

Contextualisation of the Timber Trade between the Sixteenth and Nineteenth Centuries in the Basilica of St Anthony, Padua

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Introduction

Traces of timber trades such as scribed marks, pegs and notches are visible in the medieval and eighteenth-century domed roofs of the Basilica of St Anthony in Padua. The original Basilica worksite began in the 1230s and continued until the following century with the roofing system completion. The ongoing investigations are part of a research project developed by the Institute of Construction History and Preservation (ETH Zurich), under the direction of Prof. Stefan M. Holzer, in collaboration with the Delegazione Pontificia per la Basilica di Sant'Antonio in Padova and funded by the Swiss National Science Foundation (SNSF). In the absence of medieval archives, this project aims at identifying the parts of the original building and later transformations [1].

A doctoral research project addresses the study of the Basilica wooden roofs to trace the construction development. Historical sources provide little information on the six medieval timber superstructures. The first depictions of the domed roofing system are two bas-reliefs representing the Basilica in the first half of the fourteenth century and a fresco from 1382 by Giusto de Menabuoi inside the building. Moreover, the *Visio Egidii* written by Giovanni da Nono between 1263 and 1346 attests to seven domes. In the eighteenth century, some archives document the construction of the last dome above the Relics Chapel shortly after 1740 [2]. The main event reported in the historiography of the domes is limited to a disastrous fire that destroyed four domes in 1749: the cone of the Angel (d04), the dome of St James (d05), the presbytery dome (d06) and the choir dome (d07). According to eighteenth-century sources, the flames reached St Anthony's dome (d03) – on the north aisle of the transept – but quickly extinguished. As the burnt roofs were promptly rebuilt in the following years, three domes would have been preserved from complete reconstruction: the facade dome (d01), the intermediate dome on the nave (d02) and the dome of St Anthony (d03) [3]. The first dendrochronological analyses carried out in these three domes confirmed the preservation of part of the medieval structures, magnifying their importance worldwide.

Each dome is composed of an independent timber frame above the masonry shell supporting the outer cover. Except for the cone on the crossing, the bearing system consists of four main struts placed at right angles and connected to a central king-post. A system of lateral struts supports the horizontal collar-beams, while four concentric rings carry the ribs, on which lean the cover composed of wooden boards and lead plates (Fig. 1).

There are no carpenter marks related to the construction sequence of the frames. The presence of overlapped and nailed joints would suggest their onsite shaping on top of the building. However, numerous trademarks have been recorded in the domes rebuilt after the fire in 1749 and on replaced elements in the three intact domes.

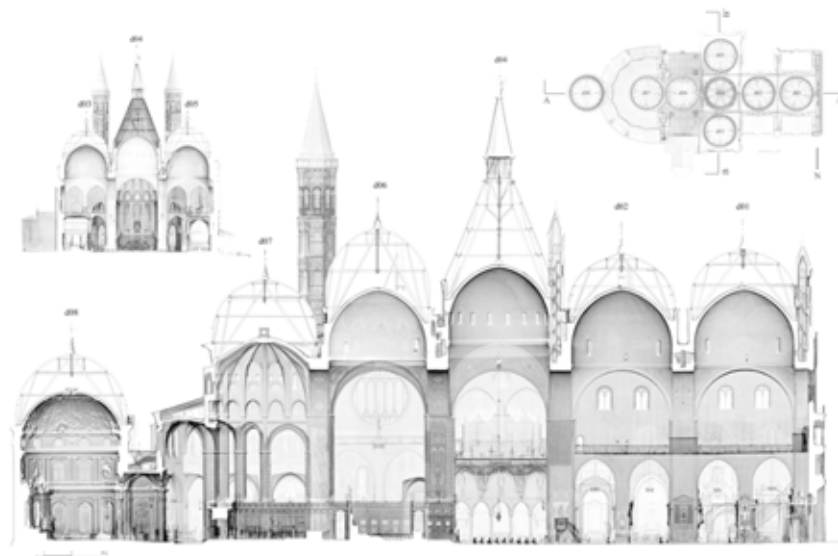


Fig. 1 St Anthony Basilica: southern longitudinal section and eastern cross section (drawing L. Vandenabeele, author).

Alongside surveying and dating the timber structures, the present research aims at answering questions about the origin and trade of the timber supplied over the centuries to the Basilica of St Anthony. The first section of this paper introduces the findings obtained by laboratory analyses, archival research, onsite observations, and the importance of combining these results. The second section focuses on historical timber supply from the forests in the south-eastern Alps, down the rivers, towards the most prominent marketplaces. Based on a comprehensive literature analysis on historical floating routes in the Dolomites, alpine historical wood resources, and historical timber supply in Veneto, the regional trade's organisation is depicted. Furthermore, archival discoveries on Paduan timber merchants are contextualised in the regional trading routes. The third section brings into focus the use of trademarks. After describing historical marks in Veneto and the Italian Alpine regions, shipping marks found in the Basilica domes are interpreted.

Findings from laboratory analyses, archival sources and onsite observations

Xylotomous analyses have ascertained that all domes' superstructures were built in larch (*Larix decidua* Mill.). Moreover, dendrochronological dating has revealed numerous medieval elements in the three preserved domes, confirming that their current configuration largely corresponds to the original one [4]. From these results, it is likely that the reconstructions of the burnt domes followed the configuration of the original ones, aside from some simplifications. Moreover, the sample analyses have identified timbers presumably sourced from different forests, even within the same dome [5]. In general, the different ages of the trees at the felling date and the different growth trends of the examined samples show that they came from areas with different climatic factors and altitudes. Although it has not yet been possible to identify an unequivocal dendro-provenance of the trees, the results have contributed to recognising different origin areas. Comparative mean curves used as references have included dendro-chronologies from north-eastern Italy, Austrian Ötztal, Trentino South-Tyrol, and Italian-Slovenian regions. In this regard, the matches identified with the reference curves of other buildings are significant to identify medieval elements, particularly from the comparison with artefacts located in Verona, Venice, and the Belluno area. These results would suggest the exploitation of fluvial networks along the Brenta and Piave rivers, which have been historical transport routes for the forest resources located in the eastern Alpine regions. Indeed, rafting and free-floating timbers have been documented in these regions since Roman times for transporting wood to marketplaces such as Verona, Vicenza, Padua and Venice.

The study of archival documents of the church dating from the fifteenth century has provided rich documentation of the building between the medieval worksite and the reconstructions of the timber frames in the mid-eighteenth century. To map the timber consignments' provenance, research on purchase and administrative acts registered by the Veneranda Arca is ongoing [6]. Following the documented interventions' timeline, restorations took part in three pivotal stages during the sixteenth, eighteenth and nineteenth centuries [7]. At the present time, fifteenth-century records have shed some light on merchants' names from Padua active in the domes' reparations. Lastly, knowledge of their trade spheres depicted in previous studies has helped identify the supplying forests and trade routes.

As mentioned above, no trademarks have been found on the medieval elements dated by dendrochronological analyses. Among the dated signs, some correspond to the eighteenth-century post-fire reconstruction while others to nineteenth-century repairs. The similarity of marks recorded in different domes enables the linking of interventions that coincided. Their presence is thus also a preliminary criterion to identify replacements in the preserved frames. (Fig. 2)



Fig. 2 Cuneiform trademark in the eighteenth-century Angel cone (picture: author).

Historical wooden supply from the south-eastern Alps to Padua

Since Roman times if not earlier, timber trading in the subalpine area developed into local, regional, and interregional scales [8]. The forest resources included mainly spruce, beech-wood and larch. Between the early Middle Ages and the twentieth century, the main trading routes exploited the Brenta and Piave rivers and their tributaries towards Vicenza, Padua and Venice [9]. From the fourteenth century until modern times, the eastern pre-alpine and alpine sectors were divided into the three central powers of the Archduchy of the Habsburgs in the Tyrol County, the ecclesiastical principality of Trentino, and the Republic of Venice. Mountain natives did not manage the timber commerce in the

woodlands; this part was instead in merchants' hands from the Treviso area, the Duchy and Venice. Depending on territorial landowners, different administrative regulations were controlling the cuts.

In the fourteenth century, the mountain communities were structured in basic units called *Regole*, which operated until the end of Venice's authority in 1797. Each *Regola* had its own statute and ownership mark to brand timber. Over time, the communities started renting forest portions in exchange for annual fees to individuals or companies. From the fifteenth century onwards, the mountain regions of Cadore, Agordino, Ampezzo, Cansiglio, Primiero, Montello, Belluno, Feltre, Altipiano di Asiago, Patria del Friuli, and Istria were progressively included in the reach of Venetian brokers [10]. Due to the unruly forest exploitation and the city's essential needs, Venice established the Forest Rangers Office, called the *Provveditori sopra legni e boschi*, in 1464, followed by a series of stricter regulations for exportations that increased the control on private woodlands under Venetian ruling [11].

As from the sixteenth century, in the Archduchy of the Habsburgs, tree felling was subject to authorisation by the Chamber of Innsbruck, which managed the cutting permits and intermediary agents played representative roles for the merchants. These agents guaranteed transactions between the Germanic and regional markets by accessing the nearby customs offices and obtaining logging provisions, which were then resold in Italian cities, first and foremost Venice [12].

Forest exploitation depended on territorial power as well. In the woodlands under the Serenissima, the *consuetude* was to select and tag the mature trunks to provide high-quality timber required by the Arsenale and other institutional buildings [13]. Officers by the Arsenal were sent to the forest to operate the most accurate selection. The forests authorities marked the selected logs with the official stamp. However, in the woodlands of Tyrol County, whole portions of forests could be harvested. The elements to be felled met standard sizes starting from 4.5 m height with an upper diameter of a Venetian foot corresponding to 34.77 cm, equal to 12 Veneto ounces [14]. This minor standard section was called *taja* or *taglia* in the Venetian dialect. The next marketable section was a 43.5 cm upper diameter, corresponding to 15 ounces. Due to the intensive exploitation of resources, from the seventeenth century onwards, the only forests still able to provide large quantities of timber were located in Cadore, Carnia and the Asiago plateau.

Between felling and downstream routes, the logs were usually debarked and hewn in sizes to facilitate transportation. Conveyance to waterways could rely on horses or wooden snow slides (*risine*). Floating started in spring. Along rivers and canals, infrastructures enabled sorting and streaming. In large rivers, barriers with diversions to stack logs consisted of a system of vertically sliding wooden gates and grates (*cidolo*). Another type of artificial floodgate allowed the damming of logs and the continuous flow of water along mountain streams (*stue*). Along the shores of larger rivers, the logs were assembled into rafts or directly sawn. The latter group was stacked, measured, and graded next to the mills, mainly located between Fonzaso and Valstagna along the Brenta, and between Perarolo and Longarone along the Piave [15]. Rafts assembly usually comprehend joined standard beams so that the smallest raft unit (*copola*) had a 4,2 m length, and a 5 m span reached flanking 18/20 elements. Longer logs could set on multiple-unit platforms built connecting head and tail basic rafts, reaching a maximal length of 30 meters (the so-called *rasi*) [16].

Direct wood trade routes towards Padua historically developed from the forests in Primiero, Tesino and Valsugana along the Brenta river that was connected to the city since the twelfth century by the Piovego canal [17]. Shipments of timber arrived in Fonzaso, where they were sorted along the riverbanks in the warehouses of the various merchants [18]. An alternative route involved channels along the Adige River, then into the Vanoi alpine stream and in the Cismon, to join finally the Brenta from the upstream station in Bassano. In the Brenta basin, the logs were conveyed by both untied floating and rafting, while only rafting is documented along the Cismon. Finally, an infrastructure of canals around Padua ensured the arrival of construction materials in the city centre via the Bacchiglione and the Piovego since the Middle Ages. (Fig. 3)

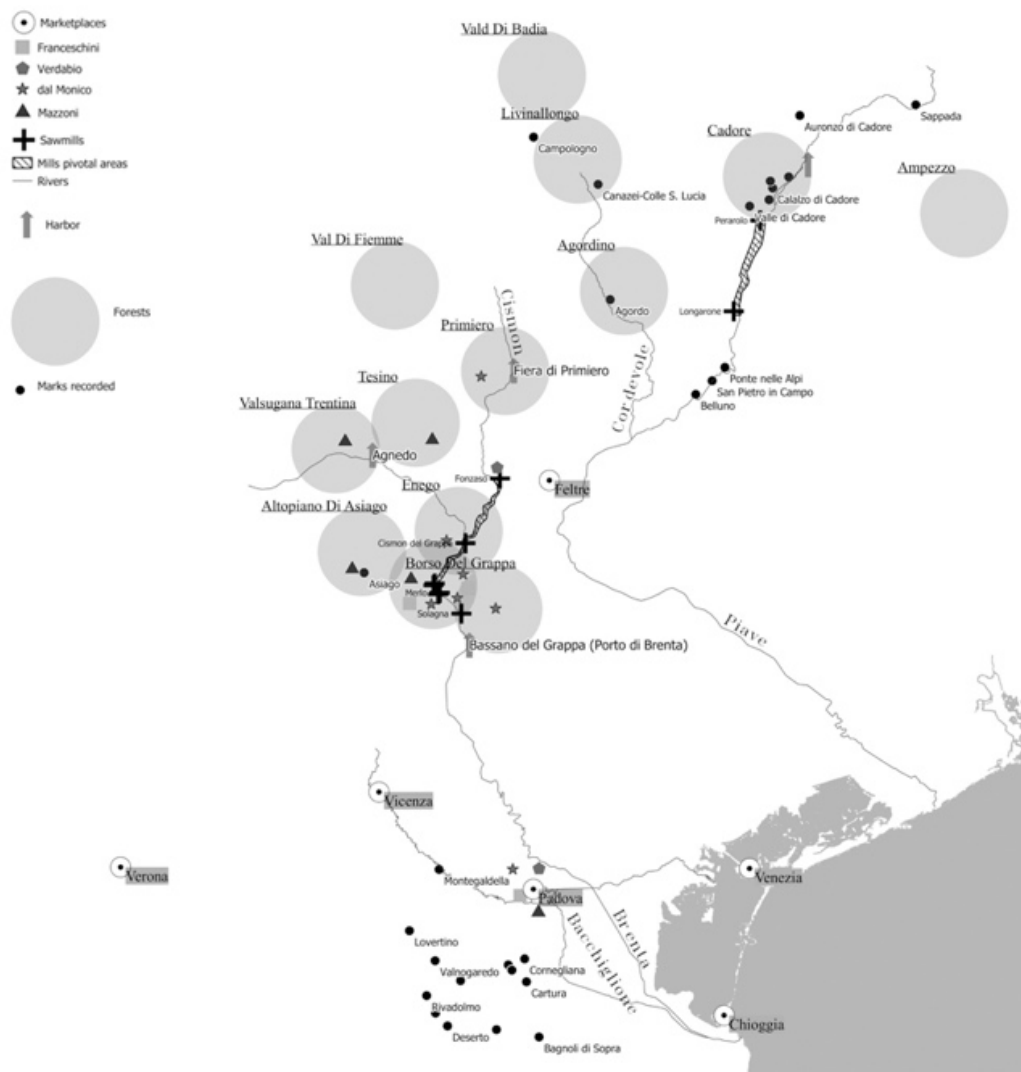


Fig. 3 Map with historical trade routes along the Brenta and Piave rivers, with historical forests, mills and Paduan merchants business areas (picture: author).

Timber suppliers in the Basilica at the end of the sixteenth century

Like Venetian merchants' business boost alongside the Piave River, Paduan brokers settled in the Brenta Valley, where they owned sawmills providing timber to the city. Information can be found in payment records in the fourteenth series, as well as in the acts registered in the second series of the Historical Archive of the Veneranda Arca di Sant' Antonio [19]. According to the so-far examined logbooks, different merchant's families from Padua played the role of timber suppliers for the roofs of the St Anthony Basilica at the end of the sixteenth century: Jacomo and Antonio dal Monico in 1562 and

Contextualisation of the Timber Trade between the Sixteenth and Nineteenth Centuries in the Basilica of St Anthony, Padua

1563, Lorenzo Franceschini in 1574 and 1582, Marco Mazzoni in 1584 and 1592, Nicolò and Bernardin Verdabio in 1591. Occhi has documented the business range of these traders' families through in-depth research in the historical archives in Bassano del Grappa, Vicenza, Venezia, and in the *Tiroler Landesarchiv Innsbruck* [20].

The families hold felling permits in Asiago, Enego, Borso del Grappa, Primiero, Valdibrenta, Tesino and in the Vanoi area [21]. Manufacturing processes took place in Fonzaso, Carpané, Cison, Oliero, Merlo, and Valstagna (Table 1).

Table 1. Listed timber merchants and business aeries. (source: K. Occhi 2004).

<i>Timber trader Families</i>	<i>Forest for tree felling</i>	<i>Sawmills</i>
<i>Dal Monico</i>	Enego, Borso del Grappa, Primiero, Valdibrenta, Vanoi	Carpané, Cison, Oliero
<i>Franceschini</i>	Valstagna	Carpané
<i>Mazzoni</i>	Valstagna, Tesino, Cison, Asiago, Primiero, Valsugana, Val di Non	Fonzaso Oliero, Valstagna
<i>Verdabio</i>		Fonzaso

Bringing together the information, reveals that by the end of the sixteenth century the timber supply for repairs to the roofs of the Basilica arrived in the city down the Brenta. The merchants managed the trades differently, depending on whether they had cut licenses or purchased the consignments once brought downstream by previous actors. Eventually, they could also recruit mountain companies that operated in the cutting phase and provide successful timber downstream landing. Further similar archival research should also provide the list of actors active in the eighteenth and nineteenth centuries during the superstructures' later restorations.

Historical trademarks in Veneto

Shipping marks on floated timber has very ancient roots in the eastern subalpine region – they have been traced back to Roman times – until their decline in the twentieth century due to railways' development. Unfortunately, there is a lack of detailed literature on the topic in the Italian context [22]. The current knowledge comes from a handful of onsite investigations and sporadically published lists of ownership marks found in local archives.

During the trade process, logs could be marked at two moments. Firstly, in the mountains, the ownership marks were carved after selecting the trunks, during the distribution by the public officers to the private individuals or companies. An axe was used to remove the part of bark on which the mark was to be impressed with a small axe (*manarin*) or a traditional type of gouge (*zapín*), later replaced by a sharpened and curved iron tool (*fer de segnà*) (Fig. 4). Between the nineteenth- and the last century, forestry hammers with stamped owner's initials replaced the other tools [23]. Later, in the valley, in designated places near the mills (*stazi da segno*), ownership marks for floated timber were affixed after sorting and before floating [24].

Marks could represent merchants' identity, mills' addresses, or the communities that managed the forests exploitation [25]. In the first case, the marks expressed the merchant families' or trading enterprises' ownership. Most of those with ancient origin were cuneiform symbols that enabled the timber sorting at sawmills and docking channels even by illiterate operators. On the other hand, communities' acronyms consisted of abbreviations of two or more alphabetical and or numerical characters. Sometimes rafted logs may include both signs by the felling wholesaler and the trader. In other cases, the presence of just one mark could refer to a trader involved in the whole process, from the tree felling until the delivery on the marketplace. In similar cases, the merchant recruited lumberjacks companies and raftsmen who provided the material and operated the transport to the mills.



Fig. 4 Traditional tool to imprint marks on timber in the Rafting Museum in Codissago (picture: author).

Communities' legislations required the registration of all active marks in official lists, some of which preserved in local archives. The oldest list of signatures found in the Dolomites and the Basso Veneto date back to the fifteenth century. In other instances, ownership marks were used as signatures in sales contracts [26]. They were usually based on an original family's symbol further developed through signs and letters annexed over lineages. The ownership mark was hereditary from the head of the family to the eldest son, while the younger brothers inherited a variant as documented in other European cultures as well [27]. Hence, the initial signs evolved through increasing complexity over generations. Moreover, a gradual replacement of signs by alphabetical characters took place, which did not always correspond to the initials of the owner's name [28]. The latter greater spread of alphabetical characters among brands and communities acronyms could find reason in the more effortless reading required in printed documents.

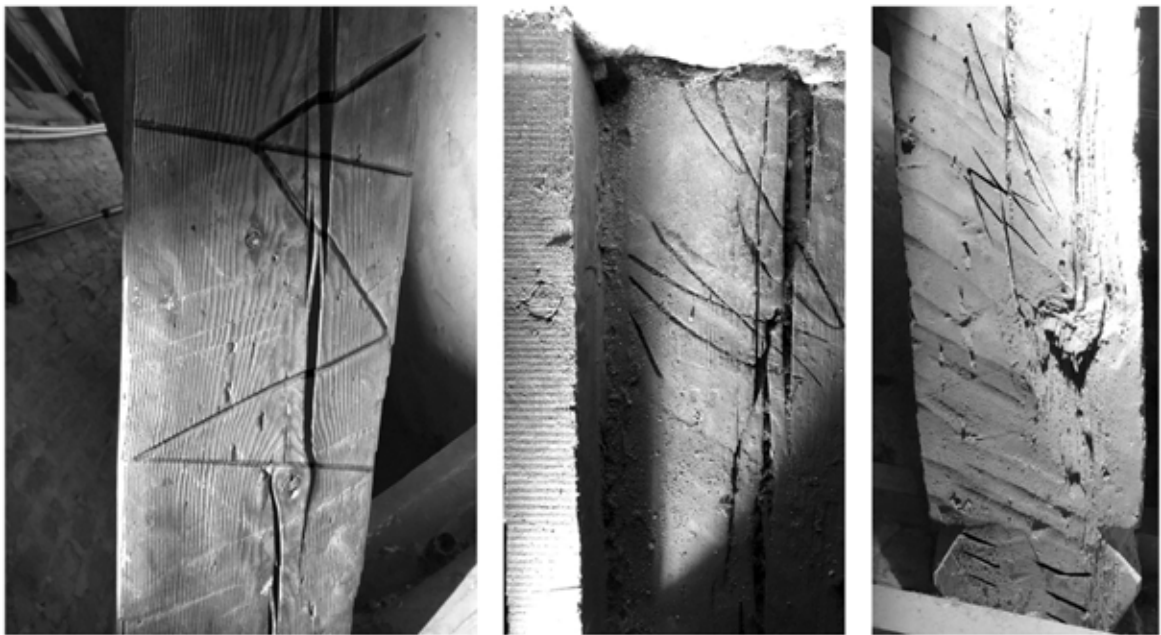
Among the most important contributions in the Veneto area, Marcuzzi collected the marks already catalogued by previous studies and compared them with new findings. The study includes a comparison between marks collected between the Basso Veneto and Cadore and previous findings from Veneto, the Italian Alps, Switzerland and Western Germany [29]. From a map of these trading centres, it is possible to recognise Padua's central position between two clusters of marks he examined in Basso Veneto and Cadore. However, the resembling types of marks and the evolutions in isolated areas implied reiterations of the same tag in different contexts and times. For this reason, their interpretation must take into account other factors such as historical periods and trade routes.

Eighteenth and nineteenth-century trademarks in the reparations of the domes

Pegs, notches, and trademarks on timber elements in St Anthony basilica's superstructures bear witness to their rafting transportation. Marks can vary in characters, position and size. Although some persistent difficulties in tracing them back to the ownerships, few contribute to identifying timber provenance and historical interventions in the eighteenth and nineteenth centuries.

In the medieval domes of St. Anthony and the intermediate one above the nave, different marks remain challenging to interpret. Some of these consist of vertical, oblique and intersecting straight lines. In St Anthony's dome, a wedge-shaped mark appears in the reparations at the base of an original strut dated to the 1280s and on the horizontal beam above. (Fig. 5a)

Different types of marks have been detected in the cone of the Angel and in the other domes rebuilt after 1749. In particular, the B, X, L acronym recurs in struts and collar-beams located in the Angel cone, in St Jacob dome, in the presbytery one and in that on the choir. It has been also found in wooden elements at the base of struts in the St Anthony dome, helping identify their replacements (Figs 5b, 5c). In some cases, an additional cuneiform symbol emerges on the same beam. Although it is not a criterion for absolute dating of the elements, this alpha-numeric mark helps identify possible elements later than the medieval building site. Likely, they refer to operators involved in the reconstruction after 1749. Moreover, the previous research by Marcuzzi detected the same inscription as an ownership mark in buildings around Basso Veneto [30]. Furthermore, its spot sometimes on sawn sides of the beams, and the juxtaposition of the cuneiform mark mentioned above would refer to a merchant who acquired the timber consignment only after the hewing, thus already in the valley.



Figs 5a, 5b, 5c. Cuneiform mark on reparations in the medieval dome of St Anthony. BXL acronym in a base of St Anthony dome and in a strut in the choir dome (pictures: author).



Fig. 6 Cuneiform symbol in a rib of the Angel cone (picture: author).

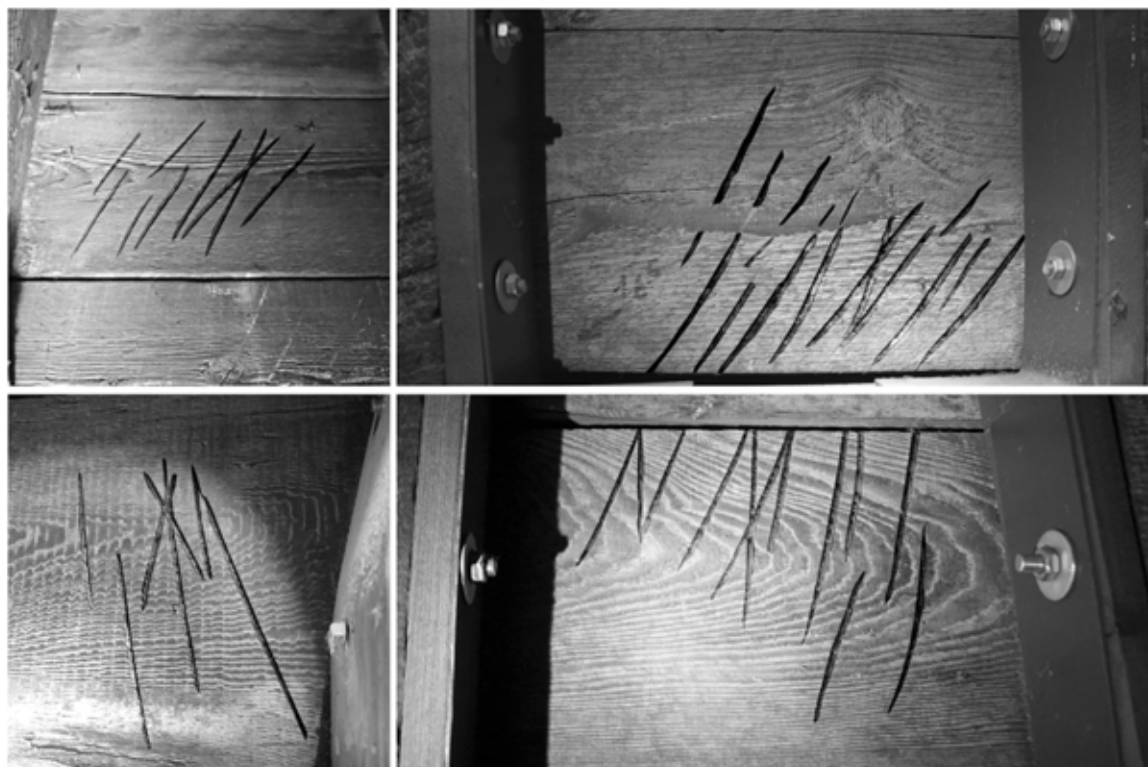


Fig. 7 Trademarks on nineteenth-century cover boards in the intermediate dome - upper row , in the St Anthony domes - lower row, left, and in the façade's dome - lower row, right (pictures: author).

Contextualisation of the Timber Trade between the Sixteenth and Nineteenth Centuries in the Basilica of St Anthony, Padua

As previously mentioned, it is not possible to codify unequivocally individual symbols because occurring in archival lists from different geographical contexts and historical periods. For instance, the above mentioned cuneiform mark could represent the ownership of Adriano da Piazza registered in Lorenzago di Cadore in 1699, as well as the one of Giuseppe Sebastiano Deppi registered in Domegge in 1777 [31] (Fig. 6). In this case, similar analogies leave open questions on the provenance from Cadore timberlands by the Piave.

From the accounting records of the nineteenth century, under the Austrian authority, documents report on partial replacements of the cover boards, king posts, rings and ribs in the three medieval domes, in the dome of St Jacob and the one above the presbytery. On the replaced boards, one can see acronyms that consist of three or more alphabetical, numerical and/or cuneiform characters. These include reiterations of the letters M, S, X and W, flanked by other characters akin to numbers. Sometimes the same mark occurs in several domes or on different elements of a single one. (Fig. 7)

Moreover, in replaced plates in the façade's dome, there are two inscriptions of analogy with those known from the northern European trades. (Fig. 8) Such diversity from the other local marks could be contextualised during the Habsburg domination for imported timber of limited sizes, such as the planking. However, more in-depth discussions on this subject are to be found elsewhere. Eventually, there is a three-symbol mark among the Relics dome's cover plates similar to tags used in the late 19th century by floating timber companies along the Piave [32]. (Fig. 9)

As it turned out, the post-eighteenth-century fire reconstructions, and the interventions in the late nineteenth century, could have involved timber supply down the Piave, likely from Cadore forests. A similar scenario would be not so unlikely accurate as in the mid-eighteenth century, with few others, the Cadore woodlands still provided large quantities of larch [33]. In addition to this, from the fifteenth century until 1797, Padua was a territory under Venice's republic. Timber purchase and other raw building materials mainly took place in Venice that strictly controlled the supply according to its constantly increasing demand.



Fig. 8 Inscriptions on replaced cover boards in the façade's dome (picture: author).

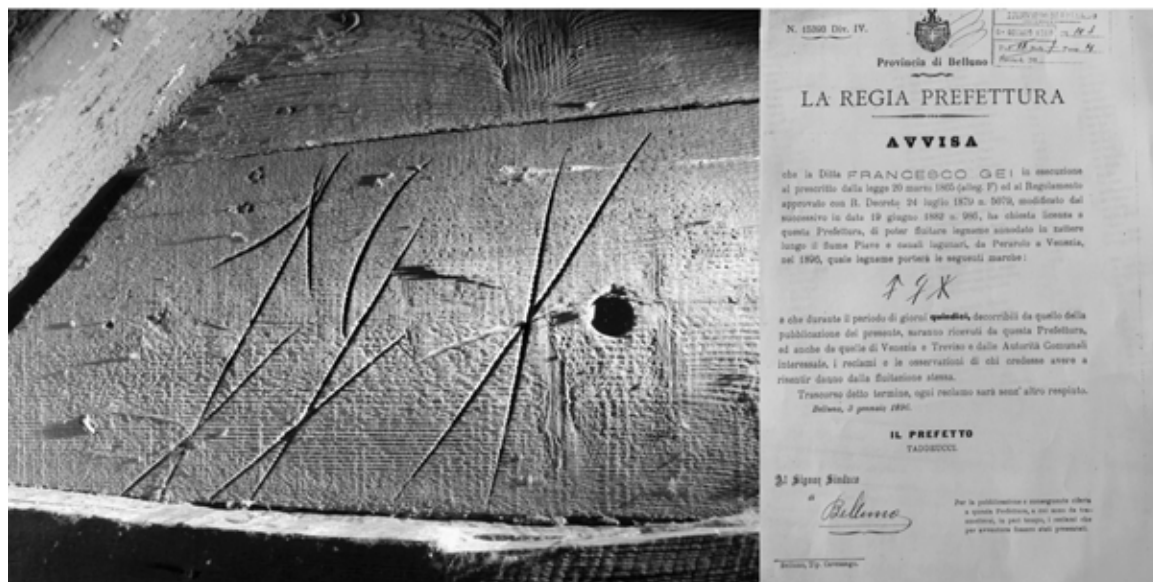


Fig. 9 Floating mark on a cover board in the Relics dome (picture: author), and similar one documented in 1896 along the Piave route, from Perarolo to Venice (State Archive of Belluno).

Conclusions

The research contributed to documenting the timber's dendro-provenance between the sixteenth- and eighteenth centuries during historical worksites in the timber superstructures of St Anthony basilica. It is possible to identify operators and trade routes involved over centuries through complementary investigations on archival documents and trademarks. In particular, from the two different types of findings (archival documents and marks), it comes out a possible shift of mountain sources and routes over centuries.

Archival documents have revealed the names of Paduan timber merchants active in the late sixteenth century, by the Cison and Brenta water systems, involving consignments from the woodlands located in Primiero, Valstagna and Grappa in the Vicenza region, as well as Asiago, Valsugana and Tesino sectors.

Trademarks found in different domes identify replacements that occurred in the superstructures during the mid-eighteenth and the nineteenth centuries. In particular, the reiteration of the same marks contributes to date interventions occurred simultaneously in several domes. Furthermore, the comparisons of these marks with others recorded by previous research suggests the use of rafted timber along the Piave. If verified by further findings, this would mean a shift in the dendro-provenance of the timber supply in the history of the Basilica's domes towards woodland resources located in Cadore between the eighteenth and nineteenth centuries.

Further archival research should help to trace the timber batches used in the Venetian building sites between the sixteenth and twentieth centuries. Lastly, further research on historical timber traders and shipping marks along Brenta and Piave routes might help depict a broader scenario of the trade history of repairs in the medieval roofs of the Basilica in Padua.

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