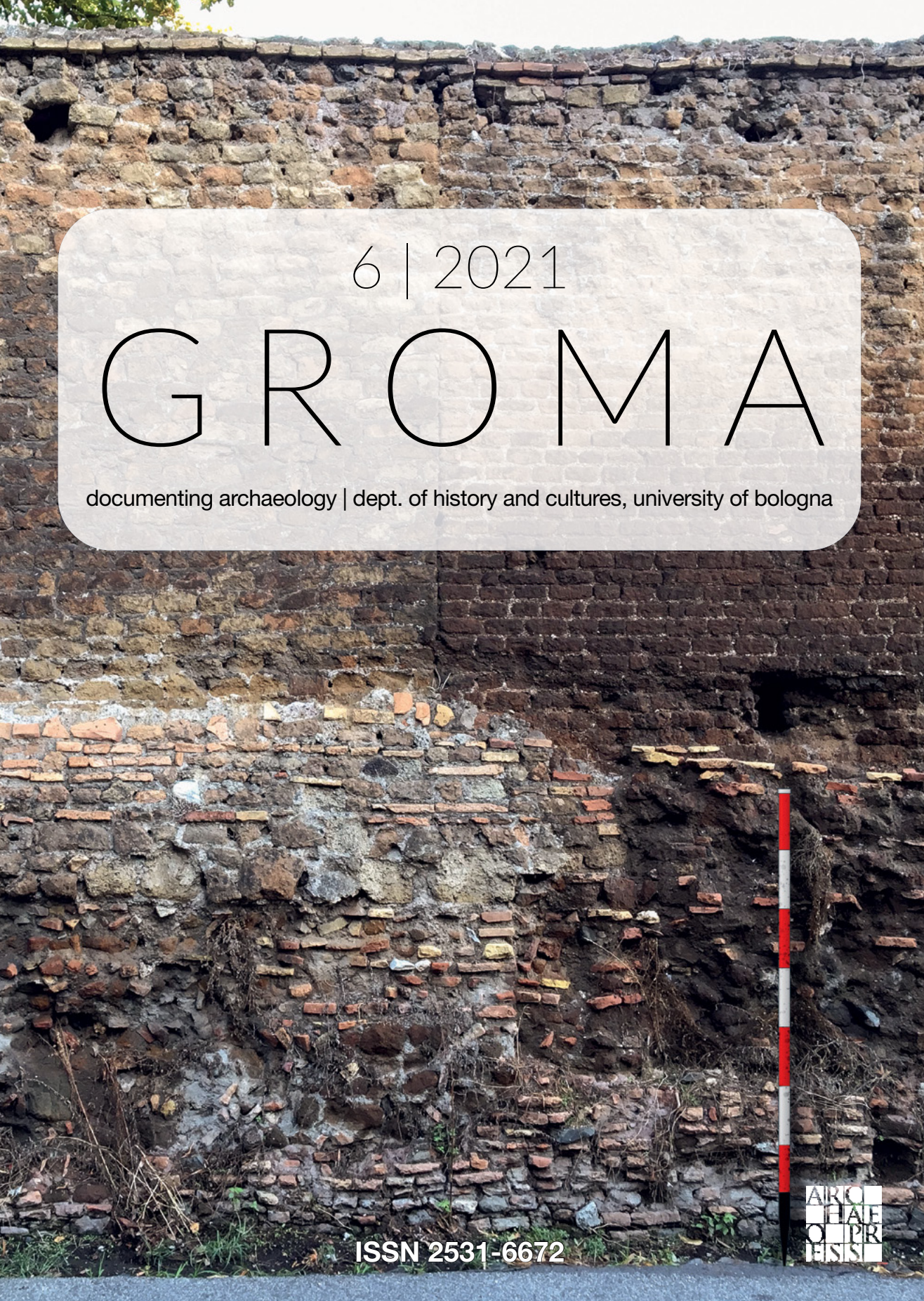

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The use of mudbricks and earth in modern Umbrian architectures: a preliminary report

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Abstract

The paper concerns with the use of unbaked bricks and clay in late medieval and early modern architectures in Umbria. In this central Italian region, a few structures are featured by such building materials, especially in areas lacking in good stone deposits. The topic has been sporadically investigated by previous studies and awaits systematic approaches. In particular, it is necessary to clarify the chronology of these building technologies and, regarding unbaked bricks, their relationship with the local baked production. Many different types of evidence will be considered: written sources, historical cartography, stratigraphic data, chrono-typological and mensio-chronological serialisations. Therefore, such focus fully locates the research within the borders of architectural archaeology. The expected goal is specifying the socio-economic, technical and chronological context in which clay-based techniques were developed and used. The paper also aims to enhance the attention and supervision on this type of material culture by related public institutions.

Keywords

Unbaked bricks, perishable materials, masonry techniques, brickmaking, mensio-chronology.

The role of earthen techniques in ancient and early medieval architecture is well-known in archaeological studies, due to ever growing discoveries.[1] What is less prominent is the use of earth across the late Middle Ages and the modern period. Earthen architectures have been registered in rural contexts of several Italian regions, with a particular frequency during the 18th and 19th century.[2] To introduce the topic, earthen building techniques can be divided into two main categories:[3]

- Rammed earth techniques (also known as pisé), built by pressing clay-based earth within wooden formworks.
- Masonry in unfired bricks (also known as earth bricks, mudbricks, or adobe), which is identical to brickwork, with the only exception that bricks were not fired.

A third typology is a mix of earthen solutions and fired bricks or stones. In most cases, the base of the structure was built in unperishable materials (usually bricks and lime), to shield earthen fabrics from ground humidity.[4] A similar protection was achieved through plastering the surface of the wall.[5]

[1] An overlook on the ancient use of these techniques is available in Cagnana 2000, 90-92; Saracco 2010, 22-24; Santangeli Valenzani 2015, 55, 57-58, 66, 110-112.

[2] Studies on different regional areas can be found as follows: on Piedmont, Pagella Poggio 1992; on Marche, Saracco 2010; on Tuscany, Francovich, Gelichi, Parenti 1980, 207-217; on Abruzzo, Mazzanti 2012; on Sicily, Germanà 2015.

[3] On these two categories and possible variants, see Pagella Poggio 1992, 11-20; Cagnana 2000, 89-90; Mazzanti 2012, 540; Pittaluga 2012, 699.

[4] Del Rosso 1793, 25; Pagella Poggio 1992, 13; Saracco 2010, 66; Mazzanti 2012, 540.

[5] Del Rosso 1793, 29; Pagella Poggio 1992, 24; Cagnana 2000, 90.

This paper deals with the use of unfired bricks and other clay-based architectural solutions in Umbria (central Italy), a region where these masonry techniques are widely unacknowledged. This research aims to offer a preliminary survey of the remains of such building practises, in parallel with what has been done in neighbouring regions (Saracco 2010, 29), and to investigate the chronology of the surviving evidence: an essential historical information affected by a series of methodological issues.

State of the art in Umbria

At present, there has been little attention on earthen structures in Umbria. Besides studies on other regions that have 'accidently' mentioned Umbrian structures, the list of 'recent' contributions on earthen structures is very limited. In first instance, studies by Henry Desplanques (1955, 81) and Bernardino Sperandio (2010) have briefly mentioned earthen masonry. Desplanques mostly profited of a 1934 survey edited by the Central Institute of Statistics of the Italian Kingdom. This study recorded 52 rural structures built in earth and greenery ('Case in terra e fogliame') in Umbria. Since 47 out 52 were meant to be demolished, the report showed the poor conditions of these structures at the time (ICSRI 1934, 19). At the same time, the document did not consider dwellings built of both earth and unperishable materials: a very common occurrence as shown below. According to Sperandio, earthen architectures became common during the 19th century due to economic reasons (Sperandio 2010, 421 and 424). However, the author fails to provide clear evidence for this assumption. Umbrian earthen structures are also briefly mentioned in the survey on these building techniques in Marche region by Marco Saracco (2010, 24). This author suggested a late 19th-early 20th century chronology for some rammed earth structures noted in the Trasimeno area.

Published sources on earthen building in Umbria.

During the Roman period, mudbricks were used in the region as documented by Pliny the Elder on the walls of Mevania, nowadays Bevagna (Plin., HN 35.173) and by recent archaeological discoveries (Ceccarelli 2018, 35-39). When the attention is focused on the late medieval and early modern period, written and archaeological evidence is rather scarce, mostly due to the lack of archaeological research on these chronologies in Umbria. However, two 18th century sources provide an interesting insight on two specific areas of the region: the Trasimeno Lake and the southern Umbrian Valley.

Around 1745, the local historian Durastante Natalucci testified the abundance of earthen houses in the valley near Trevi (central-eastern Umbria), by the villages of Cannaiola and Picciche:

> *'...the dwellings [of Cannaiola], basically everywhere, are made of fired bricks while, according to the elder, they were earthen, as it can still be noticed in same places.' (Natalucci 1985, 411).*

> *'...the people's houses [in Picciche] ... are all humble and mostly made of earth.' (Natalucci 1985, 430).*

Earthen structures were therefore relatively common around Trevi, but they were already being replaced by buildings made of unperishable materials, and only lower social strata continued to use them.

In the same century, Umbrian earthen structures are briefly mentioned by Giuseppe Del Rosso in his 1793 manual on the reintroduction of similar building techniques in Tuscany. When discussing the use of earthen houses among the farmers of the Chiana Valley, he testified the use of mudbricks in the Papal areas just outside the Tuscan border, along the Trasimeno Lake, together with the wide use of clay instead of lime as binding material (Del Rosso 1793, 47-50, 58-59, and 65).

Survey of the written and archaeological evidence

Surveying the remains of the earthen architectures across the region is fundamental for understanding the significance of such techniques in the local pre-contemporary landscape. A similar approach, also considering oral testimonies of the local population when available, has been carried out in other Italian areas (Pagella Poggio 1992, 70). At present, Umbria still lacks a comprehensive study on the topic. However, it is possible to offer an initial list of sites where earthen buildings have been noted, both by previous studies and by the present one (fig. 1).

1. North-eastern borders with Marche region. Earthen huts are documented as shelters for refugees from the village of Sigillo in a nearby woodland in 1943-1944 (Cristofaro 2009, 134).
2. Trasimeno area. Besides being testified by Del Rosso at the end of the 18th century,[6] earthen structures in this area have also been noted by M. Saracco (2010, 24), who records the presence of late 19th-early 20th century buildings. Based on the surviving evidence, earthen structures are part of farmhouses and other rural buildings.
3. Countryside around Perugia. It has been possible to survey two earthen structures around the main Umbrian town. The first one is located about one kilometre south-east of Torgiano, along the Assisana Road.[7] Another mixed-technique structure, partially in rammed earth technique, has been surveyed in front of the church of San Cristoforo of Piscille, on the hillside near Perugia.[8] Both the Torgiano and the Perugia buildings will be analysed in detail in the following section.
4. Countryside of Trevi. Besides Natalucci's testimony above (1745), it has been possible to survey five structures partially composed of mudbricks. Two of them are in the village of Picciche, one in Cannaiola, one in San Luca and another one in nearby Fratta (within the municipality of Montefalco since 1816).[9] They can all be interpreted as modest residential buildings. In Picciche, oral witnesses document other earthen structures identified during restoration works.[10] In the same village, another structure (seemingly an isolated aristocratic dwelling) is built with fired bricks bound with clay.[11]
5. Countryside around Montefalco and Bevagna. The presence of earthen huts in the countryside between these small towns was witnessed by Desplanques (1955, 81).

[6] Del Rosso 1793, 65: 'In those areas of the Papal States located beyond the China River, in the district of Castiglion del Lago...almost every country house scattered there, and even the manors belonging to very wealthy men are composed of fired bricks. Besides the base of the building, they are almost entirely built with no lime as it is scarce there, so the portion above the ground is laid with earth'.

[7] It is possible to find the building at the following coordinates: WGS84 43.035252, 12.448580 (Assisi Road).

[8] It is possible to find the building at the following coordinates: WGS84 43.095431, 12.406877 (39, Assisana Road).

[9] These structures can be found at the following coordinates: 42.847776, 12.700014 (Picciche, Via Tatarena – Via dello Scalone); 42.844190, 12.698345 (Santo Stefano Road); 42.862198, 12.711847 (Cannaiola, Via Sant'Angelo Nuovo, 47); 42.857223, 12.699151 (San Luca, Le Selvette); 42.845426, 12.687598 (Castle of Fratta).

[10] I must thank Mr. Manfredo Borasso, builder from Trevi, who informed me (11/12/2021) of having found other earthen fabrics during some restoration works in one of the buildings along Tatarena road in Picciche.

[11] 42.842380, 12.697614 (Picciche, Via Santo Stefano).

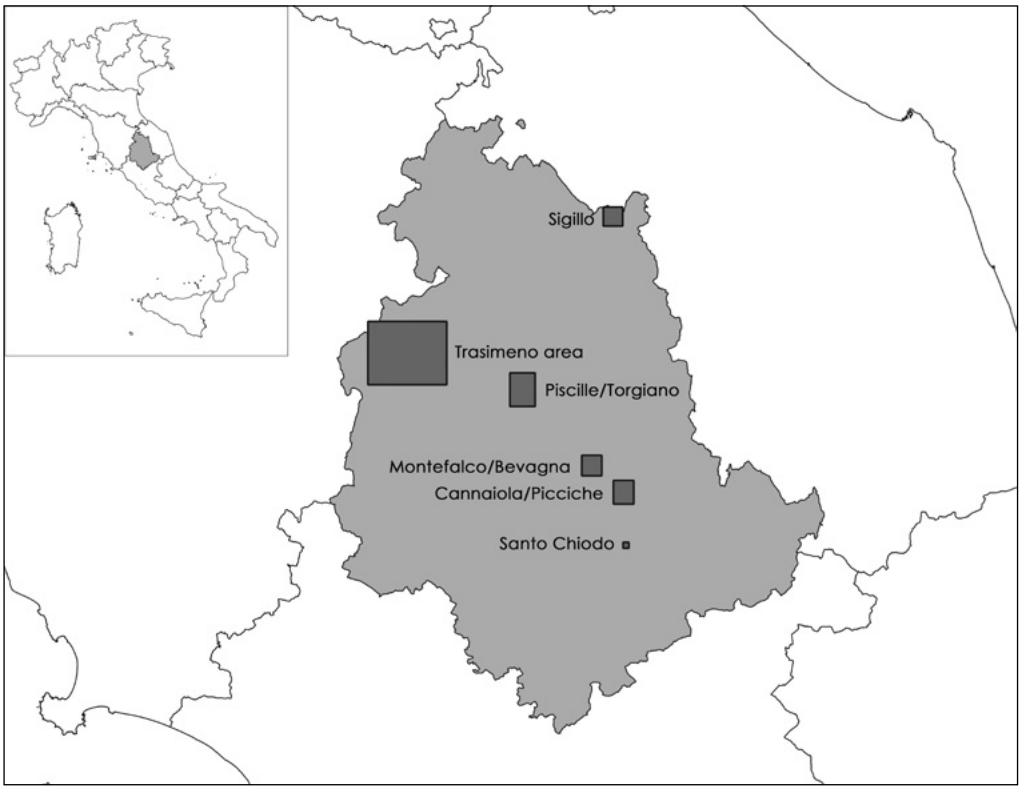

Figure 1. Location of sites and districts mentioned in the paper.

In 2013, I recorded the oral testimony of a farmer, born and raised in the village of Pietrauta, two kilometres west from Montefalco.[12] He recalled the presence of a hut (approximately 4x5 m) built with 'mud and hay'. According to the elder of the village, it was the house of local farmers. In ca. 1940, the structure was reused as a shelter for farmers and animals during heavy rains. This had brought to alterations of the original structure. It has not been possible to clarify the exact location and possible remains of the hut.

6. Rural surroundings of Spoleto. The only structure recorded here is the shed of a farmhouse, which was photographed in the 1970s (Gentili et alii 1978, 601). The picture shows the poorly preserved remains of a rammed earth structure. It has not been possible to ascertain if the structure still exists at present.

[12] Oral testimony recorded on 29th September 2013: '*Erano fatte de paja e fango, terra erano arde un pajo de metri; ce ija dentro le persone con tutte le vacche, il tetto era de cóppi. Stijano a Montefargo quando stijo a garzone di sotto a Pietrauta, jú per quilli campi, ce stija 'sta capanna che dicijono li vécchi che ce erano abitate le persone llì; doppo l'ijono trasformata in capanna, pe' quanno piovija se ija jú. L'ho conosciute, dunque, che c'avrò avuto 16-17 anni* (1944-45). *Ijono missu li travi de legno: uno dietro, uno in mezzo e uno davandi e bastoni a regge' 'sti cóppi; ce stijano travi lunghi che attraversavano e 'sti bastuni che reggijono li cóppi stijano per quest'andru versu. Saranno state quattro per cinque, una ventina de metri de spazio. Lu pianu era terra. Non ci stijano mattuni: se erano stati lehati o se era creata a quella maniera, era tuscì. Li vécchi s'arcordavano che c'erano abbitate* (le persone), *dice, fino a pocu tempu fa, mica tant'anni prima! Ci stija 'na finestrella da 'na parte, chisà se pe' lu pezzu davanti che ijono levatu se ci stija quarghe andra finestra, perché pe' entra co' le vacche dentro duvija apri' davanti. Davanti stija apertu e le tre mura, ce stijono li fianchi e lo dietro e da 'na fiancata ce stija 'na finestrella...*' (interviewer: Stefano Bordoni; witness: Nazzareno Bordoni, 1927-2018).

This short list of evidence confirms the survival of these techniques into the early 18th- 20th centuries.

Dating the archaeological evidence

The dating of earthen structures has been discussed in recent years in academia, stressing out the many problems related to the use of traditional methods (Mannoni 1984). Compared to other building techniques, earthen structures present objective difficulties (Pagella Poggio 1992, 70-72; Pittaluga 2012, 700-701; Pittaluga, Pagella 2014, 6-7). For example, the rarity of architectural elements valid for chrono-typological purposes or the still debated validity of mensio-chronological approaches when applied on mudbricks (Pittaluga, Pagella 2014, 7). On the one hand, chrono-typology often loses part of its efficacy in vernacular structures (Brogiolo 1988, 31-32); on the other hand, mensio-chronology is only valid for standardised productions under specific norms (Mannoni, Milanese 1988), which must yet be confirmed for mudbricks. To present, important elements receiving a certain consensus for the chronology are the following:

- use of dating graffiti on the earthen fabric;
- use of dating finds within the earthen fabric;
- chrono-typological evidence, when stratigraphically connected;
- dated plasters;
- oral interviews;
- written sources
- historical maps.

These elements have various chronological significance. In particular, the presence of a certain building in historical maps does not provide evidence on the identification of preserved portions as the ones drawn on the map (Pagella Poggio 1992, 71). Absolutely or relatively dated plasters exclusively allow an ante-quem chronology for the wall underneath (Pagella Poggio 1992, 74). Considering both methodologies and limitations, some of the most informative structures surveyed in Umbria has been analysed to specify their period of construction.

Torgiano – Assisana Road (fig. 2)

It is a typical farmhouse with external stairs for the second floor, originally built with rammed earth, alternated to rows of fired bricks. The building's owner, Mr. Luciano Cardinali, reported that the masonry was already there in the 1960s, when his family moved in.[13] The building is represented in the 1820 maps of the so-called Gregorian Cadastre, and the planimetry seems to mostly overlap with the present structure.[14]

The stratigraphic analysis of a highly indicative selection of the fabric has provided more chronological information. The rammed earth structure was restored twice with a similar masonry technique before a third significant intervention in bricks and lime. Data collected from the southern façade of the building suggest that this restoration followed an event causing a significant structural damage. Two breaches occurred across the wall and the roof

[13] I am grateful to Mr. Cardinali for having allowed me to access his property and the information he provided.
[14] Perugia, Archivio di Stato, *Catasto Gregoriano*, folder 162 (Torgiano II, 7/4), map 4, parcel 387.

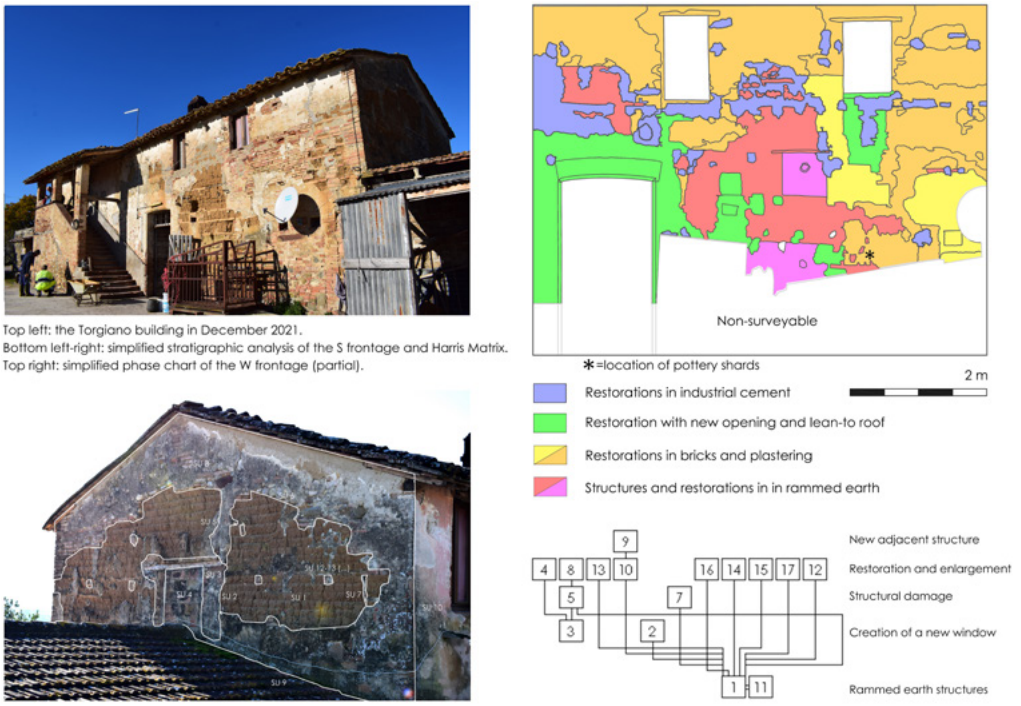

Figure 2 (a-d). The Torgiano farmhouse (stratigraphic details, Harris matrix and relevant building phases).

was completely reconstructed (SU5 and SU7). Consequently, the building was also replastered. Three pottery fragments have been noted on the nowadays eroded surface of the plaster. Although scarcely indicative, they belong to the bottom of an undiagnostic glazed pot and the handle of a slip-painted basin (18th-19th cent.?).[15] This event preceded another building phase featured by the creation of the external stairs and a lowered-arch door, often used in utilitarian architectures in Umbria between the late 19th and early 20th century.

Trying to understand the structural damage shown by the stratigraphic palimpsest, it is possible to propose earthquakes as most likely causes. Although Umbria is a highly seismic area, the only telluric event causing damage around Torgiano in modern times is the one registered in January 1832 (estimated 6.3 Mw). For example, the near centre of Bettona (4 km from the building) suffered effects classified as an 8 degree on the Mercalli scale.[16] Such destructive power is capable of considerable damage in ordinary buildings and even greater damage in poor ones (Brazee 1978, 52-53). A seismic interpretation is further favoured by the limited seismic resistance of the rammed earth, according to recent studies (Gallego, Arto 2015). Considering these chronological elements, it is possible to propose a chronology earlier than the first half of the 19th century for the Torgiano earthen structure.

[15] On this class in Umbria, see Busti, Cocchi 1996, 42-49 and Bordoni 2021 b, 184-186.
[16] Guidoboni, E. et al. 2018, 'CFTI5Med, Catalogo dei Forti Terremoti in Italia (461 a.C.-1997) e nell'area Mediterranea (760 a.C.-1500).' *Istituto Nazionale di Geofisica e Vulcanologia.* URL: http://storing.ingv.it/cfti/cfti5/quake.php?05892IT. DOI: https://doi.org/10.6092/ingv.it-cfti5.

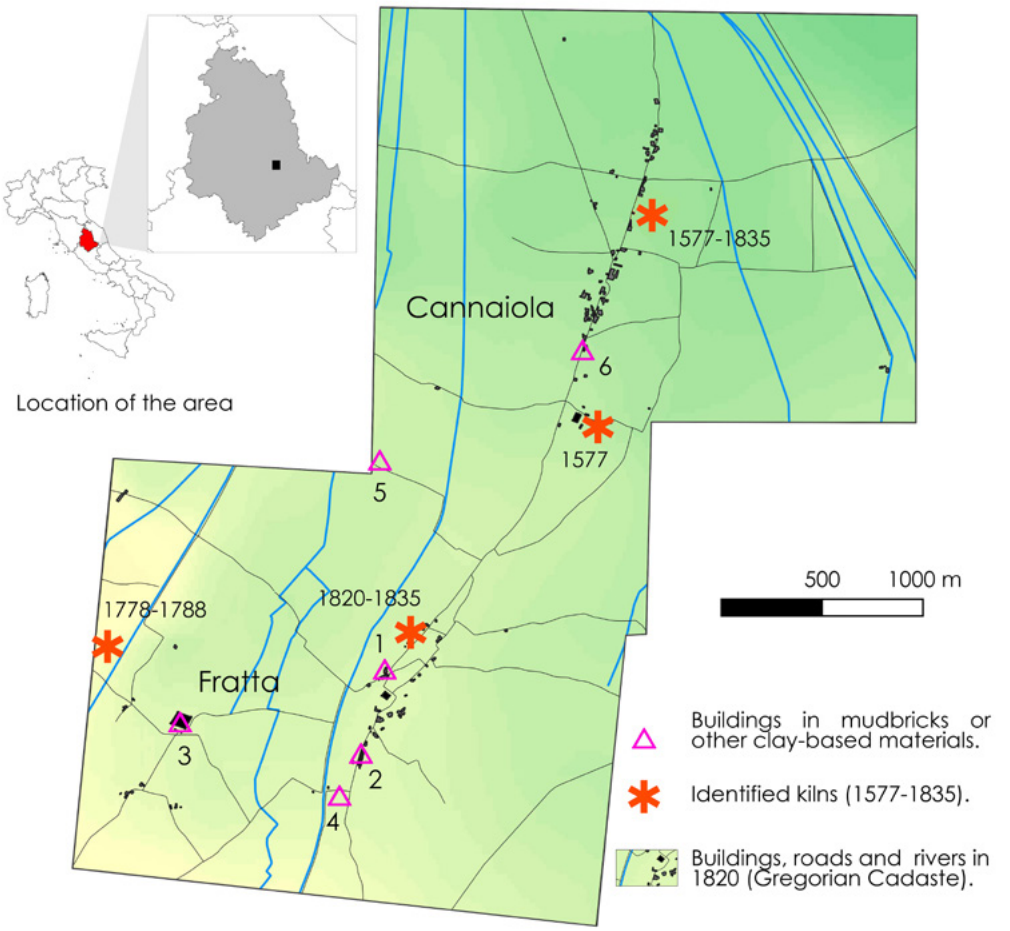

Figure 3. The Cannaiola-Picciche-Fratta district with the locations of mudbrick structures and identified kilns.

Picciche – Tatarena road (fig. 3, 1)

It is a residential building with farming facilities, located outside the castle of Picciche, a settlement entirely reorganised around 1516 (Natalucci 1985, 430). The earthen portion is built with accurately shaped mudbricks, sparsely alternated to rows of fired bricks. The first floor of the building is made of fired bricks, creating a valid isolation for the earthen masonry. The building is already represented in the 1820 maps of the Gregorian Cadastre.[17] On the other hand, drawings of the castle by Cipriano Piccolpasso (ca. 1575) do not represent buildings in the area surrounding the castle walls (Piccolpasso 1963, tab. XVI). The only noticeable element in the present-days façade, which follows the rounded shape of the road, is a painted chapel dating back to the early 16th century according to some authors (Quirino 1987, 87). The plaster covering most of the wall surface does not allow the understanding of

[17] Spoleto, Archivio del Consorzio della Bonificazione Umbra, *Catasto Gregoriano*, folder of San Lorenzo and Picciche, map 5, parcel 737.

the stratigraphic relationship between this chapel and the rest of the building. However, the stratigraphy shows that the red-painted plaster covering the façade is clearly later than the paintings of the chapel.

Further information can be provided by the first floor of the building, built in fired bricks. These are all reused bricks, but relatively homogenous in terms of size. This is probably due to the reuse of construction material from a single building. When analysed, they generate a 29.8x4.8 cm average, which is comparable to the 29.9x4.8 cm average from the Villa Faustana near Borgo Trevi (4 km NE from Picciche), dating back to 1569. This further confirms a chronology equal or later to the mid-16th century for the portions in mudbricks, in accordance with what said above.

Picciche – Santo Stefano Road (fig. 3, 2)

It is a house block, about 100 m south from the church of Santo Stefano. Mudbricks, now badly eroded, appear regularly shaped. They were coated with fired bricks laid as shiners, stone slabs and/or plaster to increase their insulation. These structures are not very informative on absolute chronology. As it appears on historical maps, the entire block was already built in 1820[18] and some of its portions are chrono-typologically datable to the late 17th-early 19th century. However, the stratigraphic relationship between mudbrick fabrics and this part is unclear. One of the two mudbrick units shows an evident 20th century restoration with concrete blocks and a steel lintel.

Picciche – Santo Stefano Road (fig. 3, 4)

An aristocratic cottage is located on the border between Picciche and Castel San Giovanni. Although being built with fired bricks, the binding material is composed of clay. From a chrono-typological point of view, the architectural elements of the building suggest a late 18th century chronology (rounded windows, T-shaped jack-arch windows). However, the building is absent from the 1820 cadastre.[19] Therefore, we must assume that it was built later, in the 19th century, probably within the first half.

Cannaiola – 47, Sant'Angelo Road (fig. 3, 6)

Rectangular structure along the road, mostly plastered. The building does not show any chronologically indicative feature. Where the plaster has fallen, just underneath the roof, it is possible to see the wall fabric, composed of brick and mudbrick portions. The building is represented in the 1820 Gregorian Cadastre already with the current planimetry.[20]

San Luca – Le Selvette (fig. 3, 5)

It is a rectangular farmhouse with external stairs to the second floor, just few meters from the present municipal border between Trevi and Montefalco. Where the plaster has fallen, it is

[18] Spoleto, Archivio del Consorzio della Bonificazione Umbra, *Catasto Gregoriano*, folder of San Lorenzo and Picciche, map 8, parcels 524-526.
[19] Ibid., *Catasto Gregoriano*, folder of San Lorenzo and Picciche, map 7, parcel 849.
[20] Ibid., *Catasto Gregoriano*, folder of Cannaiola, map 8, parcel 263.

possible to notice vast portions in mudbricks. Other parts of the structure are made of bricks laid as rowlocks, most likely to protect the core of the masonry in mudbricks. The building is not represented on the maps of the Gregorian Cadastre. Little can be said in terms of chrono-typology, besides the general typology of the farmhouse that should date back within the first half of the 20th century. However, it has not been possible to closely inspect the building, which lays in a private property.

Fratta – Structure within the castle walls (fig. 3, 3 and 4)

It is a small residential building located within the defensive system of Fratta, a castle mostly rebuilt at the beginning of the 16th century (Natalucci 1985, 426). Mudbricks are used for the filling of a jack-arch window, later replaced by another opening. The building is represented in the 1820 map of the Gregorian Cadastre.[21] Chrono-typological evidence suggests a date later than the late 15th – late 16th century for the mudbrick part. Indeed, the window filled with mudbricks replaced previous openings composed of a monocentric arch in rowlock bricks, surrounded by a crown of bricks laid as headers. This typology is widely documented in the region between the second half of the 15th and the whole of the 16th century. Besides its partial remains, some chronological considerations can also be drawn from the jack-arch window: a solution common in Umbria from the second half of the 16th century and widely applied until the whole of the 19th century. This range can be narrowed down by considering the size of its fired bricks. Despite not being able to take direct measures due to security reasons, bricks can be estimated around 8 cm in width. In Umbria, this thickness was exclusively reached around the 17th-18th century (Bordoni 2021 a, 287-296). In the municipality of Trevi, the bricks used in building the churches of Santa Croce (about 1685, average thickness: 8.2 cm) and Sant'Angelo of Cannaiola (1602-1684, average thickness: 8.9 cm) show similar values. Since mudbricks sealed the window, a late 17th-early 18th century chronology can just be considered as a terminus post-quem, although mudbricks are earlier than other 20th century alterations.

A possible mensio-chronology for mudbricks

Mensio-chronology of fired bricks is considered a reliable dating method and historical-economic indicator (Mannoni, Milanese 1988). However, the application of mensio-chronological analyses on mudbricks is still an ongoing issue. The crucial point is the relationship in the production of mudbricks and their fired counterparts. Were mudbricks made by the same kilns that produced the fired ones? Or were they the output of completely different and maybe 'homemade' productive chains? On the one hand, we would have bricks reasonably produced with the same standardised shapes of the fired production, although non affected by the shrinking in volume of the firing process (Pagella Poggio 1992, 19; Pittaluga, Pagella 2015, 292). On the other hand, we would have two completely unrelated productions, making any mensio-chronological approach unapplicable. The debate is still open, and its conclusions vary from region to region. For example, research has excluded a standardisation of the mudbrick production in some areas around Alessandria in Piedmont (northern Italy) (Pagella Poggio 1992, 19). At the same time, mudbricks studied in other settlements of the same regions match the size of the fired counterpart (Pittaluga, Pagella 2014, 7; Pittaluga, Pagella 2015, 292).

[21] Ibid., *Catasto Gregoriano*, folder of San Lorenzo and Picciche, map 5, parcel 737; folder of San Lorenzo and Picciche, map 8, parcels 524-526; folder of Fratta, map 6, parcel 4.

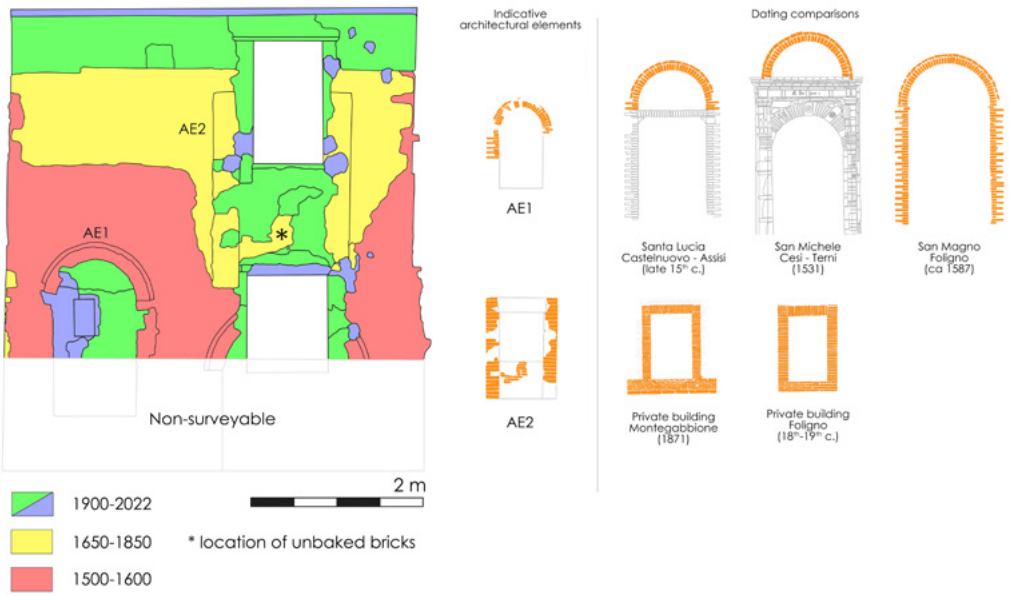

Figure 4. The Fratta structure (main stratigraphy, building phases and chrono-typological comparisons).

In Umbria, the above-mentioned cases of Picciche offer three statistically valid samples to test the relationship between mudbricks and fired bricks. For a proper comparison with the fired production, a hypothetical 8-10% shrinking in volume after the firing process has been considered. According to this, the two samples from Picciche would have ranged between 6.4 and 6.9 cm in thickness (tab. 1). Following a regional survey I have conducted, values of 6.0 cm or above are most likely reached between the late 16th and the 19th century (Bordoni 2021 a, 287-296). This is valid in Trevi as well, with values equal to 6.0 cm or above documented in the period between the 17th and the mid-19th century. The sample from Tatarena Road is particularly interesting, with values are exactly midway between a 1785 brick buttress surveyed in Trevi and the nearby structures of the Porta Nuova (1854-1858), suggesting a possible late 18th – mid-19th century chronology.

However, it is necessary to find evidence on the production of mudbricks by the local kilns to validate the application of mensio-chronology on the production of this building material. To verify this possibility, I have invested part of this research in the well-documented local archive. A production of bricks in the Trevi district is demonstrated since the first half of the 15th century (Bordoni 2019, 49-50). However, a series of still not published documentations underlines the extent of such production and its later shift from Cannaiola to nearby Fratta around the mid-18th century. In fact, mudbrick structures cluster in an area where there are at least five identifiable kilns recorded between the second half of the 16th and the mid-19th century (fig. 3).[22]

[22] Trevi, Archivio delle Tre Chiavi, Folder 28, File 526; Register 304, 50, 64 and 264; Register 445, 9 (front) and 481 (front); *Registri delle assegne*, 2 (Fratta); *Ristretti di tariffa*, *San Lorenzo e Picciche*; *Ristretti di tariffa*, *Cannaiola*; Foligno, Archivio di Stato, *Catastini*, Register 50, 1273.

Table 1. Mensio-chronological experimentations and comparisons regarding the mudbrick samples surveyed

Building	Length (cm)	Theoretical length after firing (cm)	Width (cm)	Theoretical width after firing (cm)	Thickness (cm)	Theoretical thickness after firing (cm)	Theoretical area after firing (cm^2)	Year
Tatarena road, Picciche	33.2	32.0-32.2	17.1	16.5-16.6	6.6	6.4	212	-
S. Stefano road, Picciche	31.5	30.4-30.6	15.5	15.0-15.1	7.1	6.9	217	-
Possible comparisons								
Buttress, Fantosati road, Trevi	-	31.7	-	-	-	7.3	231	1785
Porta Nuova, Trevi	-	32.4	-	-	-	6.0	194	1856

In particular, the Libro dei Fornacchiari (literally, 'Book of the Kilnmen'), a registry of the taxes paid by the local kilns to the Commune of Trevi between 1594 and 1797, represents an extraordinary testimony on small-scale dynamics of brickmaking in modern Umbria.[23] Its thorough analysis, that would take too much space to be presented in this paper, has provided evidence on the relationship between kilns and mudbricks. A 1676 record documents the payment of 200 mudbricks by the brickmaker Pasquasio of Rainaldo,[24] destined to restore the public bakery in Trevi. This suggests the same thermic use for mudbricks that Cipriano Piccolpasso proposed in his manual (Piccolpasso 1857, 29).

The archive also contained a 1589 agreement between the commissioners elected by the Commune and the local kilnmen. This document mentions a long list of products fired in the kilns active around the town. Among the various agreements, kilnmen were obliged to '... vendere e dare lo lavorio di ogni sorte quale ce sia alla fornace cotto, o, crudo come piacera a chi lo vole comprare...' (...to sell every kind of product available at the kiln, fired or unfired, to the buyer...).[25]

These two sources, at least, imply that kilns made and sold both unfired and fired bricks, further encouraging the application of mensio-chronology in the future and with wider datasets.

Conclusions

Although this research is in a very preliminary stage, it is already possible to point out some innovative results. First, some considerations can be drawn on the different distribution of rammed earth and mudbrick structures across the region (fig. 5). Rammed earth seems to mostly cluster in the former district of Perugia (Piscille and Torgiano), while mudbricks have a spot of high concentration in the area around Trevi (Picciche, Cannaiola, San Luca and Fratta). Further field research is needed to confirm the existence of two different building traditions connected to the use of clay in architecture.

[23] Trevi, Archivio delle Tre Chiavi, Folder 28, File 526.
[24] Ibid., 51 (front).
[25] Trevi, Archivio delle Tre Chiavi, Folder 28, File 51.

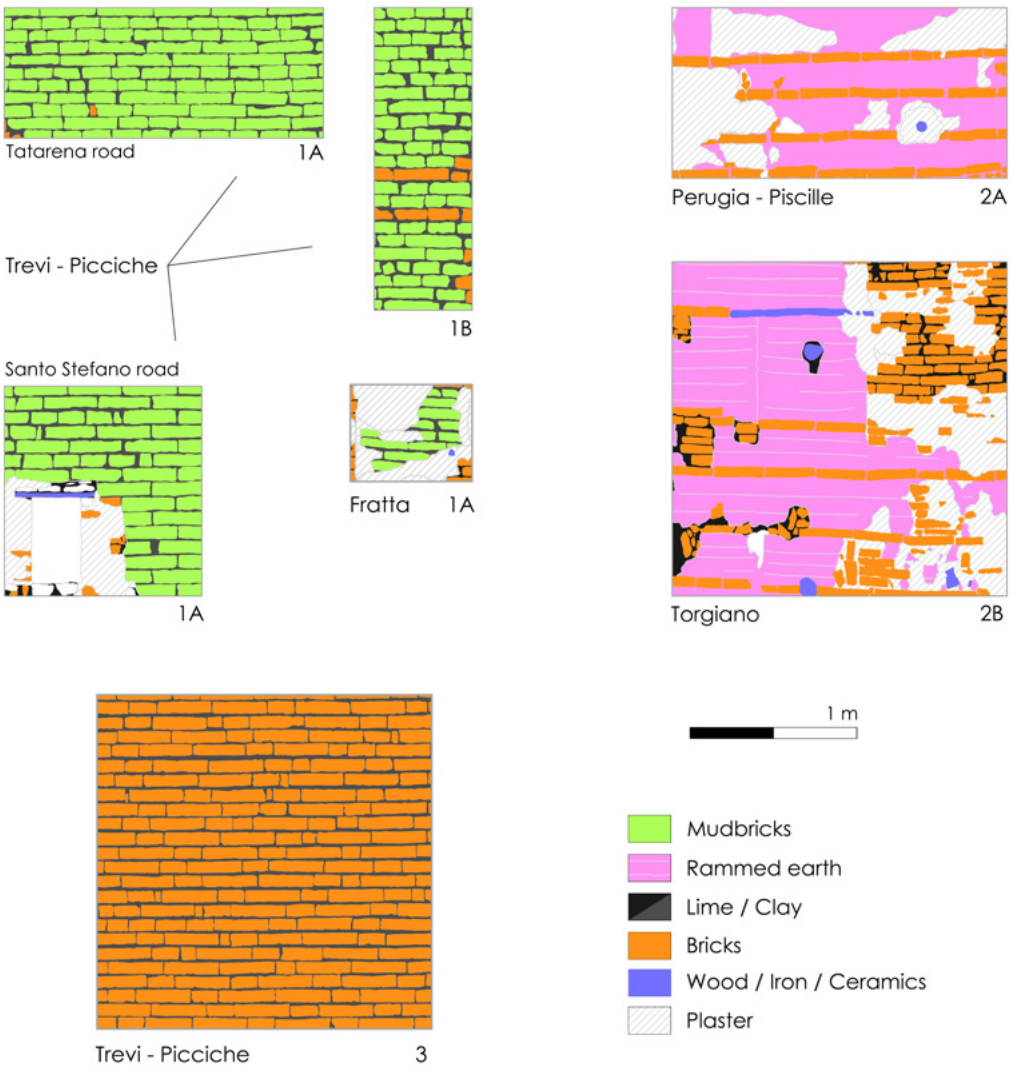

Figure 5. Synoptic catalogue of the masonry techniques (mudbricks: 1A-1B; rammed earth: 2A-2B) recorded during the survey.

In terms of chronology, both written and archaeological sources record the production of mudbricks between the late 16th and the 19th centuries, when they are (at least partially) connected to the activity of local kilns. This chronological range is not peremptory and may be extended through further evidence. A late 15th century source might document earthen structures in the same valley of Cannaiola and Picciche (1493):

> 'The fload has been so violent to demolish all the earthen houses (?) in San Lorenzo, San Giovanni, Casa Paduli and Castel Nuovo, at the borders between Trevi and Montefalco.' (Pirri 1921, 141).

Less information is available on rammed earth structures, although the Torgiano building may had been built by the early 19th century. Between the late 18th and mid-19th century, written sources on the Trasimeno area together with the building in Picciche also show the use of clay as binding material for fired bricks. In this case, further research is needed to verify the extent of such practise. Later, the use of earthen architectures survived in poor rural settings, mostly huts for farmers, until the first half of the 20th century.

These chronological ranges find sound comparisons in other Italian regions. The oldest earthen structures that are still standing in Italy date back to the 17th century (Cagnana 2000, 92; Pittaluga 2012, 699; Germanà 2015, 166). At the same time, several regional examples of these building techniques are dating back to the late 19th - early 20th century (Pagella Poggio 1992, 37-51; Saracco 2010, 42, 56; Mazzanti 2012, 542, 544).

To improve the data set on these building techniques, both systematic on-field surveys, and extensive archival research will be crucial. The need for a comprehensive and georeferenced documentation of the remains is an imperative step for a better understanding of this widely unknown architectural 'chapter'. Due to the lack of public supervision and resources on this topic, it may even be too late to produce a clear picture on the use of earth in the modern past: a practise that was surely wider than its current few remnants document. However, it is necessary to save as much information as allowed by the present architectural landscape before other irreversible losses. The clock is ticking.

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