

Extrados Vaults in the Chartreuse of San Giacomo in Capri, Italy: History, Knowledge and Conservation of a Vernacular Architecture in the Mediterranean Landscape

S. Iaccarino^{1,*}

¹ University of Naples Federico II (Department of Architecture), Naples, Italy, sara.iaccarino@unina.it

Topic: T1.4. Restoration and conservation of vernacular architecture

How to cite: Iaccarino, Sara (2025). Extrados Vaults in the Chartreuse of San Giacomo in Capri, Italy: History, Knowledge and Conservation of a Vernacular Architecture in the Mediterranean Landscape. In C. Mileto, F. Vegas, A. Hueto-Escobar & S. Manzano-Fernández (Eds.) *Earthen and Vernacular Heritage: Conservation, Adaptive Reuse and Urban Regeneration*. September 10th – 12th, 2025, Valencia (Spain). edUPV.
<https://doi.org/10.4995/HERITAGE2025.2025.19318>

Abstract

This contribution explores the restoration issues concerning extrados vaults in Capri covered by lapilli aggregate, an artisanal mortar realized with eruptive products. In particular, the contribution will focus on the vaults located in the Chartreuse of San Giacomo in Capri, one of the island's oldest architectural landmarks, built in 1371 on the lush southern shore of the island. Different kinds of extrados vaults can be found in the chartreuse, all covered by lapilli aggregate, a special protective surface whose preparation and laying down require a high level of craftsmanship. The adoption of this construction technique makes the ancient chartreuse a precursor of an extensive application of this specific covering to the rural heritage, built either on the island or on the coasts of Southern Italy. The application on the chartreuse is an important contribution to the definition of one of the cornerstones of the collective language of vernacular architecture in the Mediterranean landscape. The study starts from a material-typological reconstruction of the extrados vaults of the Chartreuse of San Giacomo, focusing also on the interventions realized on these structures in the past. Then, the conservation issues have been analysed in order to define the possible scenarios of a sustainable maintenance and restoration interventions. On this point, the study intersects with ongoing research on the identification of new products to substitute/reintegrate the technique of lapillus; this study is being conducted by the research unit of the Department of Architecture at the University of Naples Federico II, part of a PNRR Project promoted by the CHANGES foundation, which seeks to promote sustainable practices in cultural heritage preservation.

Keywords: chartreuse; Capri; vernacular architecture; vaults; conservation

1. Introduction

The experiential analysis of the Chartreuse of San Giacomo in Capri, as articulated by Roberto Pane (Pane, 1981, p. 61), immerses us in the unique architectural characteristics that distinguish this construction on the island, representing a distinctive interpretation of the monastic 'rule' of San Bruno:

The Charterhouse is the triumph of the extrados vaults, in the truly functional movement of the rounded corners of the arches, in the rough surface of the tuff concrete [...] To those who walk across the undulating roofs, an unusual pleasure is offered: the feeling of being physically – as well as mentally – involved in a plastic effect (Di Stefano, 1982).



Fig. 1 – *The Chartreuse of San Giacomo in Capri rural landscape* (Archive of Suprintendence of Naples).

This medieval religious complex is the most recent of the three charterhouses built in Campania (it has been built after the Chartreuse of Padula and the Chartreuse of San Martino) and adheres strictly to the validated plan distribution typical of Carthusian architecture. However, its volumetric realization transforms it into something singular, drawing heavily from a Mediterranean architectural vocabulary that resonates throughout the island (Fig. 1).

The chartreuse is notably characterized by various types of extrados vaults covered by lapilli aggregate, a particular protective surface crafted with a high level of artisanship. This architectural tradition claims that the Chartreuse of San Giacomo in Capri is the first instance of this construction technique applied on the island (Picone 2010). In this context, the adoption of such methods positions the ancient charterhouse as a precursor to the widespread implementation of this unique covering across rural heritage – both on the island and along the coasts of Southern Italy – contributing significantly to the

definition of a cornerstone of vernacular architecture in the Mediterranean landscape (Cantone et al., 1982). Consequently, the chartreuse serves as an important case-study to evaluate restoration strategies of a complex and fragile vernacular architectural system.

Implementing a proper intervention on these protective surfaces is particularly challenging due to the limited availability of raw materials, such as lapillus, a natural product formed from volcanic deposits, as well as the execution technique itself, which involves a labour-intensive process of layering and pressing down materials using specialized tools. The pressing process could not be interrupted, often requiring builders to carry on their work through the evening, aided by the encouragement of traditional local songs.

The complexities of planning a restoration intervention on specific materials not easy to replicate – due to either their material properties or sustainability concerns – are clear. Considering these challenges, modern

technology and production techniques have sought to propose various alternatives for the integration and conservation of extrados vault systems, often introducing new industrial or combined products that may not fully align with the original structures. Thus, it is crucial to re-evaluate best practices for restoring extrados vaults covered in lapilli aggregate.

At this juncture, the current study intersects with ongoing research aimed at identifying new products to substitute or reintegrate the lapillus technique, facilitated through collaboration with Mapei S.p.A. This study is being conducted by the research unit of the Department of Architecture at the University of Naples Federico II¹ as part of a PNRR Project promoted by the CHANGES Foundation, which advocates for sustainable practices in cultural heritage preservation.

This contribution, by a material-typological reconstruction of the extrados vaults of the Chartreuse of San Giacomo, will focus on the role this construction type plays within the formal typology of the monastic complex and its significant transformations over time. The text will also examine past interventions on these vaulted structures, revealing that the technical solutions employed in their restoration often lack consistency with the ancient protective layers of lapilli aggregate. In the final section, both historical and contemporary conservation issues surrounding the vaulted systems will be analysed to outline possible scenarios for sustainable maintenance and restoration interventions.

2. The role of the extrados vaults in the Chartreuse of San Giacomo in Capri

2.1. The vernacular architecture of Capri and extrados roofing technique

A special contribution to the central role that the chartreuse had in the constructive history of Capri and, at the same time, on the historical transformations of landscape must be addressed to the extrados vaults system. Plastic shapes of vaults define the profile of chartreuse, which recreate a formal connection with colours, materials and formal typology of vernacular architecture of Capri. In this sense, the extrados vaults are one of the most important aspects to preserve in a correct way to respect the landscape and its perception. Besides, the vaulted system links the chartreuse not only to Capri's architecture, but also to that of the Mediterranean.

Thus, the Chartreuse of San Giacomo is the result of two main construction phases: one medieval and one 17th-century. However, as noted by Roberto Pane, the medieval structures, including the vaulted system, are significantly more prominent – particularly due to their explicit reference to the Byzantine architectural style – especially visible in the buildings along the Amalfi Coast.

These medieval elements also had a more direct influence on the island's building tradition, based on artisanal construction techniques: there is a repeated use of extrados vaults covered with tuff concrete, the rustic roughness of white walls, occasionally adorned with simple, perfectly

¹ This contribution is a disseminative product of the research promoted by CHANGES – *Cultural Heritage Active Innovation for next Generation Sustainable Society*, “PE5. Humanities and cultural heritage as laboratories of innovation and creativity”, Spoke 6 – *History, conservation and restoration of cultural heritage*, MUR project: PE00000020 – CUP E53C22001650006. The research unit of University of

Naples Federico II that is working on the definition of a possible substitute of ancient lapillus aggregate – together with Mapei S.p.a. – is composed by: prof. Renata Picone (coordinator), prof. Valentina Russo, prof. Vincenzo Morra, prof. Lia Romano, arch. PhD Ersilia Fiore, arch. PhD Sara Iaccarino, arch. PhD Maria Verde.

integrated ornamental details, a departure from the more decorative tendencies typical of the 17th-century style.

On this point, the chartreuse must be considered in close relation to its natural context: the ancient Carthusian desert (Picone, 2008, pp. 29-60), which, since the early 20th century, began to be the site of a violent speculative construction phenomenon. Evaluating cases like the Chartreuse of San Giacomo from a conservation standpoint requires considering the work's values as closely tied to the ecological and environmental conditions surrounding it. As Roberto Pane and, decades later, Giovanni Urbani taught us (Urbani, 2000), it is not possible to effectively restore the first without restoring their surrounding environment as well.

2.2. The extrados vaults system in the 'life' of Chartreuse of San Giacomo: an ancient story of transformations

The monumental complex of the Charterhouse dedicated to San Giacomo is situated in a vast, flat green expanse at the foot of Mount Castiglione in Capri, approximately 100 meters above sea level in the area known as Lama (or Sama). This location fully meets the requirements of the 'Carthusian desert' as stipulated by the *Rule* of Saint Bruno, which mandated a certain distance between cloistered religious settlements and inhabited areas. In this case, the 'desert' was partially formed by a cliff overlooking the northern coast of the island near the Faraglioni. At that time, surrounding dwellings were far removed and fortified by walls, a condition that has gradually diminished due to tourism and subsequent illegal constructions.

The complex came under the ownership of Giacomo Arcucci around 1363 (Cantone, Fiorentino, Sardella, 1982, pp. 192-193; Pane, 1954; Pane, 1965, pp. 40-64), who served as secretary to Queen Joanna I of Angiò and was the Count of Minervino and Altamura, financed its

construction beginning in the 1360s, with the medieval phase of the building completed by 1371. It is important to note that the construction of the building should not be viewed as a singular authorial project. Instead, the chartreuse exemplifies a paradigmatic vernacular style grounded in the artisanal traditions of Capri and southern Italy.

The deep connection between the chartreuse and the evolution of its landscape is evident in historical sources suggesting that the Carthusian settlement may have been built upon Roman ruins of the island. This hypothesis has been proposed also by Roberto Pane, but archaeological excavations, such as those led by Amedeo Maiuri, have not found sufficient evidence to confirm the existence of earlier structures incorporated into the medieval building (Maiuri, 1957; Maiuri, 1962; Cerio, 1921; Cerio, 1922; Cerio, 1950).

During the 16th century, the monastic complex suffered significant damage from attacks – first by Frederick Barbarossa (Di Liello, 2004), then by the corsair Dragut, along with numerous other raids. In 1564, the construction of a guard tower commenced, as commissioned by a military engineer sent by the Viceroy of Naples, Parafan de Rivera; however, this tower collapsed in May 1808. These events prompted the Carthusians to abandon the monastery, leading to a prolonged reconstruction phase from 1560 to 1656, which continued in 1691 with the reinforcement of the tower and the renovation of the large cloister and presbytery of the church, completed by 1699. During these renovations, a three-arched bell tower was added next to the refectory, but it was demolished in 1908 due to safety concerns.

The Carthusian complex showcases two main architectural phases: the medieval, characterized by its foundational layout and construction techniques, and the baroque, evident in the few decorative elements that still enhance the simple, textured walls today.

In both phases, the vaulted system played a crucial role. During the medieval construction, as noted by Roberto Di Stefano (Di Stefano, 1982, p. 60), key areas of the chartreuse were covered by cross vaults, including the church, refectory, and fathers' cells along the sides of the large cloister. Secondary functional spaces, such as the monks' work areas, were covered by simpler barrel vaults.

The vault typologies evolved during the baroque period, notably with the addition of new spaces to the original complex, such as the Quarter of the Prior. This addition, featuring several attractive spaces on the eastern side of the large cloister, was distinguished by pavilion lunette vaults, a popular technique during the 17th century, as seen in the Church of Salvatore, always in Capri (White 1980, pp. 41-42). In the Chartreuse of San Giacomo, this vault type is also present in some of the fathers' cells around the large cloister. This adaptation might seem unexpected, considering the cells were constructed in the medieval phase. Originally, the cells alternated with small private gardens where each monk could pray and meditate. However, in a later phase, some gardens were transformed and enclosed to create additional cells. Several theories exist regarding when these conversions happened; today, these new rooms feature pavilion lunette vaults, suggesting this transformation may have occurred in the 17th century.

While the volumetric transformations up to the 17th century can be considered an architectural enhancement of the monastic complex, the alterations made in the 19th century, following the suppression of the Carthusian Order in 1808, compromised the ancient character of the chartreuse (Iaccarino, 2024). During this period, the properties of the Carthusians were seized by the French, forcing the monks to evacuate. This displacement led to a gradual decline in the complex, which, by 1815, was repurposed as a penal institution, housing war invalids until 1860.

Subsequently, it became the headquarters of the Fifth Discipline Company, undergoing modifications that drastically altered the spatial layout and volume of the building, resulting in the loss of many valuable assets. The vaulted structures were particularly affected, being covered by gabled roofs that distorted the geometry of the complex.

This transformation is evident in numerous artistic representations from the 19th century, where the chartreuse is depicted with its medieval extrados vaults concealed beneath large, pitched roofs. Other significant alterations occurred in the cloisters, where the elegant slender columns of the small cloister – remarkable for their Roman capitals from the medieval construction – were replaced with much bulkier concrete pillars.

These changes often undermined the intrinsic quality of the building, prompting key figures in 20th-century architectural restoration to intervene. Their efforts aimed to restore a much-desired unity of image, form, and space. Notably, the work of Gino Chierici between 1925 and 1927, along with subsequent interventions by Roberto Di Stefano from 1975 to 1980 (Picone 2013), allowed the Charterhouse to gradually reclaim its identity as a cathedral of the ancient Mediterranean. This restoration process focused on reintroducing fundamental characteristics that only such dedicated efforts could reveal.

Chierici's interventions were particularly crucial in restoring the ancient appearance of the complex, addressing significant damage inflicted by the alterations in the 19th century. His work concentrated on the church, the small cloister, and the extrados vaults, which had previously been obscured by roofs. Through his efforts, these architectural features became visible once more, allowing the essence of the chartreuse to be reinstated.



Fig. 2a & 2b – Two slides of 1980's intervention on extrados vaults system (Photographic Archive of Suprintendence of Naples, slides 017A, 067B).

3. The extrados vaults system. Conservative issues of a vernacular technique

In the previous chapter, we explored how the more than twenty extrados vaults of the Chartreuse of San Giacomo in Capri symbolize the local vernacular architectural tradition and serve as tangible evidence of the building's historical evolution. Given their significance,

these vaults must be regarded as one of the most iconic elements to observe and preserve during the restoration of the monastic complex. For this reason, understanding the common conservation issues affecting this unique heritage is essential.

It is important to note that these horizontal surfaces are directly exposed to various environmental factors, including rain, wind, and solar radiation. The design of the extrados vaults has been specifically crafted to manage rainwater through their shapes. The horizontal surfaces are modelled to create natural slopes and concavities that guide rainwater flow without incorporating foreign materials or elements, such as metal eaves. At the points where two different types of vaults connect, architectural elements have been altered to regulate water flow, such as in the father's cells around the large cloister, where ancient gardens are topped with pavilion lunette vaults interspersed with cross-medieval vaults. In this instance, small, irregular walls have been opened to facilitate the connection between these two systems.

When rainwater reaches the vertical walls, there are no metallic downspouts to direct it. Instead, at the Chartreuse of San Giacomo, water is channelled onto artisanal brick tiles, protecting the mortars and stones of the façades. In this context, the architectural shape serves not only as a formal vernacular language but also as a vernacular 'plant engineering' system.

Upon analysing the vaults of the Chartreuse of San Giacomo, we can identify issues linked to the complex and artisanal nature of rainwater management. Although lapillus aggregate is a waterproof material, it can deteriorate over time, leading to cracks that allow water to penetrate the structural stone of the vaults, thereby triggering humidity infiltration indoors. This issue has manifested notably in the church and the adjacent vestry, damaging 17th-century frescoes and stuccoes. The problem is also evident on the horizontal roof covering the porch of the large

cloister, which is similarly surfaced with lapillus aggregate. Here, the horizontal condition exacerbates rainwater accumulation, leading to increased degradation, including cracks and biological patinas. In recent years, infiltration on the porch has been particularly pronounced in the southeast area of the large cloister, resulting in damaged arches and cross vaults, along with significant staining and loss of material on the intrados surfaces. When the lapillus aggregate is compromised, robust weed growth occurs, further damaging the surfaces and, in the case of stronger roots, even the structural materials.

Since the second half of the 20th century, numerous maintenance interventions have been carried out on the chartreuse and its vaulted system (Fig. 2a & 2b). We can easily identify them by different chromatic values between original lapillus aggregate and modern interventions of mending (Fig. 3). However, these interventions are not fully compatible with lapillus aggregate, not only for an aesthetic instance. Documentation preserved in the Superintendence Current Archive indicates that many cementitious injections have been applied over time. A more robust evaluation of the vaults' conservation is essential, especially as they continue to be exposed to degrading environmental agents.

This evaluation can be significantly informed by the fact that today the monastic complex is part of the Ministry of Culture's heritage. Since July 2024, it has also housed the *Archaeological National Museum of Capri* in the beautiful rooms of the Quarter of Prior (Fig. 4). As a result, the monument is subject to maintenance and receives funding for larger interventions in specific areas.

In a culturally and managerially virtuous context like the Chartreuse of San Giacomo, it is crucial to assess and experiment with new solutions to integrate the ancient lapillus aggregate, avoiding concrete and chemical consolidation materials or waterproof additives.

To this end, a team of researchers from the Department of Architecture and the Department of Earth Sciences at the University of Naples Federico II is conducting applied research to identify a product compatible with the ancient lapillus aggregate. This research is rooted in the historical composition of the material, as assessed through ancient treatises detailing its recipe, and augmented by direct analysis of original lapilli samples. The study will test various products in collaboration with Mapei S.p.A., a leading company in producing construction materials. The goal of this investigation is to avoid industrial products and to reproduce ancient techniques adapted to contemporary needs and conservation activities.



Fig. 3 – Extrados vaults of Chartreuse of San Giacomo in Capri. It's evident the presence of different forms of degradation on roof surfaces and, at the same time, the different kind of cementitious integrations (Facchini, 2018).



Fig. 4 – Extrados vaults of Chartreuse of San Giacomo in Capri next to the Quart of Prior (Facchini, 2018).

References

- Aprèa, E. (1969). *Capri: la Certosa di San Giacomo dalla sua fondazione ad oggi*.
- Cantone, G., Fiorentino, B., & Sardella, G. (1982). *Capri. La città e la terra*. Edizioni Scientifiche Italiane.
- Cerio, E. (1921). *L'avvaloramento archeologico di Capri*. Le pagine dell'Isola.
- Cerio, E. (1921). L'architettura minima nella contrada delle Sirene. *Architettura e Arti Decorative*, 4(1), 156–176.
- Di Liello, S. (2004). *Il castello Barbarossa di Anacapri*. Electa Napoli.
- Di Stefano, R. (1982). *La Certosa di San Giacomo a Capri*. Edizioni Scientifiche Italiane.
- Iaccarino, S. (2024). Le certose campane nell'Ottocento. Una storia di riuso, trasformazione e tutela. *Confronti: Il Restauro nel/dell'Ottocento*, 13–16, 219–230.
- Maiuri, A. (1957). *Capri. Storia e monumenti*. Istituto Poligrafico e Zecca dello Stato.
- Maiuri, A. (1962). *Nel mito delle sirene*. Tutitalia.
- Mangone, F. (2005). *Capri e gli architetti*. Massa Editore.
- Pane, R. (1954). *Capri*. Neri Pozza.
- Pane, R. (1965). *Capri. Mura e volte*. Edizioni scientifiche italiane.
- Pane, R. (1981). *Capri (3rd ed.)*. Adriano Gallina Editore. (Original work published 1954).
- Picone, R. (2008). La Certosa di San Giacomo a Capri: Storia e restauri. In *Appunti per una visita. La Certosa di San Giacomo a Capri* (pp. 29–60). La Conchiglia.
- Picone, R. (2010). Capri. Mura e volte: Il valore corale degli ambienti urbani nella riflessione di Roberto Pane. In S. Casiello, A. Pane, & V. Russo (Eds.), *Roberto Pane tra storia e restauro: Architettura, città e paesaggio* (pp. 312–319). Marsilio.
- Picone, R. (2013). Restauro architettonico tra riflessione teorica e prassi operativa in Roberto Di Stefano: Il caso della Certosa di San Giacomo a Capri. In A. Aveta & M. Di Stefano (Eds.), *Roberto Di Stefano: Filosofia e prassi del restauro* (pp. 151–159). Arte Tipografica Editrice.
- Urbani, G. (2000). *Intorno al restauro* (B. Zanardi, Ed.). Skira.
- White, A. (1980). La Chiesa del Salvatore a Capri: Un'opera incompiuta di Dionisio Lazzari. *Palladio*, 3(1), 41–52.