ANCIENT WOODEN ROOFS IN THE AREA OF GENOA: AN ALMOST INTACT 17TH CENTURY SALT WAREHOUSE

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Daniela Pittaluga

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Abstract

The study on the wooden structure of the roof of the former salt warehouse in vico Malatti 13, in the ancient Genoa port area, is part of a broader research plan. It includes several university research projects: PRA 2016 "The archeology of architecture in the restoration site" carried on by DAD (Dipartimento Architettura e Design of Genoa, Italy) with the Universidad del Pais Vasco (Facultad de Letras, Departamento de Geografia, Prehistoria y Arquelogia, Spain), PRA 2018 "Conservation and restoration: methods of analysis and strategies of monitoring", led by DAD in collaboration with CISAPSI (Coordinamento Intercomunale Studi e Analisi del Patrimonio Storico della Svizzera Italiana, Fado-Switzerland) and PRA 2019 "Conservation and restoration: methods of analysis and strategies for the maintenance of the material and restoration: strategies for a quality project", also led by DAD. The roof under study has a particular structure: the trestle structure. This building technique was widespread in the Genoese context between the 15th and 18th centuries. Nevertheless, this technique has not yet been widely studied. Another notable feature, the roof had remained almost intact since the 17th century, when it was built. The difficulty of access and direct inspection of the roof structure, combined with the need for constant monitoring for its conservation, required a particular methodological effort, and an analysis procedure was identified, making use of several sources and multiple tools. Besides this roof's characterization and technological specificity, the methodological aspect is fascinating, as it could also be adopted in other similar contexts.

Keywords

Salt warehouse, 17th century, Trestle structure, Archaeological study, Conservation.

Daniela Pittaluga
DAD - Dipartimento di Architettura e Design, Università degli Studi di Genova, Genova (Italy)

Corresponding author:
e-mail: daniela.pittaluga@unige.it

1. AN ANCIENT ROOF STRUCTURE IN THE MOLO DISTRICT IN GENOA: A POSSIBILITY OF KNOWLEDGE, A PERSPECTIVE OF CONSERVATION

The study described in this article is part of a larger research project that concerns the archaeological reading of elevated historic structures in the area of the Port of Genoa and their possibilities for conservation and enhancement (see acknowledgments). In particular, we wanted to focus on a wooden roof structure in one of the many salt warehouses in the Molo district in the 16th century: the Vico Malatti warehouse [1]. This structure has undergone few changes over time. A careful study of high-level archeology has allowed us to trace the primary phases. In agreement with the Soprintendenza di

Belle Arti e Paesaggio of Genoa, we also wanted to provide a methodological approach for its monitoring over time. This monitoring aims to preserve this structure in the best possible way, promptly intervening in the event of problems and thus reducing interventions on it.

2. THE SALT WAREHOUSES IN THE OLD PORT OF GENOA

The area of the ancient Port of Genoa, its piers, and warehouses constitute a particularly stimulating heritage from several points of view. This area is, in fact, interesting for its complex history, the abundance of written sources, and the large quantity and quality of archaeological and archaeometric data available [2]. The port, and everything connected to it, has been a resource for Genoa since the Middle Ages. Over time, this awareness has also led to investments and experiments. Here, the best materials, the most innovative, and the most daring solutions were tested. The research discussed in this article started precisely by analyzing the warehouses that existed in the port area, particularly in the Molo peninsula. The Molo and the Ripa have been the trade hubs for the Genoese economy since the Middle Ages [3]: a direct example is the Molo district's subdivision which co-occurs as the construction of the first pier and the creation of the Ripa.

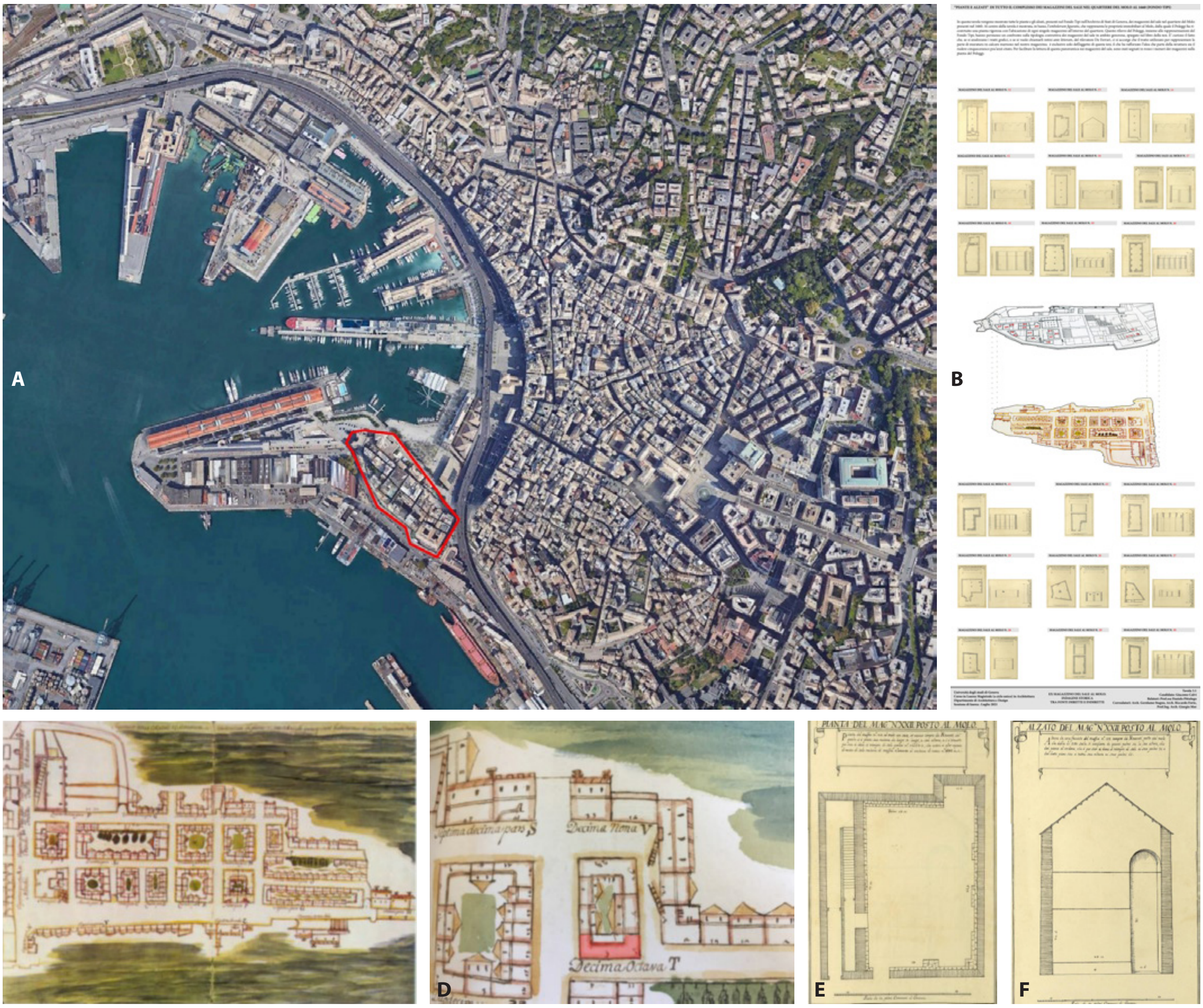

Fig. 1. *A, B- The Molo district today and the Molo district with the original numbering of the warehouses present in 1660 (Image source: [3] p. 201); C- Plan view of the district of the Molo, 1540 (S.a., Gabella Terraticorum sive Embolorum, code Figuratis (Archivio di Stato di Genova, Fondo San Giorgio, coll. E 65); D- Detail (highlighted in red) of the Magazzino del Sale n. 23 (now Vico Malatti 13) (Cfr. S.a., Gabella Terraticorum…, cit.); E, F- Plant and elevation of the warehouse n. 23 al Molo (on the left). (Image source: Piante et alzati delli magazzini e case che possiede l'Illustrissimo Officio delle compere di San Giorgio della Serenissima Repubblica di Genova, cavato da D. Leonardo de Ferrari Genovese l'anno 1660, in A.S.G., Fondo Tipi, pp. 34–35).*

Since then, the municipal consuls have understood the vocation of this strip of land as an ideal place to host all those types of workers who dealt with the construction, maintenance, and launching of boats and, more generally, with what they had to do with the maritime trade and shipping. The planned intervention aimed at giving a precise urban identity to the neighborhood, aware of its direct interaction with the reorganization of the Ripa and the creation of the Darsena and subsequently of the Arsenale as a sort of protected area. However, until the end of the 16th century, the Molo area appeared as a popular neighborhood, consisting of modest houses with a medieval layout, which had not entirely been influenced by the new ruling class's urban and architectural renewal. At the beginning and throughout the 17th century, the interest on the side of the public administration for the district concerns distribution management.

If, on the one hand, in the 17th century, we find a building overcrowding extended to the whole district that will stop at the end of the following century, on the other hand, we record a significant development of a new specialized commercial structure that we will find permanently throughout the 18th century and beyond, that is the warehouse. The salt warehouses reached 30 units in 1660, to which 4 larger ones were added during the 18th century [4]. In Genoa State Archives, in the "Tipi" collection, a precious document for the knowledge of the Molo district, the Tabula EMBOLORUM FIGURATIS, was found [1]. This Table represents the real estate properties at the Molo; it dates back to 1550 but portrays a situation from at least a previous century. From this table, it is possible to obtain quite detailed information on 18 salt warehouses present at the Molo, and most of them are provided with a planimetric representation and a section. From these data, however, it is not easy to understand what the roof structures were like, and many of these warehouses have undergone profound transformations over time. In Liguria and, more specifically, in the Genoese context from the 15th to the 18th century, it was typical the use of the "struttura a cavalletti" (trestle structures); however, at least for most of these structures, it is hard to hypothesize its presence [5, 6]. Fortunately, one specific warehouse has largely maintained the masonry and roofing structures almost intact: the salt warehouse in Vico Malatti 13. The latter has undergone few changes in ownership since the 17th century, so the PRA research focused on it.

3. "STRUTTURE A CAVALLETTI" ROOFING STRUCTURES

In traditional wooden construction, a particular structural type for the pitched roof is the "struttura a cavalletti" (trestle structures). This system is a typically local system that particularly characterizes the Genoese construction culture over a period ranging from the 15th to the 18th century, with episodes that also arrive at the beginning of the 20th century. Genoese examples of trestle roof structures are Villa Grimaldi "La Fortezza" in Genoa Sampierdarena, and Palazzo Doria in Loano [7], Villa Musso Piantelli in Genoa Marassi [8]. «This system is probably derived from naval carpentry; the main load-bearing elements themselves, having considerable dimensions, are sometimes masts and flagpoles deriving from the demolition of ships» [9]. With this type of technology, the main load-bearing structure of the roof is made up of one or more orders of wooden frames. "Trestle" is the «composite construction element used as vertical support. The term, derived from "horse", refers to one of the possible configurations assumed by the element: when it is made up of a double pair of struts arranged upside down and joined at the vertices by a crosspiece, it has, in fact, a shape similar to the profile of a horse. A trestle can also consist of only two inclined struts, joined on the upper ends in contact, or converging on the two ends of a horizontal element. In this second case, we also speak of a "lame frame"» [10]. These frames, called "cavalletti", support the secondary structure and are made up of longitudinal beams (purlins or tertiary beams) of large dimensions that rest on more slender struts, through which loads of the roof are transmitted to the perimeter walls. In the case of wider roofs, the trestle system is created as a spatial structure, formed by multiple orders of overlaying trestles. The corner beams are, therefore, load-bearing and resting on the intersections of the two contiguous trestles of the various orders. In classic examples, the trestle is composed of three or four struts converging at the vertex, sometimes also connected by horizontal stiffening elements, arranged at regular intervals along its height. A horizontal crosspiece can be supported on trestles arranged under its opposite ends. In many cases, the planking of the roof also collaborates with the underlying structure. In the pyramidal structure roofs built with this procedure, the vertex is the joining point of the extensions of the diagonal beams, which are load-bearing in the final section [10]. The first series of trestles is set directly on the perimeter walls employing a wooden element, a "wall timber plate". It works as a load distribution element on/in the masonry; due to its shape and arrangement, the wall timber plate also exerts a certain action to contrast the horizontal thrusts, as if it were a ring beam. The elements made were rather rough as the processing was limited to the simple "rough-cutting" of the piece along the body and in correspondence with the heads, which were notched for realizing the unions of the various elements making up the structure. These joints were obtained by juxtaposing the parts and nailing them together or, to reduce the resistant section's size, by the coplanar juxtaposition of a secondary element to the primary one, nailing the two to the horizontal planking. The joints are not those typical of wooden carpentry, but rough elements secured by nails and, therefore, technically rough carpentry, but intellectually very refined [9]. The connections between the components of a trestle vary according to the materials used. The wooden struts and crosspieces can be overlapped, juxtaposed, nailed, or held together by brackets or metal strapping. They can also have interlocking carvings on the joining surfaces or be notched together. In other cases, the union of two elements was made using "gattelli" (wedges). These are wooden wedges nailed to the extrados of the lower element to create "positive" support for the overlaying element. This choice allows the adoption of relatively thin sections as it avoids supports and housings in "negative", such as to reduce the resistant section precisely in correspondence with the tensile stressed fibers. It is interesting to note how these wedges are common to the Ligurian and Piedmontese traditions, which vary in the different structural logic. The first one uses "gattelli" mainly in the tense edge, while the other uses them in the compressed edge. Even the ridge joining between two rafters is rarely achieved with a proper joint; it is often obtained by juxtaposing the two roughly hewn heads to create mutual support [13]. «Rare, in the Ligurian area, are the typical combinations of wood technology such as the tenon and mortise with retaining pin, the sawtooth, the "dart of Jupiter". However, these should not lead us to think that the local workers were less capable and attentive to the problem; rather, by carefully observing these artifacts, we realize that the solutions implemented have evolved and aimed at achieving a sort of structural optimization of the entire system» [9]. The Trestle Structure system has no rigorous models; it is not a complete and invariable structural system; there are, in fact, many specific cases and many exceptions. The specificities of the individual cases make any attempt at classification difficult [9]. The most important construction problem is the need to overcome the thrusts exerted at the roof level and transmitted to the lower load-bearing structures through the verticalization of the loads and their uniform distribution on the underlying walls [9]. To prevent dangerous horizontal thrusts from being concentrated in the critical points of the masonry, usually, no struts are placed at the corners of the masonry. Furthermore, there are often chains suitably arranged to counteract the lateral thrusts. These prevent the construction from trying to "open up" under the action of the thrusts.

4. THE FORMER SALT WAREHOUSE IN VICO MALATTI: AN UNUSUAL "STRUTTURA A CAVALLETTI" (TRESTLE STRUCTURE)

The roof of the former salt warehouse in Vico Malatti looks like a gable roof with a pavilion head, with a "trestle" supporting structure, integrated with other elements that collaborate in the overall balancing of the roof, which is achieved by using three "pseudo-trusses", or "lame trusses" in shipbuilding jargon.

The classic or Palladian truss is appreciated and used in the coverage of large spans due to its static pattern (similarly to the three-hinged arch), defined as "non-thrusting". It is subject to tensile stresses on the tie beam; otherwise, the horizontal thrusts would be burdened on the support of the rafters; to compression stresses in the strut, which reduces the free span of deflection of the rafters, discharging these stresses on the "post" (or "king pendant" that is the vertical stiffening element in the truss), which is subjected to traction due to the symmetrical forces transmitted. The "pseudo-truss", on the other hand, is composed of two common rafters, usually headed on the "wall timber plate" or at a slightly lower level in the masonry. The rafters then overlap in the ridge, and by two or more horizontal tie beams, placed in correspondence of the tertiary beam ("terzere"), to which they also provide the support, therefore at about 1/3 and 2/3 of the height of the truss. Given the absence of the "post", the rafters, and the tie beam present in the classic truss, the static scheme, in this case, is defined as "weakly pushing", as all the elements of the "pseudo-truss" are subject to compression and bending. In some cases, to avoid the bending of the rafters towards the inside of the roof, a so-called pseudo-tie beam is placed at the center of the two inclined elements, subject to compression and bending stresses. This solution, however, creates strong lateral thrusts on the masonry; in fact, in these cases, the horizontal component of the thrust is contrasted by transverse iron chains in the perimeter walls in correspondence with the "pseudo-truss" [8].

The pseudo-trusses in the salt warehouse in vico Malatti are positioned at about 1/3 and 2/3 and 3/3 of the longitudinal axis of the structure, in turn, reinforced, headed into the masonry below the level of the wall timber plates, and from the southern transverse perimeter wall, in which all the tertiary beam (or purlins) have their heads stuck, except the two of the north pitch. In our case, integrating other elements, such as the pseudo-trusses, makes our structure unusual because there are very few similar cases in Genoese architecture, which will be analyzed later. On the west and north perimeter walls, the circular section "wall timber plates" can sometimes be clamped on top of the masonry. Regarding the perimeter wall to the east, three distinct circular wooden elements are clearly visible, which act as "wall timber plates" when connected to the masonry or the truss and as tertiary beams where they are not supported. They are slightly offset from each other, and the two at the end have one head embedded in the transverse masonry and the other resting in correspondence with the interlocking of the rafters of the two central trusses, but at a slightly higher level. The roof is made up of two orders of tertiary beams ("terzere") on all three sides, and the ridge; all these elements are supported both by their interlocking with the masonry and by the rafters and tie beams of the "pseudo-truss" to which they are connected, as regards the East and West pitches, and

Fig. 2. *The ancient roof of the salt warehouse in the Molo district (Genoa).*

by props collaborating with the load-bearing structure, which from the analyzes all seem to be contemporary to the structure, except one, as regards the north pitch. The ridge is a rectangular section with a sharp rotating edge.

5. OTHER “TRESTLE STRUCTURES” WITH “PSEUDO-TRUSS” IN GENOESE ARCHITECTURE

The analyzed case of the roof of the former salt warehouse is unique as regards the complex of the former warehouses at the Molo since in no other case has the roof been preserved until today without undergoing changes or removals. The former salt warehouse in Sampierdarena was also investigated, but also, in this case, the roof was rebuilt after a redevelopment project by the Municipality of Genoa [11]. We thus moved on to the search for artifacts that, in the technological scheme of the trestle structure with the use of pseudo-truss, could be compared with the roof of the former salt warehouse and which are always part of the Genoese construction culture. Three examples of coverage have emerged, all of which can be placed in the time period that goes from the 16th to the 18th century. The first taken into consideration is the roof of the Church of San Rocco sopra Principe, a building initially from the 14th century but rebuilt in the Baroque style in the 16th century and located in the center of Genoa. The roof of the Church is a gable-type roof, structurally composed of the main framework of 3 pseudo-truss, whose tie beams, in this case, are raised with respect to the position of the rafters, due to the presence of the reed vault below and from 3 “cavalletti” (trestles). Tertiary beams complete the main structure, two per pitch, which play the role of secondary elements for the trusses (on whose tie beams they rest) and the main elements with regard to the trestles (which rest on the tertiary beams). In this case, unlike vico Malatti warehouse, the tie beams of the pseudo-trusses are decidedly raised compared to the size of the rafters, not respecting the canonical position 1/3 and 2/3 of the height. This is due to the presence of the reed vault, as already mentioned [12]. In this case, the pseudo-trusses are positioned approximately at 1/4, 2/4, and 3/4, of the longitudinal axis of the roof, given the length of the building.

The other roof compared with the vico Malatti warehouse is that of the Church of the “Madre di Dio”, whose structure was studied in detail in 1993/94 [8]. The building that survived the demolition of the entire neighborhood, called “Madre di Dio”, in the 1970s, was already heavily damaged by war bombing. In the Genoese context, the four-pitched roof has the typical structural scheme of the trestle structure on several orders, completed, however, by two “pseudo-truss” consisting of rafters arranged by the inclination of the pitches, which join in the ridge, making them support it. Here, the tie beams also serve as support for the tertiary beam, and the rafters are not connected to the wall timber plate but at a slightly lower level. Their role, in this case, is that of a pressure breaker for the tertiaries of the long sides.

The last coverage considered was that of the Church of San Filippo Neri in Genoa, whose structure was studied in depth [8]; the Church is a 17th-century construction. In this case, the gabled roof structure is supported by the transverse perimeter walls, which, as in the case of the vico Malatti warehouse, collaborate with the wooden elements, and by three pairs of rafters or by three “pseudo-truss”. In addition to the rafters, the trusses are kept in their place thanks to the support of props, as in the case of the tertiary sections of the northern pitch of vico Malatti. The peculiarity of these “pseudo-trusses” is that they consist of only three wooden elements: the two inclined rafters following the pitches, and a pseudo-tie

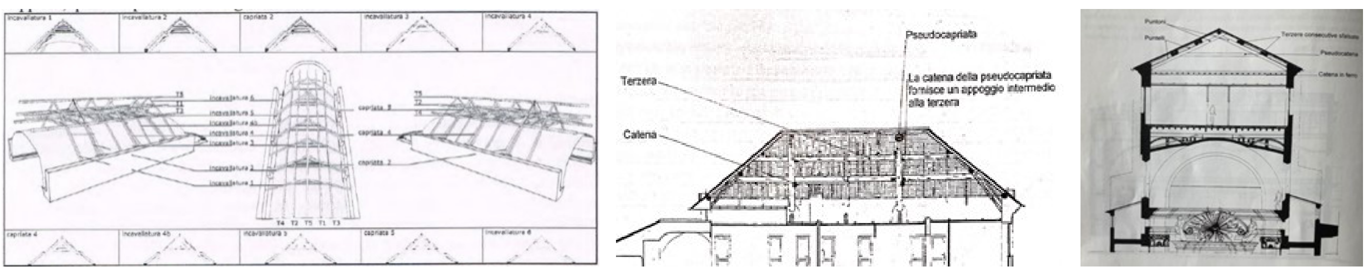

Fig. 3. *A- Scheme of the roof of San Rocco [12], B- Structural scheme of the roof [6], C- Cross section of the Church of S. Filippo Neri [8].*

beam, connecting the rafters at the level of the first order of tertiary beams ("terzere"), struts headed at the base of the perimeter wall, and also, in this case, it becomes the support of the ridge.

6. THE METHODOLOGICAL APPROACH ADOPTED FOR THE KNOWLEDGE OF THE "VICO MALATTI TRESTLE STRUCTURE"

During this study, we tried to trace a precise historical reconstruction of the former Magazzino del Sale and its development in the urban context to which it belongs and all its elements and construction phases. At the same time, we outlined a macroscopic pre-diagnosis of the conditions in which it appears today. The survey, the only one to date so detailed, of the structure was carried out, paying particular attention to the wall compartment and the wooden roof elements. The studies on the wooden roof, and the mensiochronological survey, are not enough for analyzing the problems that have arisen rigorously and completely. To date, with certainty, the entire structure of the warehouse in every single historical phase and every single element has shown how these direct analysis tools, once compared with the indirect historical sources, allow us to build solid starting points for a correct archaeological reading of the building [13].

The indirect sources have allowed us to establish the fundamental stages in the historical/evolutionary process of the warehouse. During the consultation in the State Archives, a written note was identified in the 1550 "embolorum figuratis", stating the purchase of a ruin site, according to the reconstructions, in the current Vico Malatti 13 and owned by the Rovereto family. Then we found the first sketched drawing of a plan and an elevation of 1660, in which, what a century earlier was only a ruin, had been transformed into a three-story salt warehouse, with an external service staircase on the east side, still owned by the Rovereto family. No information and sources about the warehouse could be found for the next two centuries. Only at the end of the 19th century, a period in which the ownership of the warehouse passed to the Autonomous Consortium of the Port of Genoa, as evidenced by some documents, which, more than anything else, provided some information on the deteriorating conditions of the portal and the ground floor that was raised to street level in the first decades of the 20th century [1].

The reconstructions that followed the discovery of these documents in the various archives needed confirmation, and this was possible thanks to the comparison with the direct analyses performed on the structure. Compared with the manuals and other contemporary buildings [14, 15], a scrupulous visual pre-analysis of the roof and the mensiochronological analysis carried out in the masonry sector allowed us to confirm the theories and expand our knowledge of the structure. We now know, with reasonable certainty, how the roof and the masonry compartment have undergone several construction phases, of which the most macroscopic ones have been identified. The trestle roof with "pseudo-trusses" has undergone reinforcement additions with respect to its original structure in two phases, which have been identified in some rafters and tie beams of the trusses, and in the iron chains subsequently placed in the 17th-century masonry, as seen in the mensiochronological analysis. In a certain way, these roof reinforcements also affected the masonry, as evidenced by the external buttress, in correspondence with the central "pseudo-truss" (B), visible from the shaft on the east wall. Even the masonry itself could be divided, macroscopically, on the basis of the studies carried out, into 3 main phases: the medieval/16th-century structure of the ruin partially survived and is still visible today in the three marly limestone pillars on which the three arches currently rest and in the pillar on the north wall, the main 17th-century brick structure, and the various infill or repairs that took place between the 19th and first half of the 20th century.

Furthermore, the visual pre-classification of the wooden elements, the thermographic investigation, the pre-analysis of the degradation of the roof covering, and the thermogravimetric and calcimentric investigation also allowed us to draw a first picture of the general condition in which the building currently is [16–19]. While no critical situations of deterioration were found for the main beam, it has been highlighted that some portions of the planking and the secondary beams need further investigation. In particular, as regards the part of the eastern pitch of the roof that borders the building of Vico Malatti 11, we have seen how the "ghiana" (a brick wall built on the slopes of the roof to convey rainwater [20]) on the slate mantle, which should drain the rainwater into the two gutter channels, does not perform its task correctly. This problem is causing the water to accumulate at this point and, given the low exposure to the sun that does not allow it to evaporate quickly, infiltrates the various broken pieces of the mantle. The infiltrating water is starting to deteriorate the planking and then the secondary joists, and, as seen in the thermogravimetric survey, partly the masonry. Furthermore, for the portion of the west pitch, where the skylight is present, water infiltrations were noted on the elements of the roof, and more generally, in all those points where the slate mantle shows cracks or exfoliation, such as not to be waterproof. In correspondence with the inclination of the two gabled pitches, it is supported by the partial overlapping of the rafters of the pseudo-trusses and the masonry.

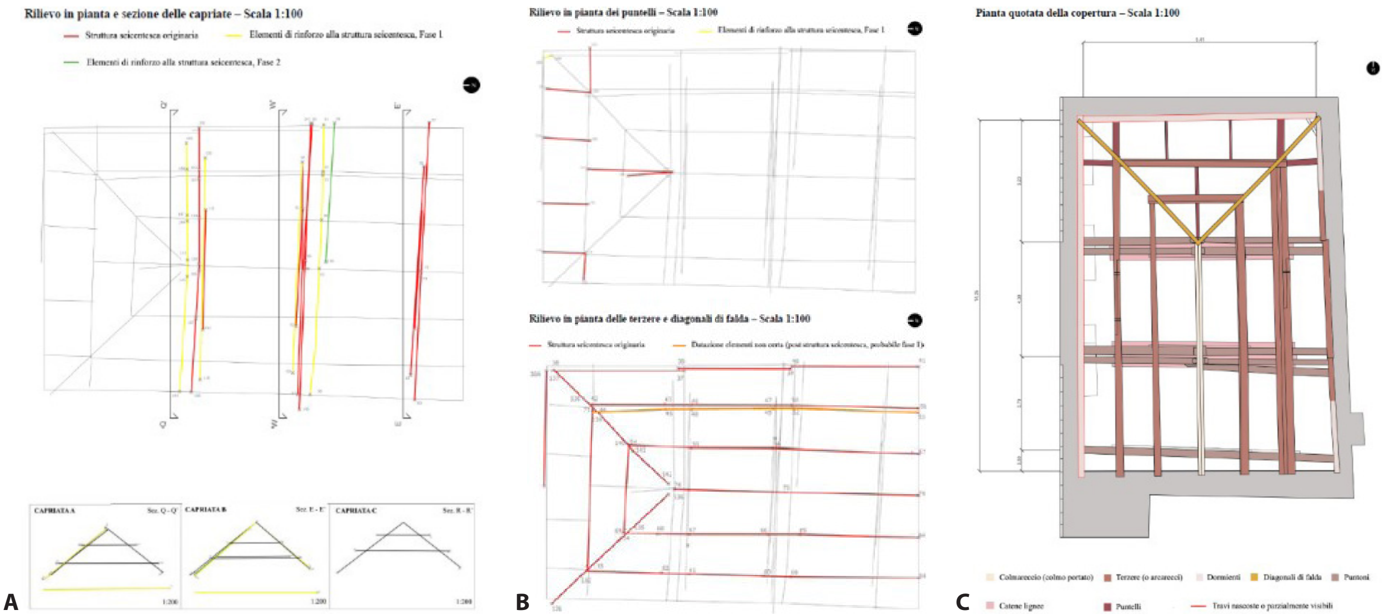

Fig. 4. *Technological elements of the roof.*

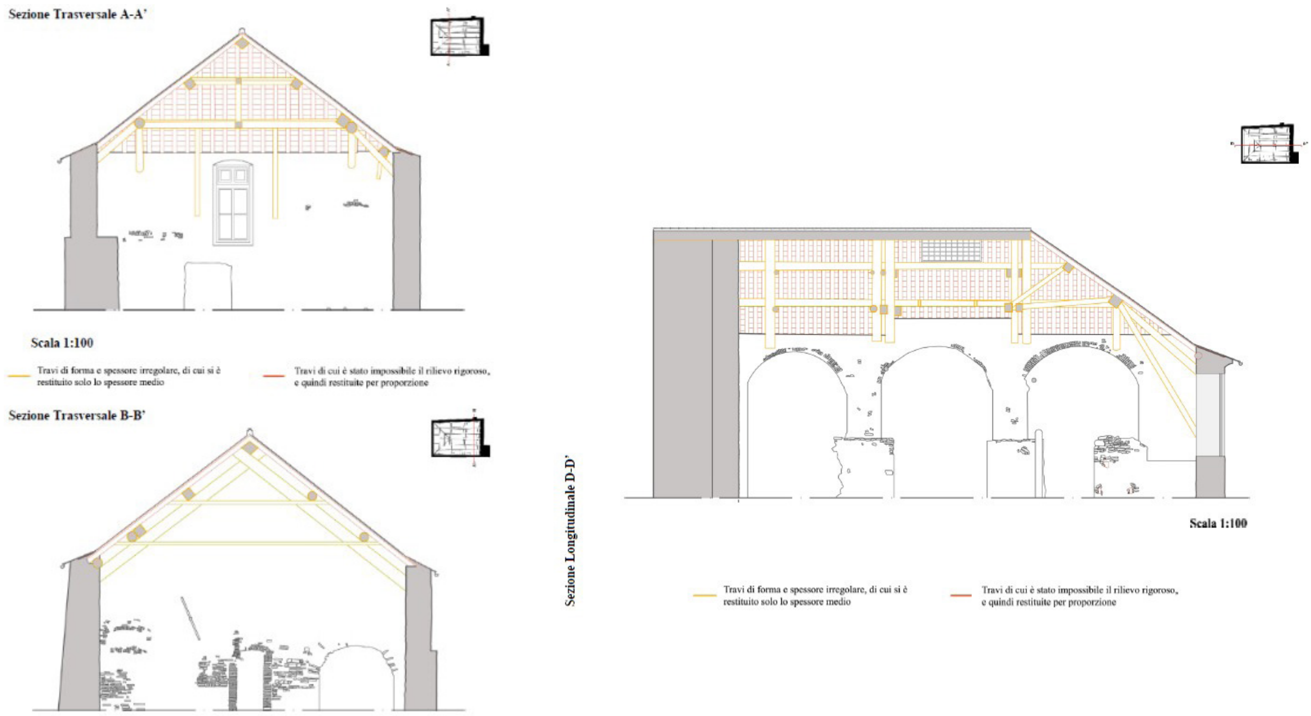

Fig. 5. *Roof diagram, cross, and longitudinal section.*

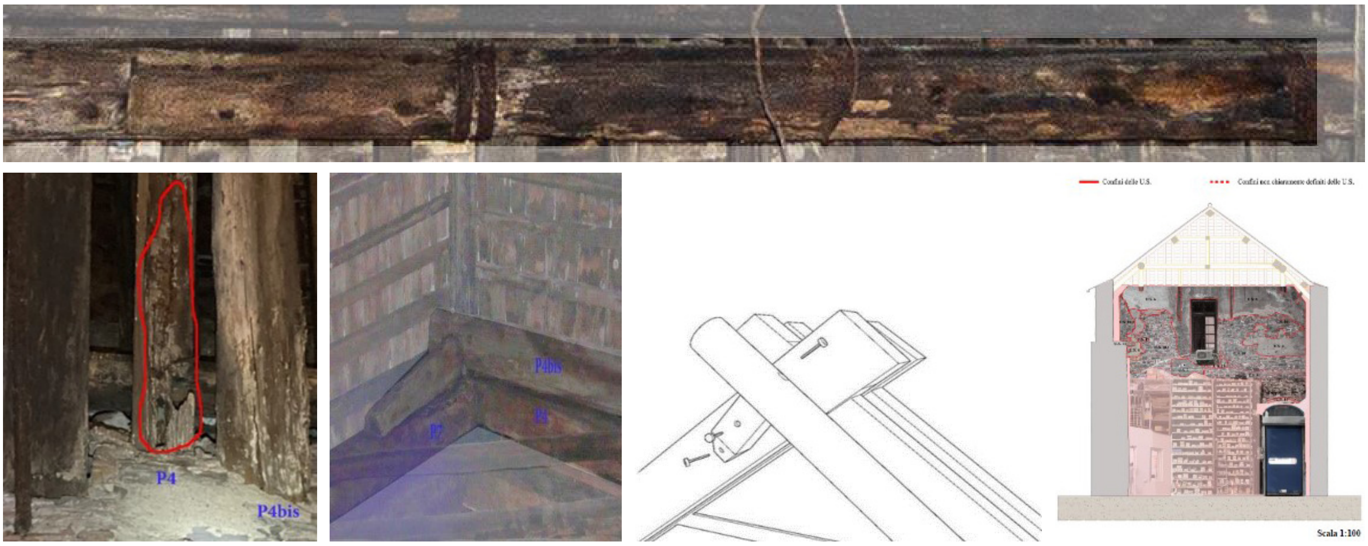

Fig. 6. *Parts of the roof showing interventions following construction [13, 16].*

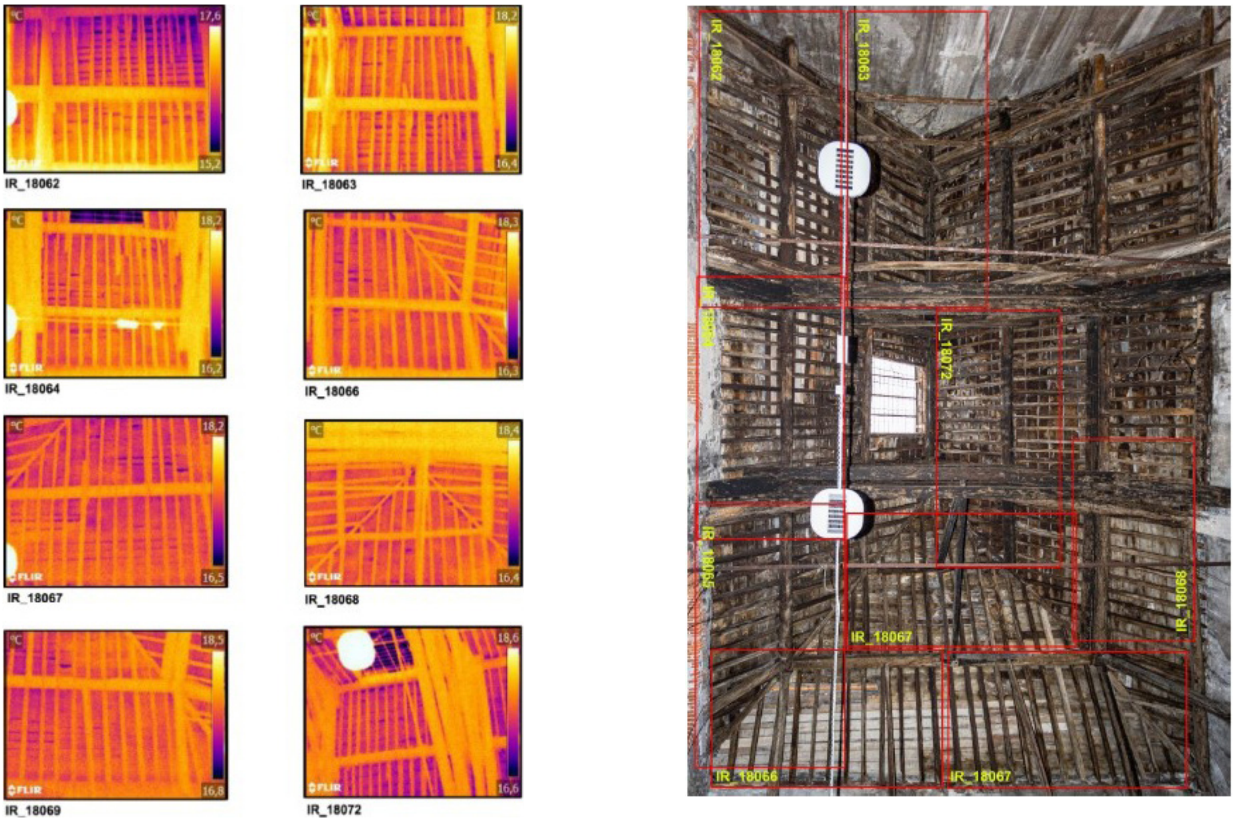

Fig. 7. *Thermographic surveys on the roof.*

7. CONCLUSION

Having no documentary sources on the evolution of this roof over time, we have only been able to hypothesize that some elements of the pseudo-trusses are the result of a subsequent consolidation of the structure, as a contrast to the load exerted on the perimeter wall, due to both the steep slope of the roof and its weight, ensuring an action that counteracts the overturning effects of the masonry. This first consolidation intervention consisted of the insertion of other rafters and wooden tie beams alongside the previous ones, but only in the case of truss A and truss B. Below these two, in correspondence with the consolidation rafters, two iron chains were inserted in the perimeter wall for further

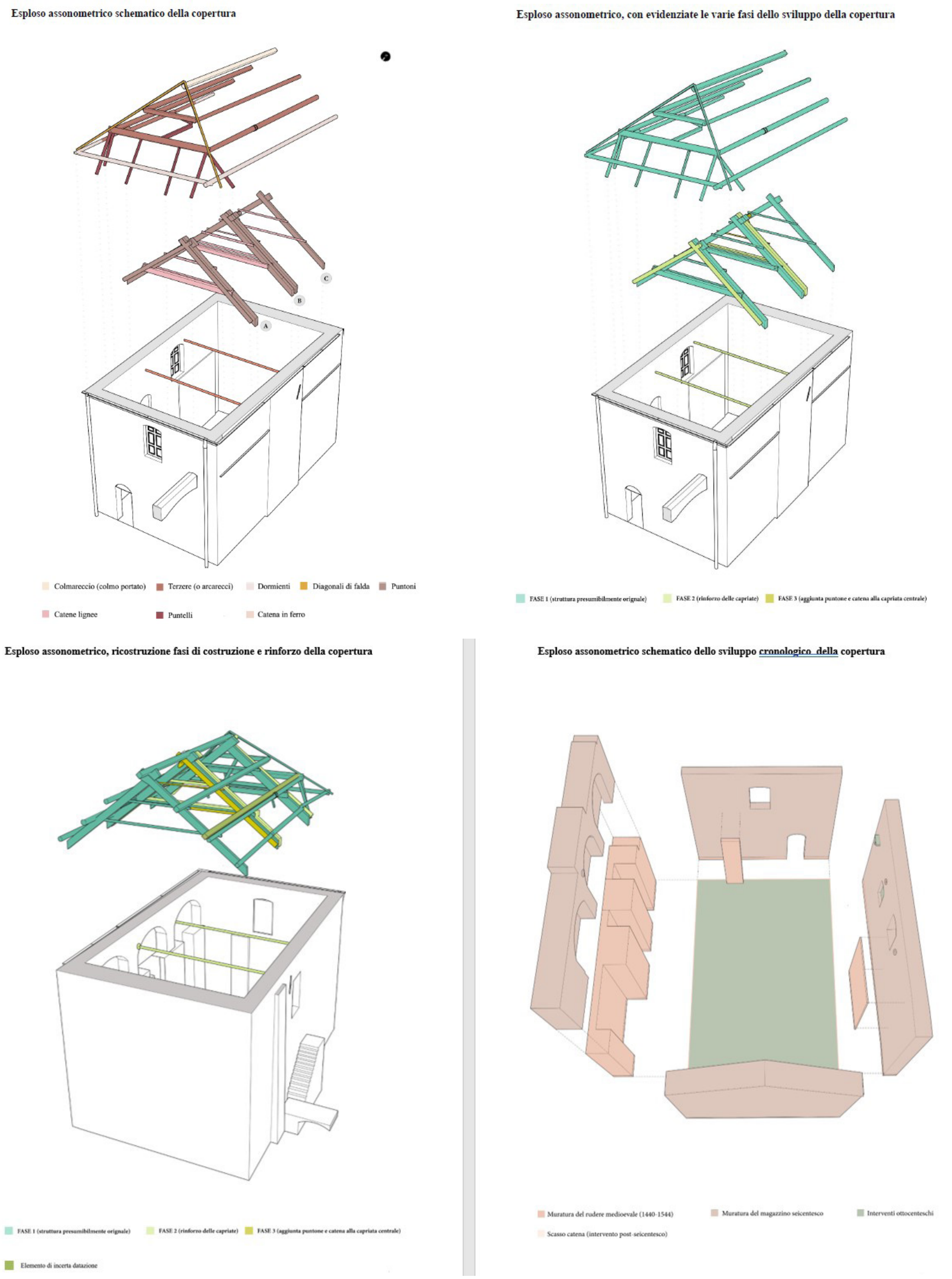

Fig. 8. *Axonometric section in which the roof transformations are related to the building.*

reinforcement. The understanding of these interventions was obtained with a stratigraphic analysis of the perimeter walls, a mensiochronological analysis of the masonry bricks, and a mineralogical-petrographic analysis of the mortar [13, 16]. The fact that these chains are not contemporary with the original structure was deduced from the analysis of the masonry to which they are connected: the 17th-century masonry was "split" on purpose to insert the iron chains. The chains contrast the horizontal actions due to the strong lateral thrusts caused by this construction system. Proof of this is the addition on the external wall, in the shaft, in correspondence with truss B, of a buttress that helps to discharge the actions mentioned above.

Indeed, another subsequent intervention is the addition of a third rafter (P4bis) to reinforce the truss B on the east pitch due to the deterioration of the central rafter. In correspondence with the connection with the masonry, the latter has an extended lack in the cross-section, causing its mechanical performance to decrease. This problem was solved by side-laying another rafter, which connects to the P7 opposite one (Fig. 6) through the use of a "gatello", a wooden wedge nailed to the extrados of the rafter [1]. Doubt remains about the two tertiary structures in the first order of the east pitch. It is not known whether these were installed at the same time as the construction of the roof, therefore being part of the original structure, or whether the one with a square cross-section, which is placed above the one with a circular cross-section, was installed as a reinforcement to the structure at a later time. Not having had the opportunity to study the roof closely, we can only make assumptions based on the information provided by the history of the materials and construction techniques of the Genoese roofing structures.

Typically, the main load-bearing structures, such as rafters or tertiary structures, were made up of elements from naval carpentry, usually made of oak. It can be assumed that this also happened in vico Malatti warehouse, mainly due to its location in the neighborhood of the pier, where all the naval workers of the port gathered [1]. Two tertiary beams have been identified with the typical tapering of the masts of sailing boats, even if we cannot say for sure in the absence of official documents. The tertiary beams in question are: the one of the first order in the West pitch, which is composed of two elements of naval carpentry, joined together through two metal riveted straps, in correspondence with the tapered part of the two elements, suitably roughened for the union, and the terzera of the second order, also in the West pitch; this type of connection is a half-timber joint. We can equally suppose the use of chestnut for what concerns the secondary truss that rests directly on the tertiary beams (terzere), to which the plank of the mantle is then supported, which can also be made of chestnut. The joints in place, which have been observed directly, are mainly "four-shot" [1] head iron nails and metal strapping, which are also nailed.

Roof structures are often poorly studied and poorly monitored due to the difficulty of accessibility and visibility. The research carried out for the Vico Malatti salt warehouse shows how it is possible to obtain reliable information even in situations that are difficult to access.

In this case, for example, it was possible to obtain precise indications regarding the chronological sequence of the interventions on the roof, analyzing the perimeter walls on which the roof rests with a stratigraphy approach. Studying an almost intact trestle roof structure made it possible to add a precious element to understanding this historical local construction technique, which is very common but little studied. All these elements also made it possible to develop direct observation sheets of the individual elements and to carry out their monitoring, a prerequisite for their good conservation.

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Authors contribution

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