative and almost sacred dimension.

7 | Germán del Sol, Termas Geométricas, Parque Nacional Villarrica, photo by Guy Wenborne (from *Termas Geométricas* 2009).

In South America, Chilean architect Germán del Sol realised the Termas Geométricas (2004) within the Villarrica National Park [Fig. 7]. Here, the thermal route follows the course of a hot river immersed in a primary forest, unfolding through a sequence of wooden walkways and pools extending for about 450 metres. The architecture, reduced to its bare essentials, becomes a pure network of connections – a path that gradually reveals the natural space and transforms it into a sensory experience. Del Sol's work represents one of the most poetic expressions of thermalism as a practice of immersion in the landscape (Del Sol 2010).

In a radically different urban context, Jean Nouvel's Bains des Docks (2001-2008) in Le Havre demonstrates the capacity of contemporary thermalism to act also as a driver of urban regeneration. Integrated within a vast redevelopment programme of the port area, the complex stands as an interface between the city's industrial memory and the new metropolitan identity of "Greater Paris". Inside, absolute white dominates the spaces, while the light reflected on the water generates a suspended, almost dreamlike atmosphere, as "the external aspect of the aquatic complex seems to mediate between the industrial image of the warehouses that once stood there and the new urbanities of 'Greater Paris'" (Rapanà 2009). Nouvel's work shows how thermal architecture can serve as a space of transition, capable of restoring meaning and cohesion to places in transformation.

Despite their geographical and linguistic diversity, these projects share a common vision: that of water as the generative principle of space. Contemporary spas no longer merely embody the meeting of therapeutic function and pleasure; they represent the search for a deep equi-

librium between matter, light, nature, and memory. In them, a new form of architecture of wellbeing is manifested – one in which the physical dimension intertwines with the perceptual, restoring to human beings the awareness of their relationship with place and with the earth. Beyond their role in processes of urban development, these projects can be interpreted as marking a return to forms of thermal experience rooted in the ancient world, particularly in Roman culture. As in Roman thermae, where bathing was conceived as a multisensory practice involving the body, water, light, and architecture, contemporary spa design reasserts the experiential and spatial dimension of thermalism. The emphasis on sequences of spaces, controlled sensory stimuli, and the integration of architecture with landscape recalls the ancient understanding of baths not merely as functional infrastructures, but as places where physical wellbeing, perception, and a symbolic relationship with nature were deeply intertwined.

Building on these premises, and in light of global transformations and growing environmental awareness, thermalism is now called upon to redefine its role within the broader framework of sustainable tourism. Mass tourism, in fact, increasingly reveals its own criticalities – from pollution to the overconsumption of resources, to the loss of local authenticity – while proximity tourism and *slow* experiences are emerging as potential strategies of resilience and innovation for thermal territories (OECD 2021).

In this direction, oriented towards the enhancement of thermal and cultural heritage understood as both tangible and intangible patrimony, several Italian initiatives are currently underway. Through projects of restoration, adaptive reuse, and integrated promotion of landscapes and historic architectures, these initiatives are contributing not only to revitalising local economies, but also to restoring meaning and identity to places once marginalised. In this process, Italy has once again come to occupy a prominent position in the international thermal panorama, reaffirming its millennia-old tradition as a laboratory of balance between wellbeing, culture, and sustainability.

According to Federterme (2018), Italy ranks fifth globally in terms of the number of facilities and the scale of its offer, after China, Japan, Germany, and Russia. The geographical distribution reveals a predominance of northern regions (48.7%), followed by southern (36.2%) and central (15.1%) ones. Regionally, Campania ranks first with 95 establishments, followed by Veneto (92), Emilia-Romagna (25), Tuscany (22), and Lazio (15). With over 317 active thermal establishments, an annual turnover of approximately €1.6 billion, and a steadily growing tourist demand, Italy stands among Europe's leaders in wellness tourism. These 317 thermal facilities are distributed across 134 municipalities, including thermal (51), seaside (18), mountain (12), hill (7), lakeside (4), and art cities (11) locations.

8 | Masterplan of the project *Montegrotto 2050*, available for download from the website. Detail of the original sheet.

Among the most significant Italian examples are several cases that have successfully reinterpreted thermal heritage through a contemporary lens, combining conservation, innovation, and sustainability. Montecatini Terme, for instance, following its 2021 inclusion on the UNESCO World Heritage List as part of the serial site "Great Spa Towns of Europe", has initiated a regeneration process aimed at recovering the historical memory of its Rationalist and Liberty architectures, integrating them into an urban system oriented towards slow tourism and a culture of wellbeing. Similarly, locations such as Bagno Vignoni and Saturnia in Tuscany, or Abano and Montegrotto Terme in Veneto, are experimenting with strategies of enhancement based on the synergy between natural resources, landscape quality, and cultural offer, promoting a concept of thermalism that is diffuse and territorially integrated.

In Montegrotto Terme, for example, the local administration is investing in an extensive regeneration programme that concerns not only individual spa complexes but also public spaces and the cycle – pedestrian network. This vision finds expression in the *Montegrotto 2050* masterplan [Fig. 8], a strategic project aimed at stitching together the urban fabric and overcoming the spatial discontinuities to which Secchi once referred. The stated objective is to "create an urban fabric on a human scale, improving public space, encouraging sustainable mobility, and strengthening spaces for social interaction".

Thermalism today emerges as a catalyst for urban, environmental, and social regeneration – capable of triggering virtuous processes of territorial redevelopment and of reinforcing the bond between communities and their landscapes. Whereas spa towns were once mononuclear and monopolar, they have since evolved into polynuclear and multipolar systems (Lozato-Giotart 2008), marking an evolution from Secchi's analysis. The recovery of thermal heritage – understood not merely as an economic resource, but as a cultural and identity-bearing asset – represents one of the most significant challenges for contemporary architecture: to reinterpret historic places through innovative languages, restoring to them a public, inclusive, and shared function.

These developments highlight a progressive shift in scale within contemporary thermal architecture. Initially focused on the experiential quality of the individual place, spa projects gradually extended their influence to the urban dimension, where thermal complexes became drivers of redevelopment and social reactivation. Now, this scalar expansion has moved beyond the city, positioning thermal architecture as a tool for territorial regeneration. In this broader framework, thermal sites operate within networks of landscapes, infrastructures, and sustainable tourism practices, redefining the relationship between water, settlement, and environment. This evolution reflects a growing awareness of thermalism not only as an archi-

tectural or urban phenomenon, but as a territorial strategy capable of integrating wellbeing, ecological balance, and cultural continuity.

In this regard, funding from the PNRR (National Recovery and Resilience Plan) has made possible, beginning in 2025, the launch of a large-scale programme for the redevelopment of Italian thermal facilities, with the aim of transforming them into true architectural, cultural, and touristic landmarks.

In Recoaro Terme, the rehabilitation of Building 1B within the Thermal Complex, launched on 3 October 2025, represents the first step in a pilot project of cultural and social regeneration. The restoration of the historic building goes beyond material recovery, redefining its function through an architecture capable of merging identity and innovation: the space will be converted into a multifunctional centre for cultural events, commercial activities, and tourism services. The intervention seeks to return to the town a symbolic place, fostering the emergence of new economies and the strengthening of local community bonds.

The Terme di Porretta, in the heart of the Bolognese Apennines, constitute an example of integrated regeneration among architecture, health, and landscape. The project – developed through a collaboration between INAIL, Gruppo Monti Salute Più, and the Regione Emilia-Romagna – involves an investment of around €30 million. The restoration of the Terme Basse and the Naiadi, the creation of a new thermal spa and an outdoor pool, together with the enhancement of the surrounding park, define a new equilibrium between historic architecture and contemporary wellbeing. One of the iconic domes will be converted into a spa, becoming an identifying and symbolic element of the entire complex.

In Acireale, where the thermal baths date back to 1873 and are distinguished by their neoclassical and Liberty elegance, the regeneration project – supported by a regional grant of €1.5 million – aims to preserve and enhance an architectural heritage of extraordinary landscape value. The restoration of the historic area and its gardens seeks to re-establish the relationship between architecture and nature, offering visitors an immersive experience within the temporal and spatial dimension of Sicilian thermalism.

The Nuove Terme di Sciacca, on the southern coast of Sicily, represent one of the most ambitious undertakings: an investment of €184 million aimed at refunctionalising and reinterpreting the historic buildings of the Terme Santa Venera and Santa Caterina. The project, which integrates thermal, hospitality, and cultural functions, intends to transform the complex into an integrated touristic and architectural hub, complete with nature trails, event spaces, and areas dedicated to the promotion of local gastronomic and artisanal excellence. Here, architecture becomes a tool of connection between memory, territory, and innovation.

Thermalism in the twenty-first century is no longer solely the care of the body, but also the care of the territory – an opportunity to rethink the relationship between human beings and the environment from an ecological and sustainable perspective. In this sense, thermal architecture presents itself as a laboratory for a new conception of collective wellbeing, in which built

space becomes the expressive medium through which the territory recognises and renews its own vocation. A vocation grounded in the harmonious integration of landscape, architecture, and the human dimension – a paradigm that restores to thermalism its original and most profound meaning: that of a place of encounter between health, nature, and beauty.

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Abstract

In Italy, thermalism has long constituted a fundamental component of the national tourism system, deeply rooted in cultural and social values. Until the 1920s, spa stays represented one of the main forms of holidaymaking, closely associated with therapeutic practices and collective rituals. From the post-war period onwards, thanks to the support of the National Health Service, the phenomenon acquired a mass dimension. However, the restrictions introduced in the health sector during the 1980s led to a gradual downsizing of the role of thermal establishments as accredited therapeutic facilities. From this transformation emerged a new paradigm in which spa offerings were reconfigured as experiential destinations oriented towards holistic wellbeing. Today, together with Germany, Italy boasts the highest number of thermal establishments in Europe—a testament to a long-standing tradition that has seen these places act as genuine hubs of social, economic, and political life. In recent years, numerous architectural redevelopment projects have reinterpreted the thermal heritage in a contemporary key, generating new territorial centralities and activating processes of urban regeneration. Among the most significant international examples is Zumthor's Therme Vals, while in Italy, noteworthy projects include the De Montel development in Milan, the restoration of the Grand Hotel in San Pellegrino Terme, and the revitalisation of the Bormio spas. The article analyses the evolution of Italian spa architecture throughout the twentieth century, with a particular focus on recent regeneration projects and their spatial, economic, and cultural impacts.

keywords | Thermalism; Architecture; Thermal tourism.

Enhancing to Preserve

The Archaeological Area of Via Scavi in Montegrotto Terme (PD)

Paolo Faccio, Silvia Scordo

I. Historical-Critical Survey of the Site

The archaeological area of Via Scavi in Montegrotto Terme represents one of the most significant ancient thermal sites in the Veneto region, owing to the presence of hot springs and natural resources that facilitated human settlement as early as the Iron Age (Capuis 1993; Guidi 1992). The site reached its peak development during the alliance between the Romans and the Veneti (49 BC), when a large-scale thermal complex was established and remained active between the 1st century BC and the 2nd century AD. This complex included three pools (including a covered circular pool), an intricate network of channels, and two water-lifting norias, as well as recreational spaces such as *palaestrae* and a small theatre/*odeum* (Bonomi, Malacrino 2012) [Fig. 1].

1 | Hypothetical reconstruction of the Roman Thermal Park at Montegrotto Terme (PD), showing the three main pools, the covered circular pool, the theatre/*odeum*, *palaestrae*, and water-lifting norias. Reconstruction based on archaeological evidence and surveys conducted by SABAP – Soprintendenza Archeologia, Belle Arti e Paesaggio of Padua.

The theatre, a rare feature in a thermal complex, comprised a cavea, a semicircular orchestra, a stage with an architectural backdrop, and various service rooms. Like the rest of the complex, it was richly decorated with marble, stucco, and frescoes. Surrounding the baths, commercial activities thrived, linked to the flow of visitors (Zanovello 2012; Bassani 2025). Following the Roman period, the site was gradually abandoned, used as a quarry, and eventually overgrown by vegetation. Early evidence of its rediscovery dates to the late 18th century (Mandruzzato 1789-1804; Basso Peressut 2012), but systematic excavations only began in the 1960s, uncovering the pools, channels, and theatre. Between 1965 and 1985, restoration and structural protection works were carried out, initially using cement covers, followed by more precise recompositions and consolidation measures (Bassani 2022). In the 1990s, a temporary metal covering was installed over the *odeum*, which today is insufficient and requires replacement (Bonomi, Faleschini 2011). The *odeum* remains the best-preserved portion, with foundational structures still legible. However, many areas remain exposed to the elements and lack accessible internal pathways, making new interventions for protection, enhancement, and accessibility necessary [Fig. 2].

II. Planning Framework, Funding Strategies, and Critical Issues of the Via Scavi Archaeological Area: State of the Art and Initial Project Actions

2 | Superintendency of Padua, aerial view of the Via Scavi archaeological site, Montegrotto Terme, 1968. SABAP Padua, photographic archive ALB.109-p.12, nos. 37674 and 37675_a. The image shows the Roman thermal complex, highlighting the arrangement of pools, the theatre/*odeum*, and surrounding structures, serving as a key reference for later excavations and conservation interventions (Bonomi, Malacrino 2012; Bassani 2022).

The design and planning process was marked by lengthy development and approval phases, partly due to the succession of technical and administrative officers within the Superintendency. These timeframes are closely linked to the continuity of the Superintendency's design and management strategies. Indeed, the project, which eventually reached a definitive stage of development, took shape under the direction of the Superintendent Dr. F. Magani, in collaboration with the Responsible Single Officer for the Procedure (RUP), Architect Silvia Scordo. This phase was followed by a subsequent approach oriented toward strengthening archaeological investigation and research, carried out under Dr. Tinè in collaboration with the archaeologist Maria Cristina Vallicelli. This process is currently continuing under the guidance of the Superintendent Dr. M. Mazza, within the framework of a progressive integration of conservation, research, and enhancement activities of the site.

For the year 2021, a total amount of €1,259,600.00 was allocated for the restoration and protection of the archaeological structures and for the implementation of new access and visitor facilities at the archaeological area of Via Scavi in Montegrotto Terme. This allocation followed the preparation of the programme planning sheet drafted by the Project Manager (RUP), architect Silvia Scordo, of the Superintendency of Archaeology, Fine Arts and Landscape of Padua, formally appointed on 24 January 2022 (Prot. no. 2006-P). The proposal was submitted pursuant to Article 1, paragraphs 9 and 10, of Law no. 190 of 23 December 2014, establishing the *Cultural Heritage Protection Fund*, intended to finance large-scale interventions on public cultural heritage, including non-state-owned assets, not covered by ordinary programming, with the aim of safeguarding and enhancing Italian cultural heritage (Ministry of Culture, *Guidelines for the Protection and Enhancement of Cultural Heritage*, 2017).

The budget was defined on the basis of the available documentation and subsequently recalibrated. The resources, required to initiate the first enhancement actions for the archaeological site within the 2021 programming framework, were approved by Ministerial Decree of 16 December 2021 (Rep. no. 450), Chapter 8099, P.G. 1, Fiscal Year 2021, CUP F65F21002250001. Following the approval of the overall funding, the financial resources were phased on an annual basis, allocating €100,000.00 in 2022 (Lot 1) and a further

€100,000.00 in 2023 (Lot 2), in order to develop the different design stages and to carry out the necessary conservation interventions (DPCM 2021–2023).

This distribution made it possible to prepare the essential elements for the execution of works in subsequent years, optimising the use of available capital (Bondini 2020) and enabling more accurate long-term planning, also instrumental to the application for additional funding (Court of Auditors 2020). Following an assessment of the site's needs and critical issues, the Superintendency decided to entrust an external professional firm with design development and consultancy tasks. This decision was formalised through Technical Report no. 15-PD of 17 November 2022, pertaining to Lot 2 – Archaeological Area of Via Stazione / Via degli Scavi, with a budget of €100,000.00. After reviewing curricula vitae, assessing the submitted bids, and identifying the proposal offering the most advantageous discount rate, the Superintendency awarded the contract to Faccio Engineering s.r.l. The appointment was formalised through Contract Rep. no. 322/2022, following a comparative evaluation of the received offers. With the urgent service handover report, signed on 7 December and officially recorded on 13 December, the first on-site inspections were initiated. The prompt commencement of these activities was necessary in order to coordinate the design process already underway by technicians appointed by the Municipality of Montegrotto Terme for the redevelopment of Viale della Stazione – an intervention affecting the southern edge of the archaeological area – with the project entrusted by the Superintendency to Faccio Engineering s.r.l.

This coordination between the archaeological project and the redevelopment of Viale della Stazione proved particularly urgent, as one of the site's main criticalities concerns precisely the relationship between the archaeological area and Viale della Stazione, a major urban axis heavily frequented by both residents and tourists (Rinaldi 2022). Although the approximately 1.5 m difference in elevation provides a direct visual connection with the archaeological area, the distance between the road alignment and the core of the thermal complex causes the park to be perceived as an enclosed and poorly accessible space, with significant limitations in its integration into the urban fabric (Publio 2017). This difficulty in establishing a relationship with the avenue forms part of a broader framework of vulnerability affecting the current condition of the archaeological park. The excavations at Montegrotto represent a rare example of Roman thermal architecture (Bonomi, Malacrino 2012), with the three main pools today readable only at the level of their foundations, preserved within an area that constitutes a true void within the dense contemporary urban fabric (Ghedini *et al*. 2015).

The park is enclosed between the highly central Viale della Stazione, characterised by intense commercial activity, a residential area, and the imposing Hotel Montecarlo, currently abandoned (Santi 2021). Despite the central and potentially strategic location of the archaeological remains, the site lacks an adequate system of access and visitor services: the entrances from Via Scavi are devoid of reception areas and appropriate paving, and ticketing facilities, offices, and restrooms are entirely absent.

3 | Superintendency of Padua, view from Viale della Stazione towards the Via Scavi archaeological area, Montegrotto Terme, 2020. SABAP Padua photographic archive. The southern access to the archaeological park is visible in the foreground; in the background, the Palazzo del Turismo, an unused provincial building in decay, highlights urban integration challenges adjacent to the Roman remains.

Internal circulation is equally problematic: there are no structured pathways, the grass-covered ground limits accessibility for many categories of visitors, and public use relies on provisional barriers that fail to guide movement or interpretation (Carbonara 2004). Further compounding these issues is the critical condition of the temporary covering of the theatre, which is now deteriorated and ineffective in protecting the ancient masonry, while also undermining the overall perception of the site (Laurenti 2006).

The site is therefore under-enhanced and in need of urgent maintenance works, as well as a comprehensive rethinking of accessibility, both from the urban context to the park and within the park itself (Ministry of Culture – Directorate General for Museums, *Guidelines for Archaeological Parks*, 2020).

The urgently initiated inspections must be understood within this framework: ensuring that the redevelopment of Viale della Stazione and the enhancement project for the archaeological park proceed in a coordinated manner is an essential condition for overcoming the identified criticalities and for restoring the thermal complex to the role it deserves at the heart of the city. The difficulty of integrating extensive archaeological areas into the contemporary urban fabric without reducing them to “residual voids” or purely contemplative spaces reflects an issue widely discussed in recent disciplinary debate (Manacorda, 2007; Bandarin, van Oers 2012). This condition calls for design approaches capable of reconciling conservation requirements with active use and urban legibility, promoting the archaeological site as a recognizable and integral component of the city (Settis 2014) [Fig. 3].

III. The definitive project level

The architectural project is deliberately positioned within the framework of the debate on integrated conservation and the architectural interpretation of archaeological heritage, conceiving contemporary design not as a neutral or mimetic element, but as a critical tool capable of making historical stratifications legible and of guiding public use and interpretation (Brandi, 1963; Carbonara, 199).

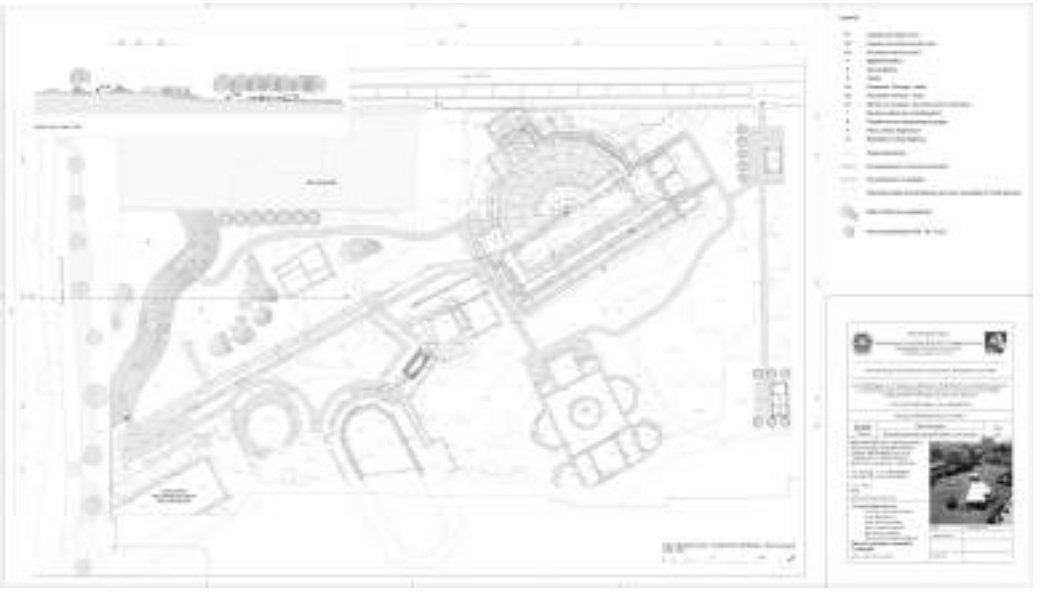
The project proposed for the archaeological area addresses the issues identified during the preliminary analysis phase, in line with the Client's requirements and by adapting the site to a new mode of use and public enjoyment (Carandini 2010; Zanchetta 2018). A primary and fundamental aspect is the internal accessibility of the site: given the limited height of the remains of the pools and other thermal buildings, it is necessary to allow visitors the closest possible approach to the structures, not only to provide an overall perception of the thermal complex, but also to enable an interpretation of the historical uses of the various architectural elements (Brogiolo 2006; Guidi 2015). For a complete and safe visit, the project also proposes a predefined "museum-like" itinerary, guided by the architecture itself (Fowler 2013).

The main tourist entrance is located at the north-western access, where visitors are welcomed into a paved resting area shaded by tree planting (Pinto 2019). Here, a ticket office is redesigned, including space for a small administrative office, housed in a contemporary volume of steel and timber; a short distance away, a separate volume accommodates the restroom facilities (Montanari 2020).

The first itinerary begins with the visit to the remains of the Roman theatre, via walkways that allow internal circulation within the structure (Sear 2006). The theatre is equipped with a protective covering that highlights its former articulation and is configured as a semi-circular *velarium*, flanked by additional flat roof elements (Milesi 2017). One of these, corresponding to the pulpitum, the installation of photovoltaic panels will ensure the site's energy autonomy (De Santoli 2014).

The covering is designed both to protect the theatre and to evoke its original spatial dimension, through a stable and durable structure that also enables the creation of elevated internal circulation paths, currently inaccessible (Choay 1992). The new route includes an asymmetrical walkway around the cavea, leading to a privileged central platform aligned with the tribunal seating. Beyond the clearly recognizable cavea, the theatre also includes a series of scenic and service spaces that cannot be perceived by visitors without appropriate enhancement and interpretation (Zanini 2015). The project therefore proposes a structure capable of addressing all these needs, while evoking – through its form – the ancient functions originally associated with the building (Settis 2002).

As anticipated, the theatre covering is conceived as a 'modern *velarium*', recalling the form of Roman amphitheatre awnings and their sense of lightness through a roof skin composed of tapered steel slats, supported by a solid steel framework. This consists of slender, limited supports, strategically positioned to avoid interference with historic masonry as much as possible (Guidobaldi 2019). The theatre could ultimately resume hosting small-scale events, in a position symmetrical to the original, through the installation of a support structure for a removable stage measuring 6 × 4 m, located in correspondence with the *postscaenium*. A small audience area could be arranged on the gentle grassy slope east of the *odeum* (Pugliese Carratelli 2000).



4 | Superintendency of Padua, definitive project for the Via Scavi archaeological area, Contract Rep. 322/2022, 2022. SABAP Padua works archive. The project highlights the north-western square as a welcoming hub and the south-western entrance with views from Viale della Stazione and a green space for visitors, alongside internal paths, the theatre/*odeum*, and the thermal structures.

Once past the theatre, the visit continues near the recreational building, then curves around the *noriae*, and subsequently approaches the thermal pools. At the final pool, a large resting area is created, as in other parts of the site, to accommodate individual visitors or groups (Greco 2012). All pedestrian pathways within the archaeological area are constructed in stabilised crushed limestone aggregate, a sustainable material that does not accumulate heat and is fully permeable (Caneva *et al*. 2011). The paths are 1.20 m wide and are developed without guardrails, reinforcing the concept of a trail unfolding within the archaeological park (Lynch 1960).

The visit concludes either by returning to the main entrance via a route parallel to the historic water channel, or through the secondary access on Viale delle Terme (Muratori 1959). This second access, opposite to the northern entrance, serves as the interface between the city and the archaeological area, integrating into the new Viale della Stazione. It is conceived as an extension of the avenue's pedestrian zone, through a broad resting area at street level that offers visual access to the remains (Secchi 2013).

The change in elevation between the two spaces is resolved through a gentle slope, created by earth fill and supported by reinforced earth structures, upon which ramps and stairways provide vertical connections (Agnoletti 2011). The slopes are articulated by bands hosting evocative vegetation, selected based on plant species identified in the oldest stratigraphic layers

5 | Superintendency of Padua, definitive project of the theatre/*odeum*, Contract Rep. 322/2022, 2022. SABAP Padua works archive. The project highlights the walkway across the cavea as the visitor route and the elevated path evoking the original forms, allowing close engagement and integrated understanding of the historic structure.

of this and other archaeological sites in Montegrotto Terme (Rinaldi 2018). These include, for example, Bellis perennis, Centaurea cyanus, Linum usitatissimum, and Triticum durum, which contribute to evoking the historical atmosphere inevitably suggested by a visit to the excavations (Bertoncello 2004).

The design concept aims to allude – while fully respecting the monumental complex – to the ancient landscape in which the thermal park was originally embedded (Antrop 2005). Geomorphological investigations based on remote sensing and the analysis of historical cartography reveal a lacustrine-marshy landscape characterising the Montegrotto area, shaped by numerous thermal springs that generated pools and small watercourses (Camuffo 1997; Brogiolo, Forlin 2011). For this reason, several vegetated masses are introduced at the centre of the urban park, composed of Polygonum persicaria (Persicaria maculosa) and Arundo donax (common reed), evoking the presence of small thermal pools once widespread in this area and throughout the Montegrotto territory (Celant 2011). Owing to their morphological characteristics, these herbaceous species require minimal maintenance (Ferrari 2010) [Figs. 4-5].

IV. Conclusion

The project aims to contribute to the disciplinary debate at the intersection of restoration theory and the enhancement of archaeological sites, demonstrating how the integration of architectural design, landscape, and light infrastructural systems can represent an effective strategy for the active conservation and cultural reactivation of urban archaeological contexts

(Brandi 1963; Carbonara 1997; Manacorda 2007). From this perspective, the project is conceived as an open structure, allowing for the development of themes and design solutions in subsequent yet coordinated phases, and capable of accommodating future advancements in both valorisation and conservation strategies (Bandarin, van Oers 2012). The configuration of pathways and protective structures is designed to be adaptable to new archaeological discoveries and potential project extensions, thus reconciling site conservation with public accessibility and use (Manacorda 2007). At the same time, the project acknowledges certain intrinsic limitations related both to the fragmentary nature of the archaeological remains and to the constraints imposed by the densely built urban context. In particular, the decision not to reconstruct the original volumes of the thermal complex necessitates cautious design choices, oriented more toward spatial evocation than toward formal reconstruction, in line with established principles of contemporary conservation practice (Brandi 1963; Carbonara 1997).

Furthermore, the intervention is framed within defined financial and temporal parameters, which may nonetheless allow for future extensions of the project, including the implementation of advanced museographic devices, envisaged for subsequent phases of development (Bandarin, van Oers 2012).

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Abstract

The contribution illustrates the new, comprehensive project for the conservation and enhancement of the archaeological area of Via Scavi in Montegrotto Terme, made possible through dedicated funding allocated by the Ministry of Culture within Italy's 2021-2023 public works programme. The intervention addresses structural vulnerabilities, the deteriorated protective systems, and the critical relationship between the archaeological park and the adjacent Viale della Stazione – one of the main urban thoroughfares. The proposed design redefines access points, introduces new visitor facilities, and creates a coherent, museum-like circulation system using sustainable materials. A major feature is the new permanent roof over the *odeum*, conceived as a contemporary *velarium* that ensures both protection and interpretative clarity while enabling elevated internal walkways and small-scale cultural events. The project also includes landscaped areas inspired by archaeobotanical evidence and geomorphological studies, evoking the ancient thermal and marshy environment of Montegrotto. Overall, the intervention aims to restore legibility, accessibility, and urban connectivity, offering a renewed framework for the public enjoyment and long-term preservation of this unique thermal heritage site.

keywords | Restoration; Valorization; Integrated Conservation and Technological Systems; Accessibility; Walkability; Landscape.

Scalafani Bagni

Exploring Thermalism between Neglect and Re-Enactment

Alba Balmaseda

1 | The nineteenth-century thermal establishment, Sclafani Bagni, Ines Lechleitner, 2024.
2 | *La Pozza*, Sclafani Bagni, Ines Lechleitner, 2024.

Introduction

The recent history of thermalism in Sicily is closely linked to small nineteenth-century thermal establishments, most of which are now out of operation. One example is Sclafani Bagni, located within Madonie Park. This site is renowned for its thermal waters, which were once prescribed for their healing properties (Cacciatore, 1828; Campisi 2015). Almost two centuries later, the site's reality has changed profoundly, offering an insightful case study of thermalism in southern Europe. Here, spatial practices coexist between neglect and re-enactment of thermal heritage. On the one hand, there is the nineteenth-century thermal establishment, now in ruins and slowly being reclaimed by nature while awaiting a decision from above [Fig. 1]. On the other hand, there is a small, open, humble thermal pool built and cared for by local inhabitants and known as *la Pozza* [Fig. 2].

Recent scholarship has renewed attention on thermal heritage as a multifaceted phenomenon. Rather than considering thermal landscapes as strictly spatial, this approach recognises them as complex cultural, social and environmental systems. From this perspective, water is increasingly understood as a shared resource that shapes places by influencing collective practices and spatial configurations (Fiorentino *et al*. 2021). Studies of ancient thermal sites have also emphasised processes of abandonment, rediscovery, and contemporary reactivation, demonstrating how historical thermal contexts can evolve from neglection to new forms of appreciation (Rami Ceci 2020). Relevant in this respect is the recent thematic issue of "La Rivista di Engramma" no. 214, *Archaeology of Thermalism. New studies on healing Waters* (Bassani, Tabolli 2024), which brings together contributions focused on the archaeology of thermal sites and proposes an interdisciplinary reading of thermo-mineral landscapes, from ancient healing practices to their contemporary cultural meanings. While these contributions acknowledge continuities between past and present and document cases in which ancient thermal sites coexist with contemporary uses, the analytical focus does not primarily lie in the investigation of the present-day life of thermal landscapes.

Within this framework, the coexistence of abandonment and re-enactment observed at Sclafani Bagni takes on significance. From this process emerge the research questions that guide this study: How might thermal sites be reinterpreted and re-enacted by the communities that inhabit them? What role should institutions play in supporting these processes? And what future could be envisioned for abandoned thermal establishments? These queries shape the structure of the paper, which first outlines the context and methods, and then discusses the findings that address said queries through historical reconstruction and lived experience.

Methodology

This contribution explores three complementary methodological approaches: archival and documentary research; field observation and territorial exploration; and situated and participatory research. All of these approaches were carried out using the author's doctoral investigation as a basis[1].

The first approach involved archival and documentary research aimed at better understanding the forms of thermalism associated with the spring of Sclafani Bagni. For this purpose, the book *Terme e bagni di Sicilia: Caratteri di un'architettura specialistica* (Campisi 2015), provides a detailed overview of the site within the Sicilian context, while *Viaggio ai bagni minerali di Sclafani* (Cacciatore 1828), offers a first-hand account of the author's experience of the place at that time. Twentieth-century Italian guidebooks such as *Stazioni climatiche, termali, marittime d'Italia* (1907), *Le stazioni termali in Italia* (1939), and *Touring Club Italiano* editions (1936, 1965, 1968, 1982) were also consulted, as they trace the transformation of thermal sites in relation to modern notions of leisure and wellness. Finally, contemporary *live archives*, such as Google Maps, travel blogs, and digital maps created by travellers, offer an additional layer of recent experiential information that complements the historical sources.

The second approach consisted of a series of on-site observations and explorations aimed at documenting the current state of the thermal spring and its surroundings. This extended to the village to which the spring belongs: Sclafani Bagni. The first visit took place as part of a tour called *Salti d'Acqua* in January 2024. This tour was curated by Libero Osservatorio Territoriale sud – LOTs, an association founded in 2020 that promotes critical and sustainable tourism in Sicily. Diego Pérez, an independent researcher dedicated to the study of water, guided the visit. Upon discovering an intriguing reality, an abandoned nineteenth-century thermal establishment coexisting with a spontaneous continuation of thermal practices in an informal pool nearby, the desire to explore the specific case further was sparked. Further individual visits were undertaken to conduct field-based enquiries and better understand this coexistence of neglect and re-enactment.

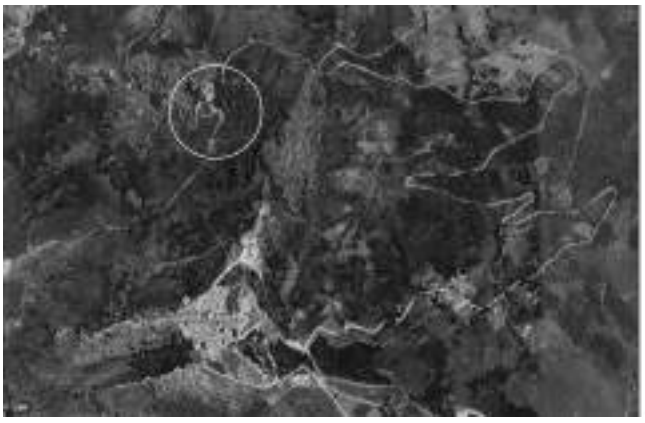
The third approach evolved into situated and participatory research, articulated through two actions: an educational experiment and a series of interviews conducted during and after it. The educational experiment consisted of a summer school, in which participants explored and intervened in the area through site-specific events, engaging directly with locals. The programme was conceived and coordinated by the author and organised by academic institutions in collaboration with local stakeholders and international experts, with financial support from the DAAD (Deutscher Akademischer Austauschdienst – German Academic Exchange Service). During this collective phase, narratives, observations, and artistic expressions contributed to a situated collective understanding of the place. Interviews with locals conducted by the author revealed their perceptions of the abandoned thermal establishment and how thermal practices had been gradually re-enacted through a grassroots process, a narrative absent from written records. They also illuminated how the site-specific events developed during the summer school were perceived and integrated within the community.

Sclafani Bagni

The Thermal Spring

Highly saline and sulphurous thermal waters, rich in sodium, chloride, and hydrogen sulphide, are yielded by the spring of Sclafani Bagni, which flows approximately 450 litres per minute at a natural temperature of 32.7 °C (Alaimo *et al.* 1978). Known for their depurative, anti-inflammatory, and dermatological properties, these waters have historically been used in the treatment of scrofulous, herpetic, arthritic, and muscular diseases, chronic rheumatism, and persistent obstructions (Cacciatore 1828).

The origin of the therapeutic practices associated with the spring remains uncertain, as no reliable archaeological evidence predates the Arab period (827–1060). The settlement of Sclafani is indeed commonly attributed to this era. However, the scholar Pasquale Cipolla (1880) proposed a much earlier foundation, suggesting that the site of present-day Sclafani Bagni may coincide with the ancient *Ambica* mentioned by Diodorus Siculus (XX, 89), later known as *Aesculapii Fanum*, thereby linking both the thermal waters and the site itself to the cult of Asclepius.



3 | The village of Sclafani Bagni and its thermal area, elaboration from Google Earth by the author, 2025.
4 | Plan of the thermal area of Sclafani Bagni, elaboration by the author, 2025.

The thermal spring lies within the Madonie Park, in the northern area of Sicily, along the route of the *Via Francigena* pilgrimage, at the foot of the mountain on which the village of Sclafani stands [Fig. 3]. The designation *Bagni* ("baths") was officially added to the town's name only in 1953, by municipal decree, in recognition of the presence of the thermal source. Near the thermal spring we find the nineteenth-century thermal establishment, now abandoned, and the informal pool created by local inhabitants, *la Pozza* [Fig. 4].

The nineteenth-century thermal establishment

The nineteenth-century thermal establishment has been closed to the public since 1985 due to a lack of funds for management and renovation [Fig. 5]. Although some investors have shown interest since the municipality purchased the majority share in 2003, the complex remains abandoned due to the significant investment required, the difficult access road (which only allows small vehicles and is in poor condition), its distance from the village and the broader depopulation of the area (interview conducted by the author 25 September 2025). Over time, people have occasionally removed building materials, further compromising the structure. Nevertheless, the forecourt in front of the building continues to serve as a gathering place for people who come to bathe in *La Pozza*.

Built in 1847, the single-storey rectangular structure consists of plastered brick and stone masonry, with reed ceilings made from local vegetation and ceramic roof tiles. Its date of construction is recorded on a white marble plaque mounted on a seasonal sundial in the central courtyard now barely visible beneath the overgrown foliage. The plaque bears the poetic line:

> Più liete l'ore segnerò al mortale, cui nuovo dà vigor l'ora termale (on-site observation, 2025).
>
> I shall mark happier hours for the mortal to whom the thermal hour gives new strength.

5 | Series of images of the nineteenth-century thermal establishment taken by the author during the field observation and territorial exploration, 2024.

A verse that captures the curative spirit of the place and the timeless link between the passing of hours and the healing power of the spring.

The building is located approximately 150 metres from the thermal spring and 1.5 kilometres from the village by footpath, or 5.6 kilometres by car via a secondary road. The village itself lies around 300 metres higher up, overlooking the site. The area is characterised by dense vegetation, cultivated land, and a nearby freshwater stream. Earlier bathhouses existed on the same site, which were successively replaced or rebuilt in response to new needs or following landslides.

Access to the former establishment follows its central axis from a forecourt that also hosts a small chapel attached to the complex, positioned to the right of the entrance. The entrance hall, dining room, kitchen, common areas, and guest rooms are arranged around a central courtyard, while the bathing area is housed in an annex on the right wing, the side closest to the spring. This section, divided into two zones with six cubicles each (each equipped with a bathtub) and a central chamber for water distribution, was connected to a settling tank that collected water directly from the spring, located at a higher elevation than the building itself.

La Pozza

In contrast to the neglect of the nineteenth-century thermal establishment, *la Pozza*, represents a living, collectively created open-air bath. Gradually shaped and maintained by the inhabitants, it consists of a small, organically shaped pool of about 2 by 3 metres, enclosed by an irregular stone wall that retains the thermal water and surrounded by riparian vegetation and reeds [Fig. 6].

La Pozza emerged unexpectedly after a public works project carried out at the beginning of the 2000s, which had been designed to redirect the spring water that, following the closure of the nineteenth-century thermal building, had begun to flood the area. The municipal intervention channelled the water toward a nearby stream, and in that process, a small basin formed naturally. People from neighbouring villages began to visit it for its healing properties and soon shaped the pool collectively, adding simple elements such as low walls, steps, a towel rack,

6 | Images of *La Pozza* taken by the author during the situated and participatory research, 2024.

and seating areas, which together constitute the thermal area visible today (interview conducted by the author 27 January 2025).

Through this process of gradual transformation, *la Pozza* became a simple yet fully functioning shared space, both improvised and cared for, that continues to attract people to bathe, gather, and engage with one another. Despite this collective stewardship, the site remains in a legal and administrative limbo: while the municipality tolerates its use, it cannot not assume responsibility for the interventions undertaken by the community.

Frequented mainly by locals, *la Pozza* has gained visibility since appearing on Google Maps, where it currently holds 144 reviews describing it as a wild and peaceful place, appreciated for its authenticity and natural setting, despite its limited facilities, with an overall positive rating (4.3/5). During site visits, groups of visitors and tourists from Poland, Germany, and even Hawaii were observed. Many camped or parked their caravans nearby, while others arrived in groups of motorcyclists.

7 | Series of images from *Tè l'Acqua, C'è o non c'è*, and *Lento* taken during the situated and participatory research, *Blue Paths: Revitalising Healing Places*, 2024.

Exploring thermalism between neglect and re-enactment

It was precisely this dichotomy between neglect and re-enactment that led to the development of a situated and participatory research process aimed at building a collective understanding of the place. To this end, a summer school titled *Blue Paths: Revitalising Healing Places* was held on-site in September 2024, followed by a series of interviews with locals. Conceived and coordinated by the author, the programme was organised by the University of Stuttgart, TH Nuremberg, and the Academy of Fine Arts of Palermo, in collaboration with *Bagno Popolare*, the municipalities of Sclafani Bagni and Petralia Sottana, and the *Istituto Italiano di Cultura* in Stuttgart, and funded by the DAAD (Deutscher Akademischer Austauschdienst – German Academic Exchange Service). It involved 31 students, five tutors, and seven guest contributors[2].

The summer school combined exploration, dialogue, and collective action through five *site-specific* interventions engaging with selected healing places: an abandoned swimming pool in Petralia Sottana, a fountain in the village, the footpath connecting the village to the spring, *la Pozza*, and the nineteenth-century thermal establishment. Each project transformed research into situated practice and public encounter, culminating in a two-day performative event called the *Blue Path*.

The subsequent interviews aimed to understand how residents perceived the presence and actions of the summer school, and how these experiences resonated with their memories, everyday life, and relationship with the thermal landscape. Their participation and openness revealed a deep emotional and cultural attachment to the site. The following section presents three of the five interventions, the ones more connected with the reflections of this contribution, *Tè l'Acqua, C'è o non c'è?*, and *Lento* [Fig. 7], together with the responses they elicited from locals.

Tè l'Acqua consisted of a tea ritual and collective walk from the village to the thermal area. It began at the village fountain, near the herbal path leading down to the spring. A plank wrapped in a white tablecloth floated on the fountain's surface, evoking a festive table adorned with offerings from the local landscape. The symbolic act of preparing and sharing hot tea infused with locally gathered herbs (pine, fennel, citronella, thyme, and eucalyptus) celebrated

collective care and the rituals of shared care. The event continued as a collective walk along the overgrown path, which was cleared and newly marked to symbolically and physically reconnect the village with its thermal heritage. For residents, this poetic act revalued an ecology and connectedness long neglected yet deeply rooted in their context.

C'è o non c'è? reflected on the ambiguity of informality in relation to institutional recognition, a thermal place that exists yet remains officially invisible. Using the reeds that grow abundantly around *la Pozza*, the students built a small, ephemeral structure to serve as a changing space, responding to an observed local need. The intervention also featured a sound installation that blended the crunching of reeds underfoot with recordings from the collection and construction process, creating a subtle acoustic landscape that harmonised with its surroundings. The project actively involved locals, who took part in the bathing ritual and continue to use the reed structure to this day.

Lento, took place at the abandoned nine-century thermal establishment. A video projection on the wall of the former bathing area presented a slow cinematic portrait of the decaying building, its textures, light, nature, and sounds, highlighting its fragile beauty and temporal depth. Since direct access to the building is restricted, the projection allowed a symbolic re-entrance for visitors, who watched from the outside as the structure became both screen and subject. The event concluded with a shared aperitif and candle installation marking the old entrance, transforming the site from a space of absence into one of temporary convivial space. Residents spoke with emotion about returning, after many years, to a place once central to their collective memory, expressing both nostalgia and frustration toward institutional inaction.

Conclusions

The combination of archival, field-based, and participatory methods has shown that Sclafani Bagni's thermal landscape operates not as a static remnant of the past but as a living system of relationships between places, bodies, and water. What appears as decay or abandonment on an institutional level reveal, on closer observation, a parallel vitality, one sustained through collective care, the quiet reclaiming of nature that welcomes new forms of life, and the persistence of informal use. The coexistence of the nineteenth-century establishment and *la Pozza* thus embody a dynamic dialogue between neglect and re-enactment.

This mixed approach has invited reflection on how neglected thermal heritage might be re-enacted by the human and more-than-human communities that inhabit them. The experience of *la Pozza* demonstrates that reinterpretation often emerges from spontaneous, small-scale actions rather than from planned restoration. The community's ongoing use, maintenance, and adaptation of the spring reveal how heritage can be activated through embodied and collective practices. These gestures, modest yet persistent, transform thermal heritage into a form of *living archaeology*, where meaning is not preserved through conservation alone but through daily engagement and ritual. On the other hand, nature taking over the nine-century thermal establishments gives another approach to abandonment.

At the same time, the case of Sclafani Bagni prompts us to reconsider the role institutions might play in supporting such processes. Rather than relying on top-down redevelopment, local authorities could act as facilitators of evolving practices, recognising the legitimacy of spontaneous human and more-than-human dynamics and providing light infrastructural support, improving access, safety, or maintenance while preserving the autonomy of local stewardship. In this way, institutional involvement would not suppress informality but sustain it, fostering a framework of shared care.

The duality also stimulates reflection on what future could be envisioned for neglected thermal heritage. Regeneration need not depend on the full reconstruction or large-scale thermal tourism. Instead, hybrid strategies could emerge that balance economy, ecology, and social use. In this case, the nineteenth-century thermal establishment of Sclafani Bagni could be repurposed as a modest hospitality facility, connected to the *Via Francigena* and complementary to the informal thermal practices around *la Pozza*. Such coexistence would allow both residents and visitors to benefit from the healing properties of the water without one excluding the other. Yet another possible future might embrace non-intervention, allowing the building to return to nature while strengthening the informal thermal site through the reuse of its materials, recognising decay as a form of transformation and continuity.

Ultimately, Sclafani Bagni invites a broader reconsideration of minor thermal sites across Southern Europe. These places, often marginal and overlooked, hold the potential to become laboratories of coexistence, where water connects memory and renewal, and where thermalism continues to find sustainable and alternative forms of life [Fig. 8].

8 | View of the thermal area of Sclafani Bagni, Courtesy of Libero Osservatorio Territoriale sud - LOTs, Photo by CAVE STUDIO, 2024.

The author would like to thank the artist Ines Lechleitner and Libero Osservatorio Territoriale sud – LOTs association for providing photographic material. Gratitude is extended to the Municipality of Sclafani Bagni and its inhabitants for their collaboration, information, and valuable testimonies. For the summer school, the author also acknowledges the support of the DAAD (Deutscher Akademischer Austauschdienst – German Academic Exchange Service); the organisation by the University of Stuttgart, TH Nuremberg, and the Academy of Fine Arts of Palermo; the collaboration of Bagno Popolare and the Italian Cultural Institute; as well as the engagement and contribution of the students and guests in the programme.

Notes

[1] The PhD, titled *Cities, Bodies, and Water: Urban Bathing as a Spatial Practice*, was defended in January 2025 at the University of Roma Tre, Department of Architecture, Italy, under the supervision of Prof. Michele Beccu, Prof. Giovanni Longobardi, and Prof. Roger Connah.

[2] Students: Dorssa Ashena, Oleksandra Bobokhina, Luca Böhringer, Michael Dalby, Julia Deger, Kasimir von Enzberg, Giuseppina Gullo, Tobias Günther, Amelie Hamann, Paul Hirt, Elsa Kleinbach, Maximilian Kohl, Anja Kubasch, Gabriele La Tona, Nina Lietzau, Nina Ludwig, Hanna Maier, Katharina Maiwald, Tobias

Minisini, Giacomo Molé, Mariia Pashchenko, Elias Röhner, Paulina Sacher, Elisa Poçi, Bastian Schuster, Eva-Maria Sölch, Lorenzo Steffenino, Stefan Weinreich, Sofie Widder, Melisa Yuca, and Edoardo Zumbo; Tutors: Dr. Pietro Airoldi, Dr. Alba Balmaseda-Domínguez, Prof. Dr. Carola Dietrich, Bettina Klinge, Gregor Löber and Špela Setzen. Guests: Kathrin Doppler (Bagno Popolare), Francesca Gattello (Libero Osservatorio Territoriale - LOTs), Ines Lechleitner, Diego Pérez, Dr. Eirini Sourgiadaki, and Dr. Lydia Xynogala.

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Abstract

Sclafani Bagni, a small nineteenth-century Sicilian thermal establishment located within Madonie Park, exemplifies an insightful case study of thermalism between neglect and re-enactment. Today, its landscape oscillates through the coexistence of a ruined bathhouse and the informal pool, *la Pozza*. This article explores this dual reality through three complementary methodological approaches: archival and documentary research, field observation and territorial exploration, and situated and participatory research. Developed during the author's doctoral thesis, this mixed methodology allows for a multi-layered interpretation of Sclafani Bagni as a thermal landscape negotiating between the past and the present, the private and the public, the top-down and the grassroots, and the human and the more-than-human. Such dichotomies have sparked reflections on themes such as water ownership, the tangible and intangible dimensions of heritage, and alternative forms of continuity.

keywords | Thermalism; Heritage re-enactment; Water; Grassroots practices; Neglection.

Around Water

Alle origini del termalismo. Una sepoltura femminile dal sito termominerale di Bad Dürrenberg

Recensione a: Harald Meller, Kai Michel, Il mistero della sciamana. Un viaggio archeologico alla scoperta delle nostre origini [Das Rätsel der Scamanin. Eine archäologische Reise zu unseren Anfängen, Rowohlt Verlag GmbH, Hamburg 2022], Feltrinelli Editore, Milano 2024

a cura di Maddalena Bassani

H. Meller, K. Michel, *Il mistero della sciamana. Un viaggio archeologico alla scoperta delle nostre origini*, Feltrinelli, Milano 2024.

Nel giugno del 2024 è stata pubblicata la traduzione italiana di un volume di Harald Meller e Kai Michel edito due anni prima ad Amburgo, dedicato alla ricostruzione delle vicende relative a una donna vissuta 9000 anni fa, sepolta nelle vicinanze di Lipsia a Bad Dürrenberg, località termale nel cuore della Germania. All'edizione italiana è seguita una recensione di Fabio Genovesi per *La Lettura* del *Corriere della Sera* di domenica 21 luglio 2024, intitolata *La maga di pelle nera era l'antenata dei nazisti*. Titolo, a mio avviso, fuorviante, nonostante nell'articolo vengano messe in risalto alcune delle principali peculiarità del libro: perché di quella donna non si può dire né che fosse una maga né che fosse l'antenata dei nazisti – ma tant'è.

Veniamo dunque al libro, che è di grande interesse non solo per l'accuratezza della ricostruzione storiografica, storico-archeologica ed etno-sociologica che gli autori propongono, ma soprattutto perché consente di aprire una finestra temporale sulla frequentazione dei contesti termominerali in un'epoca ben precedente l'età greca e romana, ovvero già nel periodo di transizione fra il Mesolitico e il Neolitico, dunque nella fase fondamentale che vide popoli cacciatori diventare popoli stanziali.

Sviluppato in 366 pagine, il libro è articolato in 25 capitoli con un epilogo finale e una ricca bibliografia tematica, che offre la possibilità di approfondire i diversi ambiti di studio dipanati nei capitoli. Questi ultimi spaziano dalla storia della scoperta della tomba, alla interpretazione iniziale del ritrovamento affiancando nuove prospettive legate ad analisi paleo-osteologiche e geo-ambientali, considerando altresì la tipologia del corredo funebre fino alla disamina di altri casi comparabili con quello di Bad Dürrenberg in Europa e nel mondo. Non si tratta quindi di un saggio di taglio storico-archeologico, ma di un affondo che intercetta diversi filoni di studio, dai quali il lettore può comprendere gli step della ricerca, le difficoltà incontrate e i risultati raggiunti, nonché le prospettive che si possono prefigurare dagli output della ricerca medesima.

Il 4 maggio 1934 erano in corso i lavori di restauro delle strutture ricettive del sito termale di Bad Dürrenberg nel distretto di Saalekreis in Sassonia, con acque ricche di sale e numerose miniere. Questa località costituiva uno dei siti termominerali tedeschi che, se pur sfruttati in parte già in età romana (si veda la tesi di PhD di Cecilia Zanetti, *Il Termalismo nelle Province Centrali. Rezia, Germania Superiore e Inferiore*, Università degli Studi di Padova, discussione: 31 gennaio 2017) e poi in epoca moderna, conobbero un grande incremento agli inizi del Novecento per fini terapeutici e turistici. Infatti, sia in Germania che in Italia, come in altri stati europei, negli anni Trenta vi furono ingenti investimenti economici per riqualificare siti termali al fine di trasformarli da semplici centri di cura in cittadine del wellness. Vi accorrevano ric-

chi possidenti in cerca di esperienze alterative, intellettuali ed esponenti politici desiderosi di paesaggi ameni cui ispirarsi per comporre opere artistiche o per progettare imprese militari, malati veri o immaginari con la speranza di guarire (si veda David Clay Large, *L'Europa alle Terme. Una storia di intrighi, politica, arte e cura del corpo*, EDT, Torino 2019 [*The Grand Spas of Central Europe. A History of Intrigue, Politics, Art, and Healing*, Rowman & Littlefiled, Lanham-Maryland 2015]).

Ma la Germania degli anni Trenta è sotto la guida di Adolph Hitler e del Terzo Reich, fondato sul presupposto di una superiorità della 'razza' ariana rispetto alle altre (altrettanto inesistenti) 'razze': ed ecco che il rinvenimento della tomba a Bad Dürrenberg, con i resti di un individuo adulto, di un bambino e di un ricco corredo, viene immediatamente interpretato come la prova di un illustrissimo antenato ariano del popolo germanico, di pelle bianca e di sicura stirpe autoctona. Peccato che invece la sepoltura fosse quella di una donna di pelle scura con un bimbo di pochi mesi in braccio, entrambi facenti parte di un clan riconducibile a gruppi di cacciatori-raccoglitori del Mesolitico, che migravano in cerca di ambienti favorevoli alla sopravvivenza e di risorse naturali da sfruttare.

Il luogo prescelto per la sepoltura non fu secondario: la tomba venne posta su un'altura al di sopra del corso del fiume Saale con vista sulla pianura circostante e presso le sorgenti ricche di depositi salini, utili anche agli animali che vi si potevano recare per trarre nutrimento. Se i residui salini erano ovviamente a disposizione anche per gli umani, per integrare la loro alimentazione, le acque ad elevata componente salina potevano, allora come oggi, risultare efficaci contro infiammazioni e infezioni di organi interni (ad esempio bronchi, polmoni) ed esterni (la pelle, gli arti). È possibile che la donna sepolta avesse imparato ad utilizzare quelle acque e i loro derivati per curare il clan? e che in virtù delle sue capacità, il clan avesse scelto proprio quel luogo per dedicarle tale eccezionale sepoltura? Gli archeologi propongono queste ipotesi sulla base di diversi indizi.

Lo scheletro era di una donna alta 1,55 metri morta intorno ai 35 anni, la cui identità femminile è stata confermata dalle analisi del DNA che hanno chiarito avesse pelle scura, capelli scuri e occhi chiari; la cronologia risalente al 7000 a.C. è stabilita con certezza attraverso il C14 utilizzato sui resti umani e animali trovati. Il cranio presentava una malformazione della prima vertebra cervicale, la quale, ostruendo parzialmente l'afflusso sanguigno al cervello quando la donna girava il capo di lato, poteva causare svenimenti temporanei: dunque, un'anomalia genetica poteva essere alla base di comportamenti 'eccentrici', ad esempio stati di trance.

1 | Ossa animali collocati sopra il corpo della defunta.

Sulla testa la defunta portava un copricapo costituito da corna e ossa di capriolo nonché denti animali [Fig. 1], mentre altri elementi erano riposti sul corpo della donna e in origine erano forse attaccati al pellame che ne copriva alcune parti. La sontuosità del capricapo e degli altri oggetti indicano il rango elevatissimo occupato dalla donna all'interno del clan: e ciò viene confermato dal corredo che le era stato dedicato, composto da 69 gioielli e 52 utensili. Corna di capriolo, zanne di cinghiale, lame di pietra, conchiglie, denti di animali, un osso di gru contenente 31 piccoli strumenti in selce, un'ascia forata posta sotto il braccio destro e frammenti di gusci di tre testuggini di palude, il cui utilizzo, come vedremo, poteva essere stato quello di contenitori per sostanze particolari.

Nel 1934, nonostante la frettolosità dello scavo, si recuperarono anche parti del corpo di un bambino posto quasi in braccio alla donna, anche lui con caratteristiche genomiche dei cacciatori-raccoglitori: aveva pelle scura e occhi chiari ma non era figlio suo, forse era un parente. Si trassero pochi frammenti del cranio e alcuni denti, sufficienti per affermare che aveva meno di un anno d'età quando morì. A lui erano state dedicate, probabilmente, le conchiglie di una piccola lumaca, la *Gyraulus*, non notate nel 1934 ma riconosciute in un saggio archeologico effettuato nel 2019 a poca distanza dal punto del ritrovamento. Qui, a circa 1 metro davanti alla tomba della donna e del bambino, furono recuperate le corna e la calotta cranica di un cervo di grandi dimensioni, deposte intenzionalmente alcuni anni dopo di fronte alla tomba, forse con la pelliccia (una sorta di vestimento riferito al suo status? Si chiedono gli autori): segno che quel luogo rimaneva un punto di riferimento ovvero di 'pellegrinaggio' per le persone del clan cui la donna era legata, che in memoria di lei e di quello che aveva rappresentato svolgevano pratiche cultuali e rituali *ad hoc*.

Un ultimo elemento viene giustamente rimarcato nel volume, e cioè il fatto che grazie alle indagini di laboratorio è stato possibile comprendere che la donna, il bambino e tutti gli oggetti del corredo erano stati adagiati scavando una fossa di forma quasi ovale, rivestita con un intreccio di rami di salice, a circa 1,3 metri di profondità; le pareti erano rivestite da uno strato rossastro, su cui i corpi furono collocati. Terminato il rituale di sepoltura, fu steso uno strato di ocra rossa, cioè di ematite, a sua volta chiuso da elementi in legno e da terra.

Perché era tanto importante omaggiare questa donna? Gli archeologi ritengono che la defunta venisse considerata una persona 'speciale' sia perché aveva forse elaborato capacità nel praticare cure e trattamenti mediante l'uso delle acque e di altri elementi naturali, sia perché, traendo forza da quella sua debolezza congenita qual era la malformazione della prima vertebra cerebrale, talora, forse, manifestava atteggiamenti anomali, particolari: gli stati di al-

terazione psichica e fisica, come apatie e trances, dovuti alla temporanea riduzione di flusso sanguigno al cervello, potevano costituire le condizioni ideali per elaborare un'aurea di rispetto e venerazione tipici di figure borderline come guaritori atipici o sciamani. Sono proprio il copricapo e il tipo di sepoltura che rappresentano l'elemento caratteristico di altri esempi di vestimenti propri di persone assimilabili agli sciamani. Questi ultimi, che per secoli furono considerati lo stereotipo del ciarlatano-stregone, erano individui, spesso di sesso femminile, capaci di stabilire un contatto con il mondo naturale (ovvero con il mondo non umano) attraverso l'assunzione di sostanze e l'uso di strumenti particolari con cui riuscivano a guarire malattie o far superare momenti di disgrazia e di criticità individuale e/o collettiva.

Gli autori dedicano molte pagine del volume alla presentazione della storia degli studi sullo sciamanesimo con particolare riguardo alle ricerche del secondo Novecento, che hanno dimostrano come questi soggetti fossero portatori di una sapienza e di una saggezza altra rispetto a quella ortodossa e tradizionale: per questo furono osteggiati, repressi e annientati, soprattutto in Russia. A titolo esemplificativo vengono ricordate sia le politiche settecentesche di Pietro il Grande volte a imporre la conversione degli sciamani al cristianesimo al fine di eliminare i 'sacerdoti del diavolo', sia la propaganda sovietica, che riconosceva negli sciamani della Siberia i *Nemici della classe operaia* (su cui si veda E. Kasten (ed.), *Schamanen Sibiriens*i*s und ihr Vermächtnis* 2021).

Quella di Bad Dürrenberg è dunque una sepoltura carica di significati, che trova confronti con altre sepolture meso- e neolitiche note altrove interpretate, anche in quei casi, come pertinenti a sciamani-sciamane. Ad esempio, la tomba del cd. *Horn Shelter Man*, sepolto in Texas 11.000 anni fa con una bambina, era provvista di una sacca con utensili atti a frantumare e mescolare sostanze riposte, come medicamenti, nei gusci di tartaruga ivi presenti: ciò è dimostrato dai residui di ematite, cioè di ocra rossa, analizzati al loro interno (pp. 272-273). Di una guaritrice dovette essere pure la tomba svedese in località Skateholm, risalente al 5000 a.C. circa: qui erano stati riposti i resti di una donna sepolta con un palco di cervo e molti altri oggetti di corredo simili a quelli della presunta sciamana di Bad Dürrenberg (pp. 280-283).

Pare quindi convincente il quadro probativo proposto dagli autori a sostegno dell'ipotesi che la sepoltura di Bad Dürrenberg non sia solo eccezionale in sé perché risalente a 9000 anni fa, ma perché costituisce la spia di una sapienza medica antichissima: lo suggeriscono il tipo di corredo e il copricapo 'speciale' proprio di chi occupava una posizione di spicco nel clan; la deposizione della donna (e del bambino) in una fossa rivestita da rami di salice dalla cui corteccia, com'è noto, si estrae la salicina - un principio naturale con proprietà antidolorifiche e antifebbrili, che è alla base della composizione della moderna aspirina, ovvero dell'acido acetilsalicilico (pp. 305-306). Ancora, lo suggeriscono i carapaci delle tre tartarughe, usati forse come contenitori per miscelare a fini terapeutici elementi naturali quali il sale, la salicina e, non ultima, l'ocra rossa: come viene posto in evidenza in uno degli articoli di questo numero (M. Cvetkovic), l'ematite rappresentò per millenni un composto di primaria importanza nelle pratiche mediche, estratto da contesti presso sorgenti minerali ricche di ferro. Infine, se pur

come dato indiziario, la sapienza medica della cd. sciamana di Bad Dürrenberg potrebbe essere confermata dal luogo stesso in cui fu sepolta, cioè le sorgenti saline: se mancano prove archeologiche che attestino la presenza di sale all'interno dei gusci di testuggine e nelle conchiglie del suo corredo, perché, com'è noto, il sale è solubile in acqua e qui non pare essersi conservato, non si può escludere che proprio attraverso le acque e i loro derivati, unitamente alla conoscenza di altri principi naturali, la donna abbia rappresentato un punto di riferimento fondamentale per il suo gruppo di umani.

Dunque, un bel libro, questo, avvincente e convincente. L'unico aspetto su cui forse ci si sarebbe aspettati un affondo maggiore è proprio il ruolo della risorsa termominerale in questo *cold case* archeologico: perché, come dimostrano studi recenti, la storia del termalismo naturale non si limita alla sola analisi delle stazioni curative di epoca romana, ma inizia ben prima, almeno nella seconda metà del II millennio a.C. con la prima stufa curativa micenea di Lipari, ovvero con il commercio dei prodotti secondari presenti attorno alle sorgenti e nelle miniere (dati proposti e commentati in M. Bassani, *Adriatico salutifero, 1. Archeologia del termalismo al* Fons Timavi *e al* Fons Aponi, Roma-Bristol 2025). Anzi, la finestra temporale dell'indagine archeologica sul termalismo potrebbe essere ben più ampia: già nel volume di Fritz Geschwendt, *Der vor- und fruhgeschichtliche Mensch und die Heilquellen*, Hildescheim 1972, citato dagli stessi autori (p. 76), venivano analizzati contesti termominerali di epoca preistorica presenti nella Renania con oggetti d'uso per sfruttare le acque sorgive (ad esempio tronchi trasformati in tubi, palificazioni) e manufatti dedicati presso le sorgenti come 'ex voto'. Altri casi sono noti in Italia, come dimostra il censimento pubblicato nel 2014 (M. Annibaletto, M. Bassani, F. Ghedini (a cura di), *Cura, preghiera e benessere. Le stazioni termominerali nell'Italia romana*, Padova 2014). Se ne possono menzionare due di particolare rilievo. Il primo coincide con le Grotte del Kronio a Sciacca (AG), dove sono presenti vapori termali caldi connessi alla geotermia locale sfruttati senza soluzione di continuità fino ad oggi: vi furono deposti diversi vasi votivi datati fra il 6000 e il 3000 a.C. quali forme di ringraziamento per una salute ritrovata (da ultima M. Bassani, *Adriatico salutifero* 2025 cit., pp. 97-98, con bibliografia). Il secondo caso è quello alle Fonti Romane della Fratta presso Bertinoro (Emilia-Romagna): lavori ottocenteschi volti ad ammodernare le sorgenti salsobromoiodiche presso il fiume Salso (dunque con caratteristiche chimico-fisiche simili a quelle di Bad Dürrenberg) scoprirono l'esistenza di un pozzo preistorico contenente un tronco d'albero usato come canna, in cui erano vasi e contenitori per l'acqua integri e frammentari con resti di fibre sulle anse (funi?) e residui di ocra e di altri resti alimentari. Nel riempimento del pozzo si trovarono anche frutti, cereali, ossa di pecore e bue, mentre nelle vicinanze si recuperarono frammenti di altri utensili propri di un insediamento alle sorgenti (si veda M. Bassani, *Per una carta distributiva degli spazi sacri alle fonti curative*, in Annibaletto, Bassani, Ghedini 2014 cit., p. 181, con bibliografia).

Credo quindi che il prosieguo degli studi sul contesto di Bad Dürrenberg e in generale sul termalismo in epoca antica debba approfondire ulteriormente il ruolo dell'acqua minerale e dei suoi prodotti secondari nelle dinamiche di vita e di insediamento, ampliando lo sguardo

e considerare anche le tracce nel continente europeo e in area mediterranea fin dalla fase preistorica. Del resto, la sola osservazione del comportamento degli animali selvatici, che spontaneamente si recano alle sorgenti termominerali per ripulire il pelo dai parassiti o per rotolarsi nel fango traendo benefici da infiammazioni o ferite, poté rappresentare la prima interfaccia conoscitiva fra uomo, animali e termalismo.

In conclusione, la donna preistorica del parco termale di Bad Dürrenberg non era né una maga né una antenata dei nazisti: era probabilmente una guaritrice, capace di trarre benefici dalle risorse naturali per sé e per gli altri: era l'antenata di tutti noi, epigoni stanziali di migranti dalla pelle scura, che si spostavano liberamente in un'Europa più selvaggia, ma di sicuro più accogliente di quella odierna.

English abstract

This review examines the Italian edition of *Il mistero della sciamana* by Harald Meller and Kai Michel, focusing on the Mesolithic burial of a woman discovered at the thermo-mineral site of Bad Dürrenberg. Combining archaeological, osteological and environmental data, the authors reinterpret a find long distorted by ideological readings, identifying the woman as a healer or shaman-like figure within a hunter-gatherer community. The rich grave goods, ritual practices and proximity to saline springs point to an early form of medical knowledge based on natural resources. While acknowledging the book's methodological strength, the review calls for a broader integration of Bad Dürrenberg into the long-term history of prehistoric thermo-mineral practices.

keywords | Mesolithic burial; Shamanism and healing; Thermo-mineral landscapes; Prehistoric medicine; Archaeological reinterpretation.

The Origins of Thermalism. A Female Burial from the Thermal Mineral Site of Bad Dürrenberg

Review of: Harald Meller, Kai Michel, Il mistero della sciamana. Un viaggio archeologico alla scoperta delle nostre origini [Italian edition from the German edition Das Rätsel der Scamanin. Eine archäologische Reise zu unseren Anfängen, Rowohlt Verlag GmbH, Hamburg 2022], Feltrinelli Editore, Milan 2024

edited by Maddalena Bassani

H. Meller, K. Michel, *Il mistero della sciamana. Un viaggio archeologico alla scoperta delle nostre origini*, Feltrinelli, Milan 2024.

In June 2024, the Italian translation of a book by Harald Meller and Kai Michel, published two years earlier in Hamburg, was released. It is dedicated to reconstructing the story of a woman who lived 9,000 years ago and was buried near Leipzig in Bad Dürrenberg, a spa town in Germany. The Italian edition was reviewed by Fabio Genovesi in *La Lettura del Corriere della Sera* on Sunday, July 21, 2024, entitled *La maga di pelle nera era l'antenata dei nazisti* (The black-skinned sorceress was the ancestor of the Nazis). In my opinion, this title is misleading, even though the article highlights some of the main features of the book: because it cannot be said that this woman was either a sorceress or the ancestor of the Nazis.

The book is of great interest not only for the accuracy of the historiographical, historical-archaeological, and ethno-sociological reconstruction proposed by the authors, but above all because it opens a window onto the use of thermal mineral contexts in an era well before the Greek and Roman ages, namely during the transition period between the Mesolithic and Neolithic periods, and therefore in the fundamental phase that saw hunter-gatherers become settled peoples.

Spanning 366 pages, the volume is divided into 25 chapters with a final epilogue and an extensive thematic bibliography, offering the opportunity to explore the various areas of study covered in the chapters in greater depth. These range from the history of the tomb's discovery to the initial interpretation of the find, accompanied by new perspectives linked to paleo-osteological and geo-environmental analyses, also considering the type of grave goods and examining other cases comparable to that of Bad Dürrenberg in Europe and around the world. This is therefore not a historical-archaeological essay, but an in-depth study that draws on various fields of research, allowing the reader to understand the steps taken in the research, the difficulties encountered, and the results achieved, as well as the prospects that can be envisaged from the output of the research itself.

On May 4, 1934, restoration work was underway on the accommodation facilities at the Bad Dürrenberg spa in the Saalekreis district of Saxony, with salt-rich waters and numerous mines. This location was one of Germany's thermal mineral sites which, although already partially exploited in Roman times (see Cecilia Zanetti's PhD thesis, *Il Termalismo nelle Province Centrali. Rezia, Germania Superiore e Inferiore*, University of Padua, discussion: January 31, 2017) and then in modern times, experienced a great increase in the early 20th century for therapeutic and tourist purposes. In fact, in Germany and Italy, as in other European countries, in the 1930s there were huge economic investments to redevelop thermal sites in order to transform them from simple treatment centers into wellness towns. They were frequented by wealthy

landowners in search of alternative experiences, intellectuals and politicians eager for pleasant landscapes to inspire them to compose works of art or plan military campaigns, and real or fake patients hoping to be cured (see David Clay Large, *L'Europa alle Terme. Una storia di intrighi, politica, arte e cura del corpo*, EDT, Turin 2019 [*The Grand Spas of Central Europe. A History of Intrigue, Politics, Art, and Healing*, Rowman & Littlefield, Lanham-Maryland 2015]).

But Germany in the 1930s was under the leadership of Adolf Hitler and the Third Reich, founded on the premise of the superiority of the Aryan 'race' over other (equally non-existent) 'races': and so the discovery of the tomb in Bad Dürrenberg, containing the remains of an adult, a child, and a rich array of grave goods, was immediately interpreted as proof of an illustrious Aryan ancestor of the Germanic people, white-skinned and of undoubtedly indigenous descent. Quite the opposite, the burial was that of a dark-skinned woman with a baby a few months old in her arms, both belonging to a clan linked to groups of Mesolithic hunter-gatherers who migrated in search of environments favorable to survival and natural resources to exploit.

The location chosen for the burial was important: the tomb was placed on a hill above the Saale River with a view of the surrounding plain and near springs rich in salt deposits, which were also useful to animals that could go there to feed. The salt deposits were obviously also available to humans, as a dietary supplement, as well as the highly saline waters were, and still now, effective against inflammation and infections of internal organs (e.g., bronchi, lungs) and external organs (skin, limbs). Is it possible that the buried woman had learned to use these waters and their derivatives to heal the clan? And that, because of her abilities, the clan chose that particular place to give her such an exceptional burial? Archaeologists propose these hypotheses on the basis of various clues.

The skeleton belonged to a woman who was 1.55 m tall and died at around 35 years of age. Her female identity was confirmed by DNA analysis, which revealed that she had dark skin, dark hair, and light-colored eyes. The date of 7000 BC was established with certainty using C14 on the human and animal remains found. The skull had a malformation of the first cervical vertebra, which partially obstructed the blood supply to the brain when the woman turned her head to the side, causing temporary fainting spells. Therefore, a genetic anomaly could have been the basis for 'eccentric' behavior, such as trance states.

1 | Animal bones placed on top of the deceased's body.

The deceased wore a headdress made of antlers and roe deer bones as well as animal teeth [Fig. 1], while other items were placed on the woman's body and were originally perhaps attached to the leather covering some parts of it. The sumptuousness of the headdress and other objects indicate the woman's very high rank within the clan, which is confirmed by the grave goods dedicated to her, consisting of 69 pieces of jewelry and 52 tools. Roe deer antlers, wild boar tusks, stone blades, shells, animal teeth, a crane bone containing 31 small flint tools, a perforated axe placed under her right arm, and fragments of the shells of three marsh turtles, which, as we shall see, may have been used as containers for particular substances.

In 1934, despite the hastiness of the excavation, parts of the body of a child were also recovered, placed almost in the woman's arms, also with the genomic characteristics of hunter-gatherers: he had dark skin and light eyes but was not her son, perhaps a relative. A few fragments of the skull and some teeth were recovered, enough to confirm that he was less than a year old when he died. The shells of a small snail, *Gyraulus*, were probably dedicated to him. They were not noticed in 1934 but were recognized in an archaeological essay carried out in 2019 not far from the site of the discovery. Here, about 1 meter in front of the tomb of the woman and child, the horns and skull of a large deer were recovered, intentionally placed in front of the tomb a few years later, perhaps with the fur (a sort of garment referring to her status? The authors wonder): a sign that this place remained a point of reference or 'pilgrimage' for the people of the clan to which the woman was linked, who, in memory of her and what she had represented, performed *ad hoc* cult practices and rituals.

A final element is rightly highlighted in the volume, namely the fact that laboratory investigations have made it possible to understand that the woman, the child, and all the objects in the grave goods had been laid to rest in an almost oval-shaped pit, lined with a weave of willow branches, about 1.3 m deep; the walls were covered with a reddish layer, on which the bodies were placed. Once the burial ritual was complete, a layer of red ochre, or hematite, was spread over the bodies, which was then covered with wooden elements and earth.

Why was it so important to pay homage to this woman? Archaeologists believe that the deceased was considered a 'special' person, both because she had perhaps developed skills in practicing cures and treatments using water and other natural elements, and because, drawing strength from her congenital weakness, which was a malformation of the first vertebra of the brain, she sometimes exhibited unusual, peculiar behaviors: states of mental and physical alteration, such as apathy and trances, due to the temporary reduction of blood flow to

the cerebellum, could have created the ideal conditions for developing an aura of respect and veneration typical of borderline figures such as atypical healers or shamans. It is precisely the headdress and the type of burial that represent the characteristic element of other examples of clothing typical of people similar to shamans. The latter, who for centuries were considered the stereotype of charlatans and sorcerers, were individuals, often female, capable of establishing contact with the natural world (i.e., the non-human world) through the intake of substances and the use of special tools with which they were able to heal illnesses or overcome moments of misfortune and individual and/or collective crises. The authors devote many pages of the book to presenting the history of studies on shamanism, with particular regard to research carried out in the second half of the 20th century, which demonstrated how these individuals possessed knowledge and wisdom that differed from orthodox and traditional beliefs: for this reason, they were opposed, repressed, and crushed, especially in Russia. By way of example, authors recall both the 18th-century policies of Peter the Great aimed at forcing shamans to convert to Christianity in order to eliminate the 'priests of the devil', and Soviet propaganda, which recognized Siberian shamans as *enemies of the working class* (see E. Kasten (ed.), *Schamanen Sibiriensis und ihr Vermächtnis* 2021).

The Bad Dürrenberg burial is therefore rich in meaning and can be compared to other Mesolithic and Neolithic burials found elsewhere, which have also been interpreted as belonging to shamans. For example, the tomb of *the* so-called *Horn Shelter Man*, buried in Texas 11,000 years ago with a little girl, contained a bag with tools for crushing and mixing substances, such as medicines, stored in the turtle shells found there: this is demonstrated by the residues of hematite, i.e., red ochre, analyzed inside them (pp. 272-273). The Swedish tomb in Skateholm, dating back to around 5000 BC, must also have belonged to a healer: here were the remains of a woman buried with a deer antler and many other objects similar to those of the presumed shaman of Bad Dürrenberg (pp. 280-283).

The evidence presented by the authors in support of the hypothesis that the Bad Dürrenberg burial is not only exceptional in itself because it dates back 9000 years, but also because it is indicative of ancient medical knowledge, seems convincing. This is suggested by the type of grave goods and the 'special' headdress typical of those who occupied a prominent position in the clan; the burial of the woman (and child) in a grave lined with willow branches, from whose bark, as is well known, salicin is extracted – a natural principle with pain-relieving and fever-reducing properties, which is the basis of the composition of modern aspirin, or acetylsalicylic acid (pp. 305-306). This is further suggested by the shells of the three turtles, perhaps used as containers for mixing natural elements such as salt, salicin, and, last but not least, red ochre for therapeutic purposes. As highlighted in one of the articles in this issue (M. Cvetkovic), hematite was for millennia a compound of primary importance in medical practices, extracted from contexts near iron-rich mineral springs. Finally, although only circumstantial evidence, the medical knowledge of the so-called shaman of Bad Dürrenberg could be confirmed by the very place where she was buried, namely the salt springs. If there is no archaeological evidence to prove the presence of salt inside the tortoise shells and seashells in her grave

goods (because, as is well known, salt is soluble in water and does not seem to have been preserved here), it cannot be ruled out that it was precisely through water and its derivatives, together with her knowledge of other natural principles, that this woman represented a fundamental point of reference for her group of humans.

So, this is a beautiful book, compelling and convincing. The only aspect on which one might have expected more depth is precisely the role of thermal mineral resources in this archaeological cold case: because, as recent studies show, the history of natural thermalism is not limited to the analysis of Roman-era healing stations, but begins much earlier, at least in the second half of the 2nd millennium BC with the first Mycenaean healing stove in Lipari, or rather with the trade in secondary products found around the springs and in the mines (data now proposed and commented on in M. Bassani, *Adriatico salutifero, 1. Archeologia del termalismo al* Fons Timavi *e al* Fons Aponi, Rome-Bristol 2025). In fact, the time frame of the archaeological investigation into thermalism could be much broader: already in Fritz Geschwendt's book, *Der vor- und fruhgeschichtliche Mensch und die Heilquellen*, Hildescheim 1972, cited by the same authors (p. 76), prehistoric thermal mineral contexts in the Rhineland were analyzed, with objects used to exploit spring waters (e.g., logs transformed into pipes, pilings) and artifacts dedicated at the springs as 'ex voto'. Other cases are known in Italy, as shown by the census published in 2014 (M. Annibaletto, M. Bassani, F. Ghedini (eds.), *Cura, preghiera e benessere. Le stazioni termominerali nell'Italia romana*, Padua 2014). Two particularly significant examples can be mentioned. The first is the Kronio Caves in Sciacca (AG), where hot thermal vapors connected to local geothermal energy have been exploited continuously to this day: several votive vessels dating from between 6000 and 3000 BC were deposited there as a form of thanksgiving for regained health (from M. Bassani, *Adriatico salutifero* 2025 cit., pp. 97-98, with bibliography). The second case is that of the Fonti Romane della Fratta near Bertinoro (Emilia-Romagna): nineteenth-century works aimed at modernizing the salsobromoiodic springs near the Salso River (therefore with chemical-physical characteristics similar to those of Bad Dürrenberg) discovered the existence of a prehistoric well containing a tree trunk used as a pipe, in which there were intact and fragmentary water vessels and containers with remains of fibers on the handles (ropes?) and residues of ocher and other food remains. Fruit, cereals, sheep and ox bones were also found in the well, while fragments of other tools typical of a settlement at the springs were recovered nearby (see M. Bassani, *Per una carta distributiva degli spazi sacri alle fonti curative*, in Annibaletto, Bassani, Ghedini 2014 cit., p. 181, with bibliography). Finally, in recent months near Grosseto, in the Terme di Sorano place, a prehistoric thermal place for healing and worship was discoverd by Authority for Archaeology.

I therefore believe that further studies on the context of Bad Dürrenberg and on thermalism in ancient times should further explore the role of mineral water and its secondary products in the dynamics of life and settlement, broadening the perspective and also considering traces on the European continent and in the Mediterranean area since prehistoric times. After all, simply observing the behavior of wild animals, which spontaneously go to thermal mineral

springs to clean their fur of parasites or to roll in the mud to benefit from inflammation or wounds, may have represented the first cognitive interface between humans, animals, and thermalism.

In conclusion, the prehistoric woman of the Bad Dürrenberg thermal park was neither a sorceress nor an ancestor of the Nazis: she was probably a healer, capable of drawing benefits from natural resources for herself and others: she was the ancestor of all of us, sedentary descendants of dark-skinned migrants who moved freely in a Europe that was wilder but certainly more welcoming than today's.

Abstract

This review examines the Italian edition of *Il mistero della sciamana* by Harald Meller and Kai Michel, focusing on the Mesolithic burial of a woman discovered at the thermo-mineral site of Bad Dürrenberg. Combining archaeological, osteological and environmental data, the authors reinterpret a find long distorted by ideological readings, identifying the woman as a healer or shaman-like figure within a hunter-gatherer community. The rich grave goods, ritual practices and proximity to saline springs point to an early form of medical knowledge based on natural resources. While acknowledging the book's methodological strength, the review calls for a broader integration of Bad Dürrenberg into the long-term history of prehistoric thermo-mineral practices.

keywords | Mesolithic burial; Shamanism and healing; Thermo-mineral landscapes; Prehistoric medicine; Archaeological reinterpretation.

“Spes sit mihi certa videndi Niliacos fontes”. Alla ricerca di un confine del mondo, sulle tracce del grande Alessandro

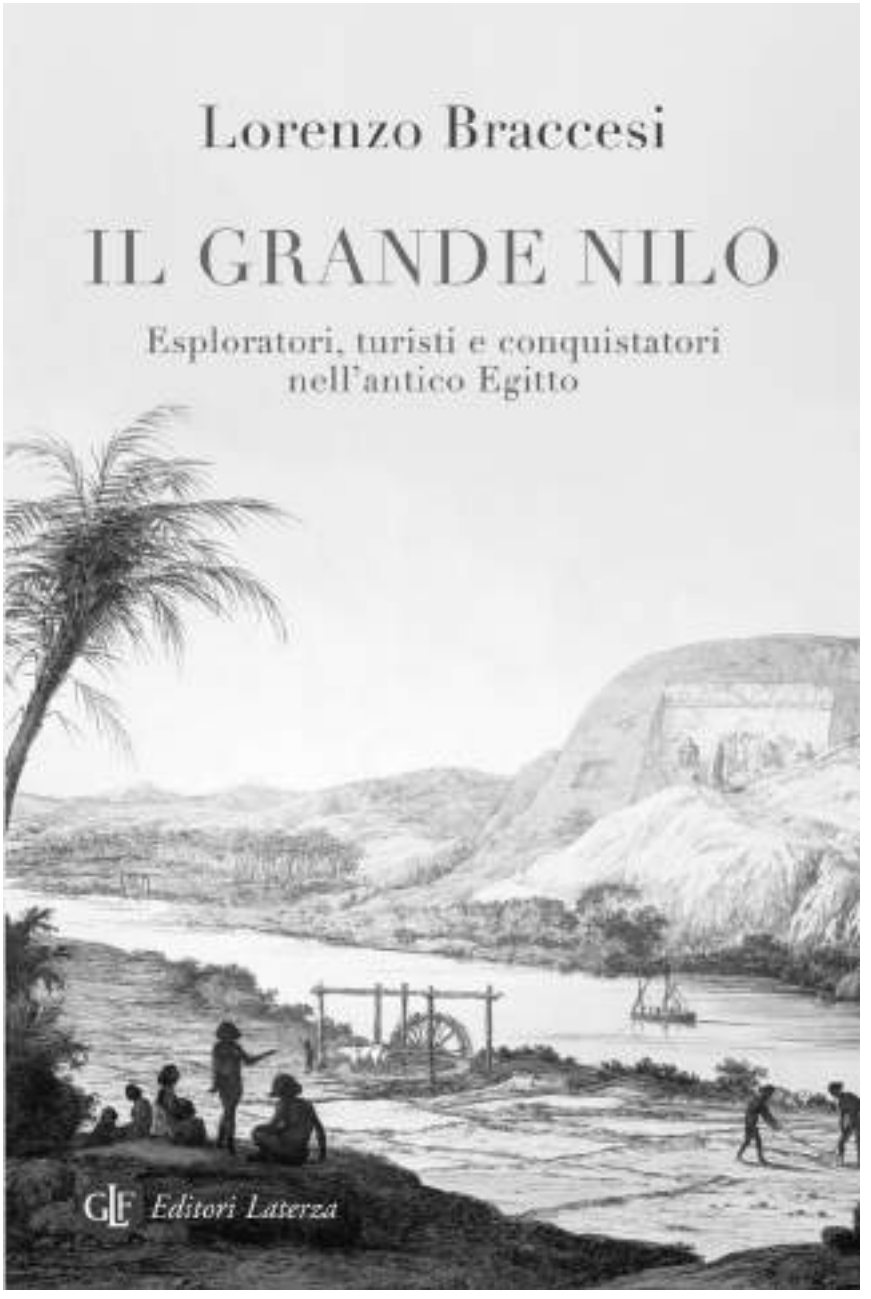
Recensione a: Lorenzo Braccesi, Il grande Nilo. Esploratori, turisti e conquistatori nell'antico Egitto, Laterza, Roma-Bari 2025

Monica Centanni

> *Sed cum tanta meo vivat sub pectore virtus / tantus amor veri, nihil est quam noscere malim / quam fluvii causas per saecula tanta latentis / ignotumque caput. Spes sit mihi certa videndi Niliacos fontes, bellum civile relinquam* (Lucano, *Fars.* X, 189-192).
>
> Ma in tanto ardore che mi vive nel profondo del cuore / e in tanto amore del vero, nulla desidero sapere / più della causa delle piene di questo fiume, nascosta da secoli, / e l’ignota sorgente. Dammi sicura speranza / di vedere le fonti del Nilo, e lascerò la guerra civile (trad. di Luca Canali).

Nei versi di apertura dell’ultimo libro della *Farsaglia*, Lucano aveva sferrato il suo infiammato attacco contro Alessandro, il *felix praedo […] terrarum fatale malum fulmenque* che aveva umiliato la libertà di tutti i popoli di Grecia e di Oriente e che, se la natura non avesse messo fine alla sua follia, nella sua smania infinita di conquista si sarebbe volto verso Occidente e avrebbe “bevuto alle sorgenti del Nilo” (*Fars*., X, 20-52). Ma una piccola barca approda di nascosto alla reggia di Alessandria: sbarca Cleopatra “Erinni fatale […] che con il suo sistro avrebbe abbattuto il Campidoglio” (*Fars.*, X, 56-ss.); ed è a questo punto che a un Cesare, oramai sedotto dalle malîe della regina, stanco di guerre civili e desideroso di rivolgere altrove la sua *virtus* e il suo *amor veri*, Lucano fa pronunciare i versi sulla speranza di “vedere le fonti del Nilo” – versi che ci introducono al tema, e ci fanno immergere nel clima, del libro di Lorenzo Braccesi sul “grande Nilo”, edito da Laterza nell’estate del 2025.

Ma cominciamo dalla dedica, posta in exergo al volume, che recita: “*alla memoria del mio bisavolo Henry Fiorentino, primo cassiere di Suez*”. Il bisavolo Henry altri non è che il primo, in ordine di comparsa, del cast di personaggi che Braccesi ha arruolato per raccontare il suo viaggio nel “grande Nilo” attraverso i secoli dell’antichità. Il cassiere H.F. sta sulla soglia di questo lavoro, personaggio tutt’affatto minore rispetto al profilo dei protagonisti, destinato per noi lettori a rimanere probabilmente del tutto oscuro: ma il nome e la professione ne fanno



Lorenzo Braccesi, *Il grande Nilo. Esploratori, turisti e conquistatori nell'antico Egitto,* Laterza, Roma-Bari 2025.

una comparsa utile ad agganciare la rassegna di fonti di storie, e il corteo dei personaggi che si srotolano nel volume, alla stessa vita, prima ancora che alla genealogia, del suo bisnipote, "L.B., storico dell'antichità greca e romana".

Come leggiamo nella prima riga della Prefazione, il libro *Il grande Nilo* indaga sulle sorgenti del fiume e sull'immaginario che hanno generato attraverso i secoli: questi i due temi – il Nilo e il suo immaginario – i due cardini su cui si annodano e si distendono i fili della ricerca che sta dietro all'ariosa restituzione narrativa che Braccesi ci propone. Fin dalle testimonianze più antiche, lo storico cerca e trova la conferma di un'ipotesi che ha a che fare con la storia culturale prima ancora che con la geografia o la storia delle esplorazioni: dalle fonti del Nilo sgorga, insieme alla materiale polla sorgiva, l'impulso di un desiderio che anima diversi personaggi e una svariata varietà di leggende prosopografiche che, attorno ai dati storici, sono fiorite: sfila così una galleria di personaggi mossi dalla smania di esplorare quel ganglio che forse potrebbe coincidere con un punto di confine del mondo e, insieme, dalla brama di gloria di potersi intestare il primato di una scoperta che sarà procrastinata per secoli. Le fonti del Nilo ispirano, da sempre, la gara dell'*inventio* – una vera e propria *quête* che muove idee e progetti, passioni e traiettorie, prima durante e anche dopo il loro – molto tardivo – rinvenimento.

La prima traccia risale a Cambise che, stando a Diodoro, avrebbe fondato la città di Meroe, scendendo o costeggiando il corso del Nilo: al fondatore della città situata alla confluenza tra Nilo Bianco e Nilo Azzurro sarebbero – nota Braccesi – da ascrivere alcuni toponomi nubiani fra i quali il *Forum Cambusis* e la località chiamata *Kambushija*. Braccesi ricava da Diodoro un altro indizio dell'impresa di Cambise negli "alberi persici" che avrebbe fatto trapiantare dall'Etiopia all'Egitto. L'impresa espansionistica verso l'Etiopia è dettata, recitano le fonti, dall'"ira" di Cambise contro il sovrano etiope che avrebbe disdegnato i suoi doni scrive: è l'*orghé* – scrive Braccesi – "tipica del dispotismo orientale".

Non rivalsa, né prepotenza dell'ira, ma un diverso sentimento anima i personaggi storici convocati nei capitoli seguenti, spinti a cercare le sorgenti del Nilo dall'impulso di tutt'altra passione. È Alessandro che dà il *la*: il primo a desiderare di bere alle fonti del "grande Nilo" è "il grande Alessandro". Braccesi – sempre attento a scegliere con cura gli elementi lessicali e sintattici della sua scrittura scintillante, e insieme sorvegliata, e a valorizzare la giusta posizione delle parole – non adotta già la locuzione identificativa del personaggio, consunta dall'uso: non è "Alessandro il grande" ma "il grande Alessandro", laddove l'intensa marcatura dell'aggettivo descrittivo premesso al nome salda il profilo di Alessandro alla denominazione parallela del "grande Nilo", ma rende anche evidente il riconoscimento tutto personale che l'autore riserva alla grandezza del Macedone con una passione coltivata per tutta la sua vita di studioso. Tra "la storiografia dell'amore e quella dell'odio per Alessandro" che, come ci insegna Santo Mazzarino, fin dall'antichità divide gli storici, non c'è dubbio su quale sia il partito nel quale Lorenzo Braccesi si arruola. Nel capitolo dedicato, Braccesi richiama le fonti secondo cui Alessandro avrebbe spedito Callistene a scoprire le sorgenti del Nilo. Dietro c'è l'insegnamento, seguito e poi tradito, di Aristotele, rispetto al *peras* il limite che circo-

scrive concettualmente, prima che geograficamente, l'immaginazione e il disegno stesso del *kosmos*: "Senza limite, niente è forma: *peras* è causa e essenza, *peras* è principio" (*Metaph*., 1022 a). Del cosmo, limitato e armonicamente ordinato, nel *Trattato sul Cosmo* (dedicato proprio ad Alessandro) il filosofo aveva indicato al giovane principe un paradigma, rappresentato dalla forma e dall'ordine dell'impero persiano (*De mund.* 398 a). Era lo stesso Aristotele, per altro, che incitava Alessandro non solo a conquistare la gloria, ma anche ad affrontare imprese grandi, esplorando l'inesplorato:

> È per questo che coloro che mettono tutto il loro impegno nell'analizzare la natura di un solo luogo, la forma di una sola città, la grandezza di un fiume, la bellezza di un monte [...]. Tutti quelli che si occupano del particolare, ci dovrebbero far pena perché hanno un'anima piccina, [...] perché non sono capaci di guardare alle cose grandi – il cosmo e quanto di grande è nel cosmo. Perché se esperissero la vera conoscenza, proverebbero meraviglia per essa e per nient'altro, e tutto il resto parrebbe loro piccola cosa. [...] Io credo davvero che tu Alessandro, debba perseguire la ricerca e l'esplorazione di cose grandi; per te, come è per la filosofia, non vale la pena investigare su questioni da poco (*De mund*., 391a).

L'impresa, l'esplorazione dell'ignoto, è come la filosofia in quanto è una forma – la più autentica – di pensiero in azione, pensiero che produce mondo. È l'insegnamento di Aristotele che dà l'innesco al giovane principe per il suo viaggio, che sarà impresa e conquista di gloria, ma anche conoscenza, avventura e cerca ai confini del mondo, "meraviglia" da cui scaturisce filosofia. Alessandro mette alla prova l'idea di confine oltrepassando e trasgredendo tutti i confini possibili. Ispirato dalla sua *virtus* e, come sarà per il Cesare di Lucano, dall'*amor veri*, cercherà di inverare la meraviglia come conoscenza, in cerca, ovunque, dell'ultimo confine – anche a sud, alla scoperta dei *Niliaci fontes*. E non si tratta di *orghé*: non è, come quella di Cambise, vana curiosità, capriccio o impulso irrazionale del tiranno orientale. È *pothos*, inesausto desiderio di nuove mète, creativa e inarrestabile mania dionisiaca, che sborda nello spaesamento, nello smarrimento del senso del limite. Questo il desiderio che segna la rotta dell'itinerario fantasmatico di Alessandro che, stando non solo alla versione leggendaria del *Romanzo di Alessandro*, lo spinge a cercare in tutte le direzioni, i confini del mondo. E – ci insegna Braccesi una volta di più in questo suo libro – questo *pothos*, che è un nome dell'occhio aperto illimitato di Alessandro, è anche un nome del desiderio, destinato a restare inappagato, di scoprire l'*ignotum caput*, il punto incognito da cui ha origine il grande fiume da cui si irradiano le vene degli altri fiumi che irrigano i continenti. Il Nilo è sempre il Nilo, o forse no: nel *pothos* smisurato del Megalexandros, il Nilo si confonde con l'Indo e Alessandro arrivato alle sponde di quel che crede sia Oceano, secondo Massimo di Tiro, crede che un fiume si confonda con l'altro.

Nei capitoli dedicati ai vari altri attori della storia antica che si sono cimentati nell'impresa – Tolomeo Filadelfo, Giuba, Cesare, Augusto, Germanico, Caligola, Nerone, Zenobia – il filo che tiene insieme le diverse storie è l'*imitatio Alexandri.* Anche per la smania *ad Nili de fonte bibendum* – impresa che nessuno nell'antichità riuscirà a compiere – tutto ruota, tutti ruotano, intorno alla prima 'cerca' che è quella di Alessandro, e le loro imprese altro non sono che

un capitolo postumo di quella stessa storia, fino a vagheggiare l'ipotesi che la stessa Zenobia, nella sua i*mitatio Cleopatrae*, pensasse di arrivare alle sorgenti del Nilo. Tutti, destinati a essere sconfitti dal "mistero della natura" (così Lucano a proposito di Alessandro e poi di Cesare), sono in qualche modo "innamorati di ricordi" (e Braccesi qui riprende ancora Lucano, un testo-guida di questo lavoro). Esemplari alcuni episodi, particolarmente illuminanti, di questa catena di avventure che si snoda da Alessandro fino agli ultimi *principes* dell'impero romano: la tensione, che Braccesi riattiva, del sapiente Giuba II, sposo di Cleopatra Selene per il quale "la scoperta delle fonti del Nilo è occasione di gloria". E poi, senza dimenticare Augusto e la sua, tutta particolare, declinazione della *imitatio Alexandri riattivata* nella forma della nuova cosmocrazia, è la favolosa, incredibile, crociera sul Nilo di Germanico e Agrippina, la coppia legata da un vero vincolo di passione, che compiono un lungo viaggio di amore e di avventura: "Il nipote di Antonio e la figlia di Giulia" vivono intensamente quella crociera sul Nilo "popolata di fantasmi", ed è ancora l'*imitatio Alexandri* che muove quel desiderio e spiega la durata di quel viaggio, dato che "la permanenza egiziana di Germanico non cessa di stupirci". Presto Germanico morirà, all'età fatidica di 33 anni, ma forse in quella crociera c'era con loro anche il piccolo Caligola che, potrebbe – ce lo suggerisce indirettamente ancora Braccesi – aver imparato da quel viaggio l'amore per le sontuose navi egizie che avrebbe ricreato a Nemi in onore della sorella-sposa Drusilla.

Questo è il limite, sconfinato e ineguagliabile, della dottrina che Braccesi mette al servizio del suo mestiere storico, quel mestiere che fin dai primi suoi contributi scientifici agli ultimi, interpreta non solo come analisi puntuale e accurata delle fonti, ma soprattutto come uso intensivo delle stesse fonti, analizzate oculatamente per costruire ipotesi di ampia portata, per aprire a nuovi orizzonti di senso che illuminino i dati grazie al brillìo dell'intelligenza ermeneutica. Non potremo più godere delle nuove conquiste del suo studio e delle aperture del suo pensiero perché questo è l'ultimo libro di Lorenzo Braccesi, pubblicato nel luglio del 2025, un mese prima della sua morte. Non avremo più la gioia e la fortuna di nutrirci delle sue ricerche e delle sue visioni. Possiamo però tornare a leggere e a studiare le centinaia di articoli e saggi, le sessanta e più monografie che, in sessant'anni di ininterrotto lavoro, il nostro maestro e amico ha pubblicato: nelle pagine che ha scritto possiamo risentire la sua voce. E di quel dono, fatto alla comunità scientifica e a tutti i lettori colti, che Braccesi ha sempre considerato il suo pubblico di elezione, possiamo far tesoro come lezione di metodo.

English abstract

Published in July 2025, one month before his death, Lorenzo Braccesi's last book, *Il Grande Nilo*, explores the search for the source of the Nile, as well as the imagery associated with it in ancient times and over the centuries. These two themes are seamlessly intertwined throughout the narrative. Rather than focusing on the geography or history of exploration, Braccesi seeks and finds confirmation of a hypothesis concerning cultural history: the sources of the Nile have always inspired a quest, driving ideas, projects, and passions. The first protagonist in the search for the Nile's sources is Alexander the Great, and the *imitatio Alexandri* ties the different stories together. The book's chapters are dedicated to all

the protagonists of ancient history who attempted the feat: Ptolemy Philadelphus, Juba, Caesar, Augustus, Germanicus, Caligula, Nero and Zenobia. According to Braccesi, they are all inspired by the *imitatio Alexandri*.

keywords | Nile' sources; Alexander the great; imitatio Alexandri.

Il termalismo antico nell'alto Adriatico

Un dialogo con un recente studio di Maddalena Bassani

Rachele Dubbini

Il termalismo rappresenta un fenomeno complesso del mondo antico, nel quale pratiche terapeutiche, architettura e organizzazione del territorio si intrecciano, riflettendo il ruolo centrale delle acque in ambito terapeutico, cultuale e più in generale economico e sociale. Non sorprende quindi che negli ultimi anni la bibliografia sul tema sia cresciuta notevolmente, come peraltro evidenziato in questo volume (già in Bassani 2025, 1-14; cfr. Nocca 2025), panorama in cui ormai da tempo emergono le ricerche coordinate da Maddalena Bassani, volte a interpretare i contesti termali come elementi strutturanti del paesaggio e delle dinamiche insediative nell'Italia romana. A tali ricerche, lo scorso anno la studiosa ha aggiunto un nuovo lavoro monografico dal titolo A*driatico Salutifero, 1. Archeologia del termalismo al* Fons Timavi *e al* Fons Aponi edito da "L'Erma" di Bretschneider nel 2025 per la collana ΑΔΡΙΑΣ, diretta da chi scrive.

Un approfondimento dedicato al contesto alto-adriatico era fondamentale per inquadrare un fenomeno cruciale nell'ambito dell'elaborazione di miti e di realtà cultuali che caratterizzano quest'area sin dalle origini della loro frequentazione, fortemente modellati dalla presenza greca e micenea nelle fasi più antiche (Braccesi 2001; Čače, Tassaux 2006; Capuis 2024, 384-385). Come è noto, infatti, elementi naturali percepiti come eccezionali (che si tratti di un albero, una roccia o una cavità particolare, una sorgente con caratteri peculiari, un bosco etc.) sono catalizzatori di attività rituali, in quanto interpretati come manifestazioni della presenza di una potenza sovrumana o divina (Lafond, Michel 2016). Tra tutti, la presenza di una o più sorgenti d'acqua è in particolar modo cruciale non solo quale sede privilegiata di una potenza sovrumana (è notissimo il commento di Servio *ad Aen.* VII, 84, secondo il quale non esisterebbe fonte che non sia sacra), ma anche in relazione alle diverse funzioni che l'acqua poteva assumere all'interno di uno spazio sacro (Edlund-Berry 2024, in particolare p. 638; Klingborg 2025). Il mito concorre quindi a 'dare un nome' a tale presenza, rivelando la frequentazione e l'uso dei territori, anche per le epoche più antiche: per tale motivo, nel capitolo IV si sceglie di ripercorrere la stratigrafia mitologica relativa alle risorse termominerali del Mediterraneo antico, quale passaggio essenziale per comprendere il rapporto tra il termalismo e l'evolversi delle tradizioni mitiche del nord-adriatico. Diomede, Era ed Artemide nell'area del Timavo e Antenore, Gerione ed Eracle nell'area aponense sono infatti figure centrali tanto nella diffusione della cultura greca nell'area quanto per la testimonianza del valore salutifero delle

sorgenti, sia per la cura umana che animale, e del loro utilizzo in varie attività come il lavaggio dei tessuti e delle fibre, illuminazione, sanificazione, colorazione delle fibre etc. In questo senso, la ricerca sulle acque termominerali quali spazi ibridi in cui natura, entità sovrumane ed extraumane, uomini e animali si incontrano in attività interrelate tra l'ambito del sacro, quello terapeutico e quello economico-sociale, permette di entrare nel vivo di alcuni tra gli ambiti più importanti dell'esistenza umana, non solo per l'antichità, e quindi di conoscere i territori adriatici in una nuova prospettiva.

La scelta di concentrare la ricerca nell'area euganea è d'altronde legata proprio alla possibilità di indagare un fenomeno di sfruttamento della risorsa termominerale senza soluzione di continuità, dalla protostoria fino a oggi (Selmin *et al.* 2009). La prima parte del lavoro di Maddalena Bassani è così dedicata al riesame delle fonti scritte e dei documenti archeologici pertinenti il *Fons Timavi* e il *Fons Aponi* (entrambi da considerare non come singole fonti ma come molteplici sorgenti di acqua termominerale) consentendo di intravedere una conoscenza delle potenzialità del termalismo locale e una frequentazione delle sorgenti già dall'VIII-VII sec. a.C., non solo con finalità terapeutiche ma anche per lo svolgimento di attività economiche e produttive, da inquadrare in quelle tradizioni di matrice greca dell'area alto-adriatica che evidenziano l'importanza dell'allevamento degli animali e in particolare dei cavalli, curati all'occasione con bagni terapeutici proprio presso le sorgenti termominerali. Sarebbe ridondante tornare sul ruolo centrale della figura di Diomede (Braccesi 2001, 39-43), mediatore tra le diverse culture che si incrociavano in questi snodi commerciali, ma – in relazione a tale contesto culturale – è importante ricordare anche la funzione del santuario di Altino quale centro-cerniera rispetto alla via endolagunare che assicurava i collegamenti tra il delta del Po e proprio la risorgiva del Timavo e propagatore di attività propizie all'*hippotrophia* (in Tirelli 2020 viene evidenziata la frequentazione ibrida del santuario in relazione all'esportazione e al commercio dei cavalli). D'altronde è un dato ormai acquisito che, già dall'epoca orientalizzante, diversi santuari dell'Italia centrale fungevano anche da luogo di scambio e di incontro tra diverse culture mediterranee per la creazione di reti commerciali a lungo raggio (Bolder-Boos 2016; Michetti 2020; Krämer 2023; più in generale, Chankowski 2025): lo stesso accadeva in Adriatico[1] e la presenza di elementi salutiferi non poteva che attrarre ulteriormente la presenza 'straniera', rafforzando tali circuiti economici. In questa visione cosmopolita, così come al Timavo il culto venne presto ellenizzato, allo stesso modo presso le sorgenti euganee accanto ad *Aponus*, divinità di natura epicorica, si affiancarono le figure di Gerione ed Ercole[2]. In entrambi i casi, è proprio la polifunzionalità delle sorgenti termominerali – soprattutto in relazione all'allevamento degli armenti – che consentì a tali centri di svilupparsi nel corso dei secoli come 'attivatori' degli snodi portuali marittimi più vicini. Ciò contribuì alla proliferazione di insediamenti sempre più complessi e portò – in seguito alla romanizzazione dell'area tra la fine del III e il II secolo a.C. – allo sviluppo di un articolato turismo termale e salutifero potenziato dalla tecnologia romana e dall'affinarsi delle conoscenze in campo medico e architettonico-ingegneristico, come testimoniato dalle fonti letterarie e dagli indizi archeologici fino alla fine dell'età imperiale (Bassani 2025, 80-81).

Caratteristica peculiare di questo volume è l'approccio integrato alla questione trattata: la lettura archeologica viene ampiamente suffragata dalle fonti archivistiche, mettendo a sistema le informazioni tratte dalle fonti scritte e materiali con quelle manoscritte, nel tentativo di ricostruire nella maniera più completa possibile i contesti analizzati. La seconda parte del libro presenta così una serie di riflessioni e commenti su un testo di Giovanni Lavagnoli (1773) rimasto allo stato di manoscritto, incompleto e mai pubblicato, sulle antichità delle sorgenti termo-minerali dell'area euganea, la cui sintesi viene riportata nell'appendice 1 del volume, mentre l'appendice 2 presenta integralmente la memoria, anch'essa inedita, di Antonio Maria Zanetti sulla statua del cd. dignitario da Montegrotto Terme. Gli scritti di Lavagnoli sono particolarmente preziosi perché presentano diverse scoperte non ancora prese in considerazione in relazione allo studio del territorio euganeo: una serie di ex-voto rinvenuti nel lago oggi scomparso di S. Pietro Montagnon; infrastrutture idrauliche messe in luce negli scavi del tempo; iscrizioni relative alla frequentazione del *fons Aponi* e al suo culto e forse proprio la rappresentazione del dio, barbato e appoggiato a un pilastro su cui si rovescia un vaso, finora conosciuta come 'dignitario' (Bassani 2025, 143-169). L'attributo del vaso rovesciato rimanda a raffigurazioni di Ninfe, personificazioni di fiumi e a divinità delle acque e il confronto con la statuetta di divinità delle acque dal ninfeo di Collazzone sembrerebbe anche sostenere l'identificazione con il dio *Aponus* (Bassani 2025, 160-165), nonostante l'eccezionalità della posizione stante rispetto alla consueta disposizione recumbente del corpo[3]. Pur non potendo escludere che il cd. dignitario stringesse nella mano sinistra un *rhyton* o magari una canna palustre, tuttavia la posizione inconsueta della statua e la mancanza di fuoriuscita di acqua dal vaso rovesciato o quantomeno del gesto con la mano del dio sulla bocca del vaso stesso, quale rappresentazione simbolica della sorgente zampillante, lasciano ancora qualche dubbio sull'attribuzione proposta[4].

D'altro canto, il lavoro di Maddalena Bassani può dirsi tutt'altro che concluso, come suggerito già dal titolo, in cui si fa riferimento al primo volume di una ricerca ancora in corso. La prospettiva è infatti quella di sviluppare ulteriormente temi legati allo sfruttamento delle risorse termominerali per finalità produttive e di definire i contesti esaminati in un quadro più ampio di mobilità dei pellegrini e di trasporto commerciale, in relazione sia alle strutture ricettive che alle attività produttive esistenti, ampliando lo sguardo anche all'Adriatico meridionale e orientale. In questa ottica, paiono particolarmente interessanti da approfondire quelle fasi storiche antiche in cui la complessità economica e gestionale di matrice imperiale non si era ancora affermata o era ormai entrata in crisi, "prima e dopo i Romani" insomma, per ricostruire nuovi tasselli della storia economica e sociale di un *Adriatico Salutifero* ancora da esplorare.

Note

[1] Si pensi per esempio al caso del santuario di Cupra nel Piceno, in Demma, Casci Ceccacci 2020.

[2] Le fonti letterarie di matrice greca sembrano in realtà non conoscere il nome preciso della divinità patrona delle sorgenti, ammesso che un nome già lo avesse (Bassani 2025, 53).

[3] Sui canoni di un tipo di divinità fluviale, fissato in età tardo ellenistica e ampiamente diffuso in epoca imperiale: Klementa 1993.

[4] Klementa 1993 e da ultimo il confronto con la personificazione del fiume Almone in De Cristofaro 2025.

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English abstract

Thermalism in the ancient world was a complex phenomenon in which therapeutic practices, architecture, cult activities, and territorial organization were deeply interconnected, reflecting the central role of water in religious, economic, and social life. Focusing on the Upper Adriatic region, this article examines ancient thermo-mineral springs as structuring elements of landscape and settlement dynamics, with particular attention to the *Fons Timavi* and the *Fons Aponi*. Through an integrated analysis of archaeological evidence, literary sources, mythological traditions, and previously unpublished archival materials, the study highlights the long-term continuity in the exploitation of thermal waters from protohistory through the Roman period. Special emphasis is placed on the role of myth in shaping cult practices and perceptions of the salutary power of springs, as well as on the multifunctional use of thermal waters for therapeutic, ritual, and productive purposes. The article ultimately proposes a reading of thermo-mineral sites as hybrid spaces where natural resources, divine presences, human communities, and economic activities converged, offering a renewed perspective on the cultural and social history of the Adriatic area.

keywords | Ancient thermalism; Upper Adriatic; Thermo-mineral springs; Cult and mythology; Landscape and settlement dynamics.

Ancient Thermalism in the Northern Adriatic.

On a Recent Study by Maddalena Bassani

Rachele Dubbini

Thermalism is a complex phenomenon in the ancient world in which therapeutic practices, architecture, and territorial organisation are intertwined, reflecting the central role of water in therapeutic, cultural, and more generally, economic and social contexts. Therefore, it is not surprising that the bibliography on the subject has grown considerably in recent years, as highlighted in this volume (see Bassani 2025, 1–14; cf. Nocca 2025). Maddalena Bassani's research in the field has long emerged with the aim of interpreting thermal contexts as structuring elements for both the landscape and settlement dynamics in Roman Italy. Last year, Bassani contributed to this body of work with a new monograph entitled *Adriatico salutifero. Archeologia del termalismo al Fons Timavi e al Fons Aponi* (*The salutary Adriatic. Archaeology of thermalism at Fons Timavi and Fons Aponi*), published by "L'Erma" di Bretschneider for the ΑΔΡΙΑΣ series, whose editor I am.

A detailed study of the upper Adriatic was crucial to understand a significant phenomenon in the development of myths and cults that have characterised this area since its earliest phases of human occupation, which were greatly influenced by the Greek and Mycenaean presence (Braccesi 2001; Čače and Tassaux 2006; Capuis 2024, 384–385). As is well known, natural features perceived as extraordinary, such as trees, rocks, caves, springs with unique properties, forests, and so on, are catalysts for ritual activities, since they are all seen as signs of a supernatural or divine presence (Lafond, Michel 2016). The presence of one or more water sources is particularly crucial among all these elements, not only as a privileged *locus* of superhuman power (Servius' *comment ad Aen. VII*, 84, which states that no spring is not sacred), but also since water is related to the various functions it can have within a sacred space (Edlund-Berry, 2024, 638; Klingborg, 2025). Myth therefore helps to give a name to this presence and reveals how territories were used and frequented, even in ancient times. For this reason, Chapter IV retraces the mythological stratigraphy connected with the mineral thermal resources of the ancient Mediterranean as an essential step in the understanding of the relationship between thermalism and the evolution of mythical traditions in the northern Adriatic. In the Timavo area, Diomedes, Hera, and Artemis are central figures in spreading Greek culture and testifying to the health benefits of the springs for both human and animal care. They also played a role in various activities, such as washing fabrics and fibres, lighting, sanitising, and dyeing fibres. In the Aponense area, Antenor, Geryon and Heracles played a similar

role. Researching thermal mineral waters as hybrid spaces where nature, superhuman entities, humans, and animals interact in sacred, therapeutic, and economic activities provides insight into some of the most significant aspects of human existence, not only in ancient times. This allows us to explore the Adriatic territories from a novel perspective.

The decision to conduct research in the Euganean area is motivated by the opportunity to study the ongoing exploitation of thermal mineral resources from prehistory to the present day (Selmin *et al.*, 2009). Bassani's work, therefore, begins with a re-examination of the written sources and archaeological documents relating to the *Fons Timavi* and the *Fons Aponi*. These should be considered as multiple sources of thermal mineral water, providing insight into the potential of local thermalism and the use of the springs as early as the 8th–7th century BC. This use was not limited to therapeutic purposes, but also included economic and productive activities. This can be encompassed within the Greek traditions of the Upper Adriatic area, which highlight the importance of animal husbandry, particularly horses, which were healed through therapeutic baths at the thermal mineral springs. It is perhaps not necessary to emphasise the central role of Diomedes (Braccesi 2001, 39–43) as a mediator between the different cultures that crossed paths at these commercial hubs. However, as far as this cultural context is concerned, it is also important to acknowledge the function of the Altino sanctuary as a hub for the inland lagoon route that connected the Po delta with the Timavo spring. This promoted activities conducive to hippotrophia (Tirelli 2020 highlights the sanctuary's dual purpose in relation to the export and trade of horses). Similarly, it is now widely accepted that several sanctuaries in central Italy served as places of exchange and encounter for different Mediterranean cultures during the Orientalizing period, thus facilitating the creation of long-range trade networks (Bolder-Boos 2016; Michetti 2020; Krämer 2023; Chankowski 2025). The same was true of the Adriatic[1], where the presence of health-giving elements would have attracted 'foreigners', further strengthening these economic circuits. In this cosmopolitan context, the cult in Timavo was quickly Hellenised, and the same occurred at the Euganean springs alongside the deity *Aponus*. Here, the figures of Geryon and Hercules also appeared[2]. In both cases, it was precisely the multifunctionality of the thermal mineral springs, especially with regard to livestock breeding, that enabled these centres to evolve over the centuries as 'activators' of the nearest maritime port hubs. This led to the proliferation of increasingly complex settlements and, following the Romanisation of the area between the end of the 3rd and 2nd centuries BC, to the development of a sophisticated thermal and health tourism industry, enhanced by Roman technology and the improvement of knowledge in medicine and architectural engineering. This is evidenced in literary sources and archaeological findings. It led, besides, to the development of a well-structured thermal and health tourism industry, enhanced by Roman technology and the refinement of medical and architectural engineering knowledge, as evidenced by literary sources and archaeological findings until the end of the imperial age (Bassani 2025, 80–81).

The volume's distinctive feature is its integrated approach to the subject matter. The archaeological interpretation is extensively supported by archival sources, combining written and

material information with manuscript sources to reconstruct the analysed contexts as thoroughly as possible. The second part of the book presents a series of reflections and comments on an unpublished, incomplete manuscript by Giovanni Lavagnoli (1773) on the antiquities of the thermal mineral springs in the Euganean area. A summary of this text can be found in Appendix 1 of the volume. Moreover, Appendix 2 presents Zanetti's complete, unpublished memoir on the statue of the so-called dignitary from Montegrotto Terme. Lavagnoli's writings are particularly valuable because they give details on several discoveries that have not yet been considered in relation to the study of the Euganean territory, including a series of ex-votos found in the now-disappeared Lake S. Pietro Montagnon – a hydraulic infrastructure brought to light during excavations at the time – and inscriptions relating to the use of the *Fons Aponi* and its cult. Perhaps most notably, they detail the representation of the bearded god, leaning against a pillar with an overturned vase, known as the 'dignitary' (Bassani 2025, 143–169). The overturned vase is a common attribute in depictions of nymphs, personifications of rivers, and water deities. The comparison with the statuette of the water deity from the nymphaeum of Collazzone also supports identification with the god *Aponus* (Bassani 2025, 160–165), despite the unusual standing position compared to the usual reclining position of such deities [3]. While we cannot rule out the possibility that the dignitary was holding a *rhyton* or a marsh reed in his left hand, the statue's unusual position and the absence of water spilling from the overturned vase, or at least the god's hand gesturing towards the vase's mouth as a symbolic representation of the gushing spring, cast doubt on the proposed attribution[4].

All in all, however, Maddalena Bassani's work is far from complete, as suggested by the title, which refers to the first volume of an ongoing research project. The aim is to further develop themes related to the exploitation of thermal mineral resources for productive purposes, defining the contexts examined within a broader framework of pilgrim mobility and commercial transport in relation to accommodation facilities and existing productive activities. The scope will be extended to the southern and eastern Adriatic. In this context, it is particularly interesting to explore those ancient historical phases in which the economic and managerial complexity of the imperial system had not yet been established or had already entered a period of crisis. In short, we need to consider "before and after the Romans" in order to piece together the economic and social history of a *Salutipherus Adriatic* that remains largely unexplored.

Notes

[1] See, for example, the case of the sanctuary of Cupra in Piceno, in Demma, Casci Ceccacci 2020.
[2] Greek literary sources do not seem to know the precise name of the patron deity of the springs – assuming it had a name (Bassani 2025, 53).
[3] On the canons of a type of river deity, established in the late Hellenistic period and widespread in the imperial era, see Klementa 1993.

[4] Klementa 1993 and, most recently, the comparison with the personification of the river Almone in De Cristofaro 2025.

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Abstract

Thermalism in antiquity constituted a complex cultural system in which therapeutic practices, architectural forms, cult activities, and territorial organization were structurally intertwined, reflecting the centrality of water in religious, economic, and social life. Focusing on the Northern Adriatic, this article investigates thermo-mineral springs as active agents in landscape formation and settlement dynamics, engaging in critical dialogue with Maddalena Bassani's recent study, which places particular emphasis on the *Fons Timavi* and the *Fons Aponi*. Through an integrated analysis of archaeological data, literary testimonies, mythological traditions, and previously unpublished archival materials, the study reconstructs long-term patterns in the exploitation and conceptualization of thermal waters from protohistory to the Roman period. Particular emphasis is placed on the role of mythopoetic narratives in shaping cult practices and framing the perceived salutary efficacy of springs, as well as on the multifunctional character of thermal sites, which operated simultaneously as therapeutic, ritual, and productive spaces. This interpretive framework advances a renewed perspective on the cultural and socio-economic history of the Northern Adriatic, viewing thermo-mineral contexts as hybrid nodes where natural resources, divine agency, human communities, and economic activities converged.

keywords | Ancient thermalism; Upper Adriatic; Thermo-mineral springs; Cult and mythology; Landscape and settlement dynamics.

New Displays for the Bronzes of San Casciano dei Bagni. Reggio Calabria, Berlin and Aquileia

Massimo Osanna, Jacopo Tabolli
in collaboration with Chiara Bonanni and Guglielmo Malizia

1 | Apollo at Palazzo del Quirinale, photo by Emanuele Antonio Minerva – MIC.

In previous issues of "La Rivista di Engramma" (Tabolli 2023; Osanna, Tabolli 2024b), we have presented the exhibition trajectory of the Bronzes of San Casciano, starting from their display at the Quirinal Palace in Rome (Osanna, Tabolli 2023) and at the National Archaeological Museum of Naples (Osanna, Tabolli 2024a).

As the excavation at the Etruscan and Roman of Bagno Grande at San Casciano dei Bagni continued (Mariotti, Salvi Tabolli 2023; 2025) between August 2024 and March 2025, the exhibition was presented at the National Archaeological Museum of Reggio Calabria (MArRC),

within a radically different spatial context (Osanna, Tabolli 2024-2025). The exhibition enters into dialogue both with the identity of the museum itself – as the home of the Bronzes of Riace – and with contemporary approaches to context-oriented archaeological museography. As in the previous displays, the exhibition design was conceived as a temporary intervention capable of constructing a contextual narrative device, rather than a mere display of excavation assemblages. The layout organizes the artefacts along a path that places the thermo-mineral context of the Bagno Grande sanctuary and the processual dimension of archaeological research at its core, guiding visitors "through the landscape of sacred waters" and its historical and cultural stratifications. The exhibition sequence – structured as a spatial-temporal progression, beginning with a section dedicated to the territory and the history of research and followed by a focused exploration of the votive deposits – integrates statues, small bronzes, and anatomical offerings as evidence of ritual and therapeutic practices. This approach reinforces a "choral" reading of dedications and inscriptions – the "voices" of the dedicants – transforming the visit into an interpretative reconstruction of the site.

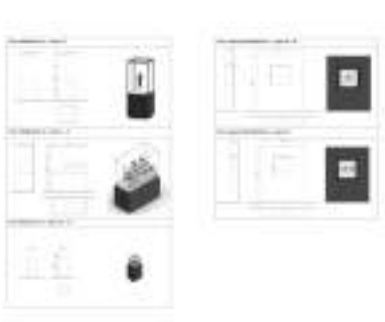
At the James-Simon-Galerie in Berlin, the exhibition *The Bronzes of San Casciano dei Bagni. A Sensation from the Mud* (5 July-12 October 2025), conceived together with colleagues Martin Maischberger and Agnes Schwatzmeier (Osanna *et al*. 2025), proposed an exhibit design that highlights the exceptional nature of the archaeological finds through a carefully calibrated dialogue between ancient art and contemporary museum space. Installed within the large galleries dedicated to temporary exhibitions, the arrangement of the bronzes does not merely replicate the sequence of their discovery, but instead constructs a spatial continuum that invites visitors to traverse a kind of "ritual landscape," evocative of the ancient Etruscan-Roman sanctuary of San Casciano dei Bagni, while also engaging in dialogue with materials from the territory of the ancient Etruscan city-state of Chiusi preserved in the Berlin collections. The works - from cult statues to small votive bronzes – are presented with rigorous attention to three-dimensional visibility, narrative sequencing, and their relationship with the architectural surfaces of the Galerie. The exhibition design – abandoning the aquatic blue tones that characterized previous installations and recontextualizing the objects within a black spatial environment - exploits overhead light and the open volume of the galleries to create contrasts and perspectives that enhance the material presence of the bronzes and the sense of discovery. Didactic panels, bilingual captions, and neutral chromatic choices support the historical and cultural legibility of the artefacts, here exhibited outside Italy for the first time. The architecture of the James-Simon-Galerie, with its large volumes and modern language, thus becomes not merely a container but an active interpretative device, capable of accompanying the visitor from the formal perception of the sculptures to their ritual and anthropological contextualization.

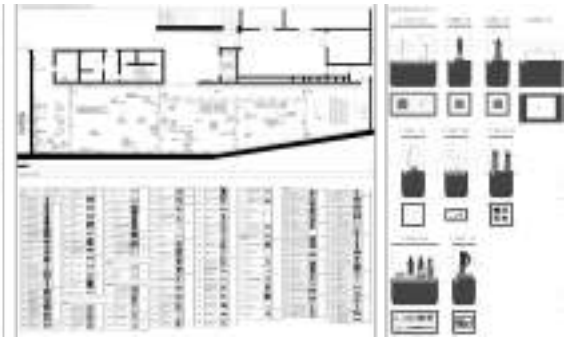
In its most recent stage at the National Archaeological Museum of Aquileia, from 5 December 2025, the Bronzes of San Casciano dei Bagni are presented within an exhibition layout (Osanna and Tabolli 2025-2026) organized in the new musealized storage areas, redefined as temporary exhibition spaces (in the project by Studio Modland) while remaining fully in-

tegrated into the museum's structure. This setting reflects a curatorial strategy aimed at simultaneously enhancing the material and documentary richness of the largest deposit of Etruscan and Roman bronzes ever discovered in Italy. The exhibition design exploits the vertical and horizontal spatiality of the storage areas – also characterized by rich mosaic pavements – transforming an environment traditionally dedicated to conservation into a narrative device in which more artefacts, including those from the 2024 excavation campaigns presented to the Italian public for the first time, engage in dialogue with one another and with visitors. Statues, votive figurines, anatomical offerings, and coins are arranged in display cases and niches that recall the stratification of the original discovery context, evoking the presence of sacred waters and the centrality of thermal ritual practices within the sanctuary of San Casciano. The exhibition further exploits the darkening of the storage lighting system, deliberately suspending the usual visibility of the deposits to create a sharp contrast between the fully illuminated bronzes of San Casciano and the surrounding display of stored materials, perceived as "ghosts of things." Far from a merely atmospheric effect, this choice establishes a high-level, intellectual dialogue based on meta-references between presence and absence, visibility and latency. The musealized deposits thus function not as a background, but as a parallel, reflective layer, proposing a kind of second, implicit itinerary that runs alongside the exhibition path – one that invites visitors to reflect on the status of archaeological objects, the conditions of their preservation, and the shifting boundaries between exhibition, storage, and interpretation. The decision to exhibit the bronzes within museum storage spaces is far from neutral: it overturns the traditional hierarchy between spaces of conservation and spaces of display, proposing a process of scientific and museographic legitimization that emphasizes the provenance, chronology, and ritual functions of the objects, enriched by interpretative tools intertwining typological, epigraphic, and contextual perspectives. Beyond offering a rich and layered visitor experience, this exhibition foregrounds the relationship between archaeological heritage and the new museological use of storage spaces, contributing to the contemporary debate on exhibition architecture and the musealization of archaeological materials.

Across its successive displays, the Bronzes of San Casciano dei Bagni emerge not as fixed masterpieces but as a dynamic archaeological corpus whose meaning is continuously rearticulated through exhibition design: in Reggio Calabria, Berlin, and Aquileia, architecture, light, and spatial sequencing become integral to the interpretation of the sanctuary itself, allowing the material evidence of ritual, healing, and deposition to be re-read through a series of site-specific, yet conceptually coherent, museographic translations

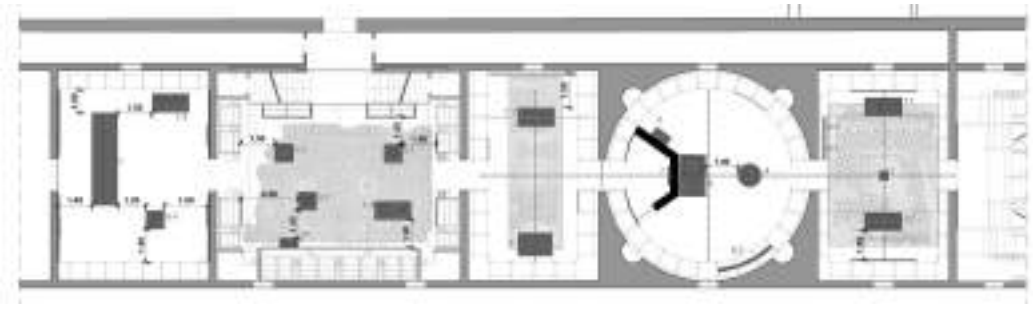
2 | The exhibit at MANN Naples, photo by Emanuele Antonio Minerva – MIC.
3 | Encountering the thermo-mineral spring at MANN, photo by Emanuele Antonio Minerva – MIC.



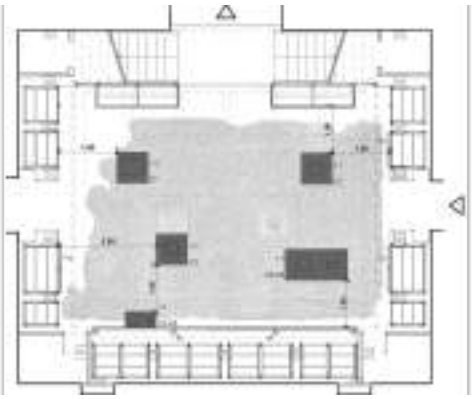


4 | Designing the display at Museo ARcheologico Nazionale in Reggio Calabria (© Decima Casa).
5 | James Simon Galerie in Berlin, General Plan (© Decima Casa).
6 | James Simon Galerie in Berlin, microsetting of the Sacred Pool (© Decima Casa).

7 | James Simon Galerie in Berlin, discoveries on display, 2024 (© Decima Casa).
8 | Entering the exhibit at MAN Aquileia (© Decima Casa).



9 | General Plan of the exhibit at MAN Aquileia (© Decima Casa).


10 | Aphrodite and the altars at MAN Aquileia (© Decima Casa).
11 | The storages on Display at Man Aquileia (© Decima Casa).
12 | Views on the oranti at Man Aquileia (© Decima Casa).

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Abstract

This article examines the successive exhibition displays of the *Bronzes of San Casciano dei Bagni* in Reggio Calabria, Berlin, and Aquileia, focusing on how exhibition design functions as an interpretative and narrative tool rather than a neutral framework. Across these three contexts, the bronzes are presented through site-specific museographic strategies that emphasize ritual practice, sacred waters, and the processual nature of archaeological research. The exhibitions articulate different relationships between objects, space, and architecture: from the context-oriented narrative at the National Archaeological Museum of Reggio Calabria, to the immersive and monumental staging at the James-Simon-Galerie in Berlin, and finally to the reflexive use of musealized storage spaces at the National Archaeological Museum of Aquileia. Together, these displays demonstrate how contemporary archaeological museography can reconfigure the meaning of an archaeological corpus, transforming the bronzes from isolated masterpieces into a dynamic assemblage whose interpretation evolves through spatial sequencing, light, and curatorial design.

keywords | Archaeological museography; San Casciano dei Bagni; Exhibition design; Sacred waters and ritual practice; Musealized storage spaces.