



**Third Edition**

## **RISK MANAGEMENT**

**Knowledge, Forecasting, Prevention,  
Protection, Planning, Preparedness**

**20 - 27 July 2025**



**RAFFAELE DAVANZO**

**Former President of the Orvietano Historical and Artistic Institute**

## ***Preservation of the cultural heritage in Orvieto***

**ORVIETO**

**HEADQUARTERS OF ALTA SCUOLA**

**CHURCH SANTA MARIA DEL VELO**

**25 July 2025**

## Acknowledgements



My heartfelt thanks go to Mister President of Alta Scuola, Prof. Giovanni Selli and especially to Dr. Endro Martini, who involved me in this exhibition on the restoration of the historical and artistic heritage of Todi and Orvieto, carried out under various Special Laws.

For more than 20 years, from the initial studies in 1981 until the early 2000s, I was directly involved as an architect for the Superintendence of Umbria, responsible for the territories of Todi and Orvieto.

But perhaps my closest relationship with Endro Martini was after the earthquake of September 26, 1997: we were both members of the Joint Operations Center (COM) of Nocera Umbra. The city was one of the hardest hit by the earthquake, and I undertook many challenging emergency interventions, and then the final restorations, on several particularly damaged monuments in the historic center: the Civic Tower, the Cathedral, the Town Hall, and the Church of San Francesco.

1978: *annus horribilis* – Terrible year

May 9: death of Aldo Moro

May 25, 1978: Urgent measures to consolidate the Orvieto cliff and the Todi hill  
**to safeguard the landscape, historical, archaeological and artistic heritage  
of the two cities**

L. n. 230 del 25 maggio 1978

*Provvedimenti urgenti per il consolidamento della rupe di Orvieto e del  
colle di Todi a salvaguardia del patrimonio paesistico, storico,  
archeologico ed artistico delle due città.*

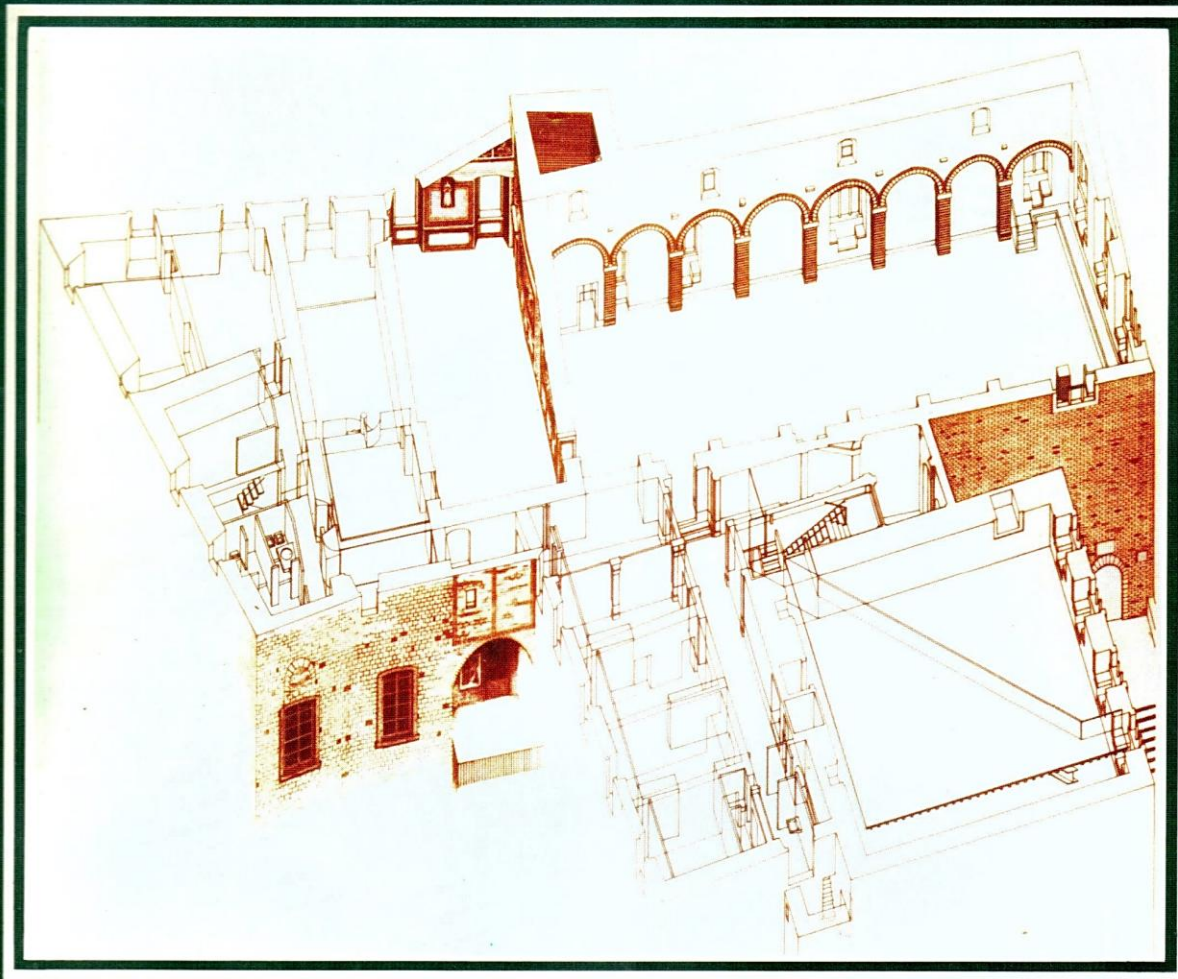
(Gazzetta Ufficiale n.155 del 06.06.1978)



**Preservation of the cultural heritage was decided from the first legislative provision**



# VERSO UN MUSEO DELLA CITTA'



CATALOGO DELLA MOSTRA PROGETTO  
TODI SALA DELLE PIETRE

## The cultural debate: 1981 *The Places of culture*

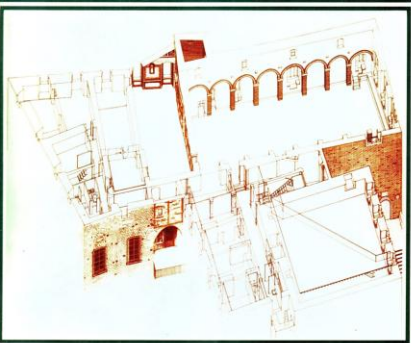
*Mostra degli interventi sul patrimonio archeologico,  
storico, artistico di Todi.*

Todi, Sala delle Pietre, 8 agosto, 31 dicembre 1981



Orvieto, Teatro Mancinelli





CATALOGO DELLA MOSTRA PROGETTO  
TODÌ SALA DELLE PIETRE

## XII. RESTAURI ARCHITETTONICI A TODÌ (Raffaele Davanzo)

XII.1	Problemi di metodo .....	p. 283
XII.2.	San Fortunato e il linguaggio medievale: spazi e luci gotiche .....	p. 284
XII.3.	Fasi principali della costruzione .....	p. 290
XII.4.	Il restauro di S. Fortunato .....	p. 292
XII.5.	Santa Maria della Consolazione: spazio ideale e problemi bramanteschi.....	p. 295
XII.6.	Fasi principali della costruzione .....	p. 298
XII.7.	Il restauro di Santa Maria della Consolazione .....	p. 299



fig. 1. San Fortunato ed il Borgo omonimo. Il forte salto di scala fra il monumento ed il tessuto circostante qualifica l'ambiente con un intenso rapporto fra perno visivo e strutturazione urbana. (Foto Soprint. BB.AA.AA.SS. Perugia).

### XII.2. SAN FORTUNATO E IL LINGUAGGIO MEDIEVALE: SPAZI E LUCI GOTICHE

La tipologia di San Fortunato di Todì <sup>6</sup> è di solito riferita a quella delle Hallenkirchen renane ed al linguaggio gotico-angioino del Poitou (in effetti la cattedrale di Poitiers, iniziata nel 1162, ma terminata nella seconda metà

<sup>6</sup> - La bibliografia sull'argomento non è ancora molto vasta (è in preparazione una monografia su S. Fortunato con contributi di G. de Angelis d'Ossat, C. Calano, G. Comez, M. Pericoli, F. Santi); oltre agli studi monografici (BRANZANI 1909 e PENSI 1926), numerosi i riferimenti in KRÖNIG 1938, WAGNER RIEGER 1960, KRÖNIG 1971, PARDI 1972 e CHIUNNI 1978.

del Duecento, è l'esempio più vicino). Il discorso, inquadrato complessivamente, può prendere però meglio l'avvio da quella concezione di edificio religioso che si stava formando in Italia nel Duecento nell'ambito degli Ordini mendicanti.

Siamo nel periodo della difficile ricerca di una identità da parte dell'architettura italiana: il *gotico italiano*, lo *stil novo*, sono termini d'uso comune per indicare questo momento storico di intensa ricerca di un nuovo linguaggio architettonico <sup>7</sup>.

<sup>7</sup> - Sull'argomento fondamentale il contributo di A. M. ROMANINI 1978; vedi anche WAGNER RIEGER 1957.

### XII.5. S. MARIA DELLA CONSOLAZIONE. SPAZIO IDEALE E PROBLEMI BRAMANTESCHI

Scrivono Arnaldo Bruschi: "Se... esiste un modello esemplare, paradigmatico, di "chiesa ideale del Rinascimento", questo è rappresentato dalla Consolazione di Todì... La chiesa di Todì sembra rappresentare il "tempio" ideale del Rinascimento nella sua forma più chiara, elementare ed icastica, pregnante rappresentazione del mondo umanistico non solo nei suoi aspetti strettamente architettonici, figurativi, visivi, ma anche nelle sue componenti socio-economiche e "politiche", oltre che culturali, religiose, filosofiche e concettuali più specifiche" <sup>14</sup>.

La Consolazione è un'ipotesi di realizzazione del programma umanistico: un microcosmo dove, nell'assolutezza dell'immagine, è raffigurato il macrocosmo divino.

L'isolamento e la contrapposizione all'ambiente circostante ed al paesaggio rendono ancora più trascendente la simbologia dell'immagine. Così il cubo di base è il mondo visibile, le quattro tribune le sue quattro parti, la cupola e le quattro semicalotte il cielo. Lo spazio centrico è colto nella sua totalità come armonia cosmica e l'asse verticale diventa, come nel corpo umano, l'elemento principale della composizione; lo spazio diviene simbolo della ragione umana che tende a fondersi con quella divina <sup>15</sup>.

Architettonicamente e tipologicamente la fonte classica, la presa diretta con l'antico dell'architetto della Consolazione sta nella spazialità tardo-romana e nelle sue riletture quattrocentesche: i riferimenti sono S. Lorenzo a Milano e la bramantesca tribuna di S. Maria delle Grazie. Le masse nell'architettura tardo-antica non si distribuiscono all'esterno secondo una successione di piani prospettici, ma si accentrano gravitando (vedi il c.d. Tempio di Minerva Medica a Roma) su un asse centrale; all'interno invece le cavità sono a prospettiche, e suggeriscono un indefinito spaziale <sup>16</sup>.

<sup>14</sup> - Arnaldo Bruschi, in NOFRINI 1970, pp. 7-8.

<sup>15</sup> - *Ibidem*, p. 9; cfr. anche WITTKOWER 1964, p. 21.

<sup>16</sup> - Sul problema del rapporto con l'antico in Bramante vedi ARGAN (1934), e Bruschi, in NOFRINI 1970, pp. 11-12.



fig. 11. La Cupola durante i lavori di sostituzione della copertura in piombo (1972). (Foto Dr. E. Mammoli).

Il rapporto classico fra pieno e vuoto diviene in area tardo-antica rapporto fra massa e atmosfera: il valore plastico diviene valore pittorico. Nella Consolazione di Todì, e nell'architettura milanese di Donato Bramante, c'è l'interpretazione critica del passaggio fra i due momenti architettonici, avvenuto 1300 anni prima. Si cercano sottili commenti lineari all'interno del Tempio (ordine inferiore e costoloni delle calotte), in una vaga e spettacolare spazialità. Le tribune dilatano la superficie col loro valore atmosferico, sottolineato dalla decorazione come avviene coi mosaici bizantini. Non c'è la perfetta rotondità classica



**The cultural debate: 1981**  
*The Places of culture*

Two leading Ideas: The City Museum and the Archaeological Park.

The role of the museum in how the maintenance and conservation of the past can consolidate and transmit historical memory while simultaneously making it a resource for planning the future.

An Archaeological Park stems from a broad movement of ideas linking an archaeological site with a green belt, which, thanks also to the associated educational activities, should create a unique cultural landscape.





## The City Museum

Moving away from the traditional concept of the museum as a place that preserves works intended for specialists and scholars, that is, as a place of pure and simple preservation. The City Museum must be a highly flexible tool, as it must be the place where everything the city preserves from its history is communicated, so that all the testimonies are still legible and relatable. It must be a moment of preparation for the actual visit; with just a few exhibits, the city's history can be reconstructed, offering visitors a good level of preparation.

It is the exact opposite of the concept of a museum where valuable objects are preserved: rather, it is the premise for a city where objects are preserved in their authentic environment.

The city can thus fully showcase its past as a place of culture.

The results of scientific research must be the subject of content communication, so as to provide visitors with an ideal vision of an ancient civilization alongside the excavation material.







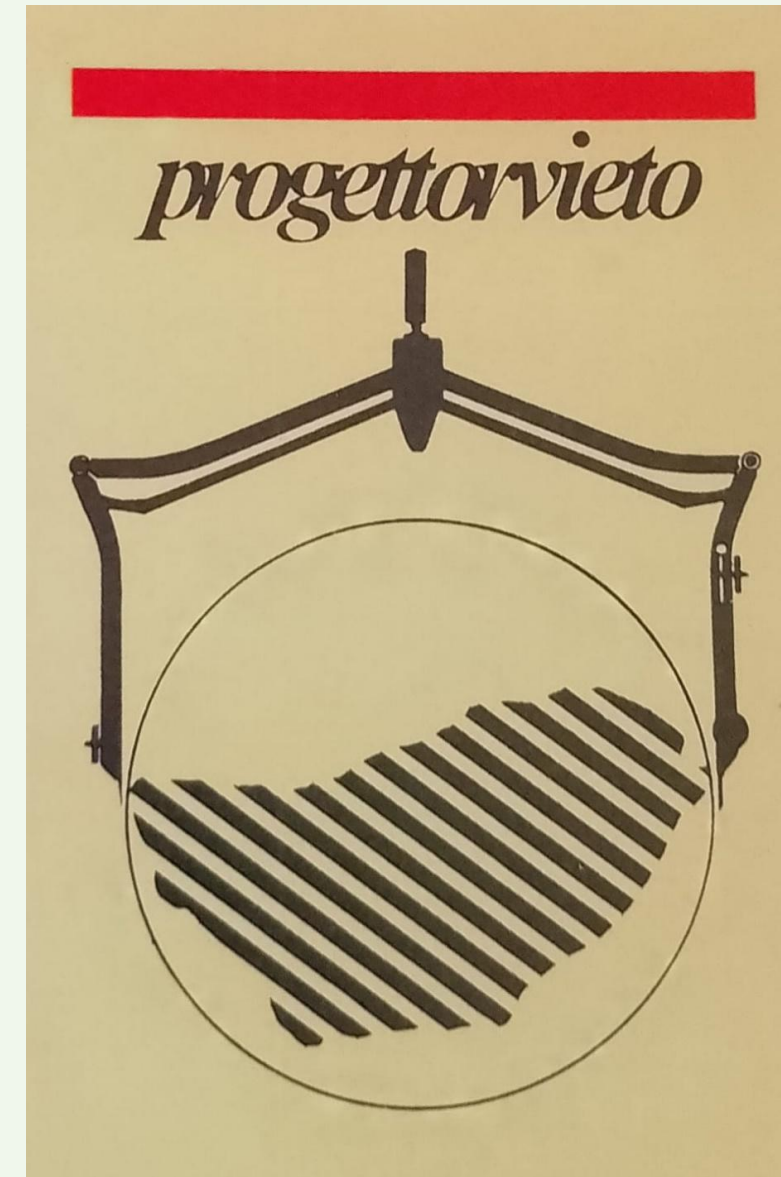


## Il Progetto Orvieto

The Orvieto Project was the sum of all the interventions planned for the rehabilitation of the cliff (la Rupe), with consolidation measures aimed at eliminating the causes of landslides, the restoration and enhancement of much of the historic center's historical and artistic heritage, and the implementation of an alternative transportation system.

The Orvieto Project represented a complex redevelopment and enhancement project, becoming a model for other Italian cities due to its coherence, its ability to simultaneously protect and enhance the urban environment: to socially experience the urban environment and carve out spaces that are materially productive from a cultural perspective. The objective: a comprehensive reconsideration of its history also by the Orvieto community. This would directly engage the citizens in a shared vision.

The Orvieto Project was therefore based on a unified cultural vision of nature & history and environment & culture. The aim was to preserve and enhance the heritage of the cliff and the historic center: that is, the cultural sites as an integrated cultural asset.



## The new laws for the preservation of the cultural heritage in Orvieto and Todi

**LEGGE 12 giugno 1984, n. 227.** *Rifinanziamento della legge 25 maggio 1978, n. 230, riguardante il consolidamento della Rupe di Orvieto e del Colle di Todi.* Per studi, progettazioni e primi interventi atti ad affrontare la situazione di grave dissesto strutturale del Duomo di Orvieto e di altri edifici storici ed artistici nonché delle mura di cinta di Orvieto e di Todi, è autorizzata la spesa di lire 1 miliardo, per ciascuno degli anni 1984 e 1985,

**LEGGE 29 dicembre 1987, n. 545.** *Disposizioni per il definitivo consolidamento della Rupe di Orvieto e del Colle di Todi.* È autorizzata la spesa di lire 120 miliardi negli anni 1987-1992 per interventi, di competenza del Ministero dei Beni Culturali e Ambientali, di recupero, restauro, conservazione, valorizzazione ed utilizzazione degli edifici, nonché dei beni e delle opere di pertinenza degli stessi.

The Refinancing of law 230/1978.

For studies, planning and initial interventions aimed at addressing the serious structural damage of the Orvieto Cathedral and other historic and artistic buildings.

It was also planned to draft an economic plan that would include all the works on the monuments of the two cities. Preliminary projects were studied for each building, in order to guarantee an economic basis for the subsequent law.

For interventions, under the jurisdiction of the Ministry of Cultural and Environmental Heritage, for the recovery, restoration, conservation, enhancement and use of buildings, as well as the assets and works pertaining to them.





## The importance of Law 545/'89

Law 545/'89 was an important and far-sighted law not only because it addressed the issue of the deterioration of the historical and artistic heritage of two important centers of national and international interest, but also because it was one of the rare examples of public administration intervention aimed at a comprehensive solution for the area, understood as a combination of social and cultural factors.

Strategic reasons induced the Ministry to appoint a general contractor: was chosen the *Bonifica* company, part of the IRI (Istituto Ricostruzione Industriale), although this was its first time working on cultural heritage.

The restoration works was awarded to the company under a concession, along with operational coordination. A work plan was thus developed based on the forecasts of the Soprintendenze, as preliminary projects, in accordance with Law 227 of 1984. The Bonifica company therefore handled the executive design, contracting, and management of the works, but always in close collaboration with the Soprintendenze.

DIRETTORI DEI LAVORI

Anni 1991-1996 Arch. Giovanni Venturini

Anni 1997-1999 Arch. Raffaele Davanzo

## **Restorations carried out in Orvieto with funding from Law 545**

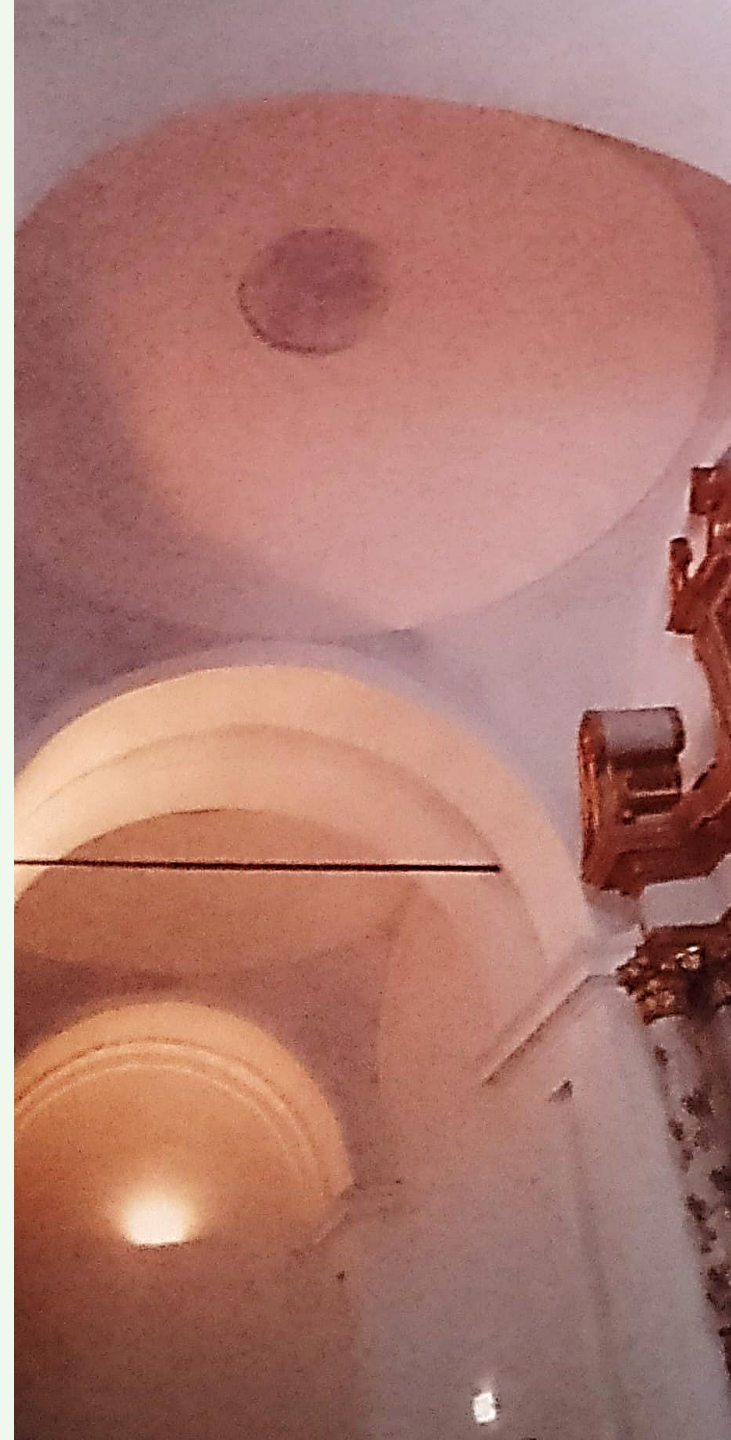
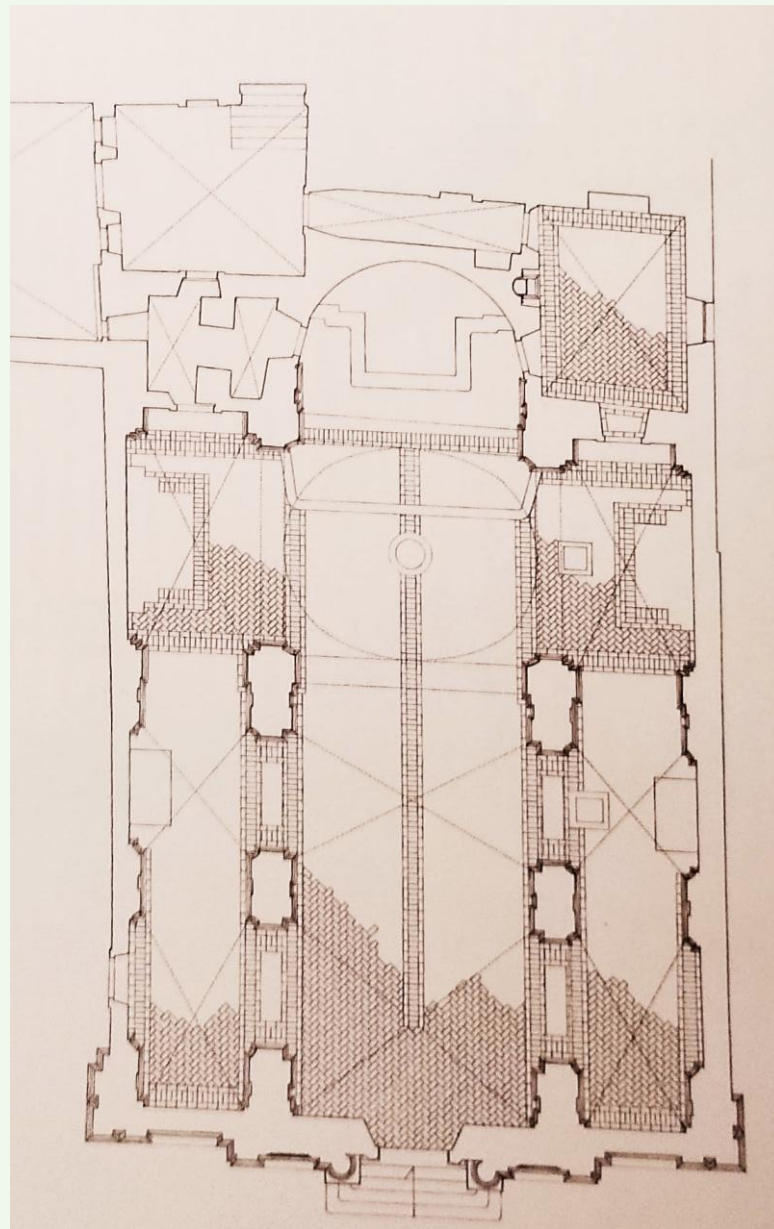
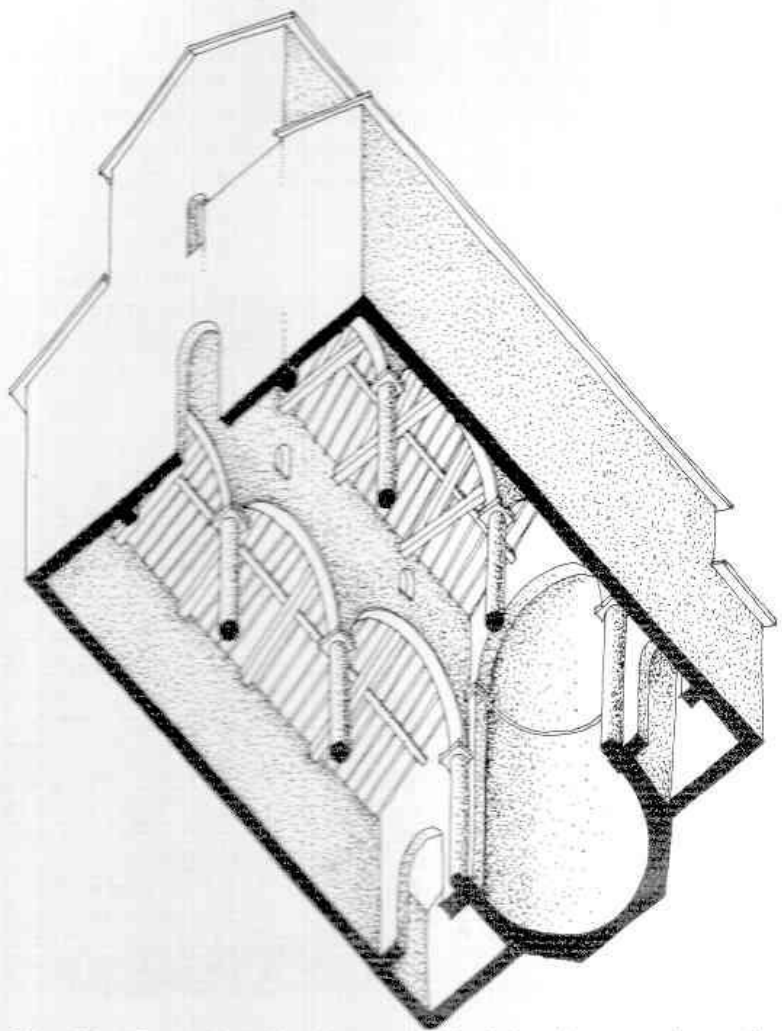
### **HOLY APOSTLES CHURCH**

The original medieval church had three naves, traces of which remain on the right exterior. It was completely renovated at the end of the 16th century, when it became part of the Society of Jesus. The Jesuits initially built in Orvieto the church of the Gesù, but it proved too small, and was later used by the Clarisse, Franciscan Poor Clares. The late 16th-century plan follows the medieval one, incorporating the individual medieval columns into composite pillars; the vaulted roof like false domes, was a direct reference to the church of Sant'Ignazio church in Rome, the second Jesuit church after the Gesù. An elliptical dome was built in place of the medieval church's transept.

The building was in a state of total abandonment. To consolidate the dome, multiple rings were created; and to support the new lead sheets, an aluminum structure was created. A new laminated wood roof was installed above the consolidated vaults. The building has regained its appearance as a simple and dignified baroque-style hall, with perfect acoustics for preaching and religious music.

















## **Restorations carried out in Orvieto with funding from Law 545**

### CARMINE CHURCH

The Carmelites were the last mendicant order to settle in the city of Orvieto: this occurred in 1308, when the friars occupied the end of the Loggia dei Mercanti, filling in the arches and inserting a pointed portal.

It was conceived as a single hall divided into two bays separated by a transverse arch. From 1580, in the church underwent various decorative works, with stucco and frescoes.

It was reduced to a state of ruin, without the roof.

Complete restoration was carried out, and the decision was made to adapt the hall into a multipurpose cultural center for theatrical and musical performances. The walls were consolidated while still in ruins, and the roof was designed to accommodate technological systems.

Outside, the remains of the Fontana del Carmine, by Ippolito Scalza.











## CHURCH OF SANT' AGOSTINO

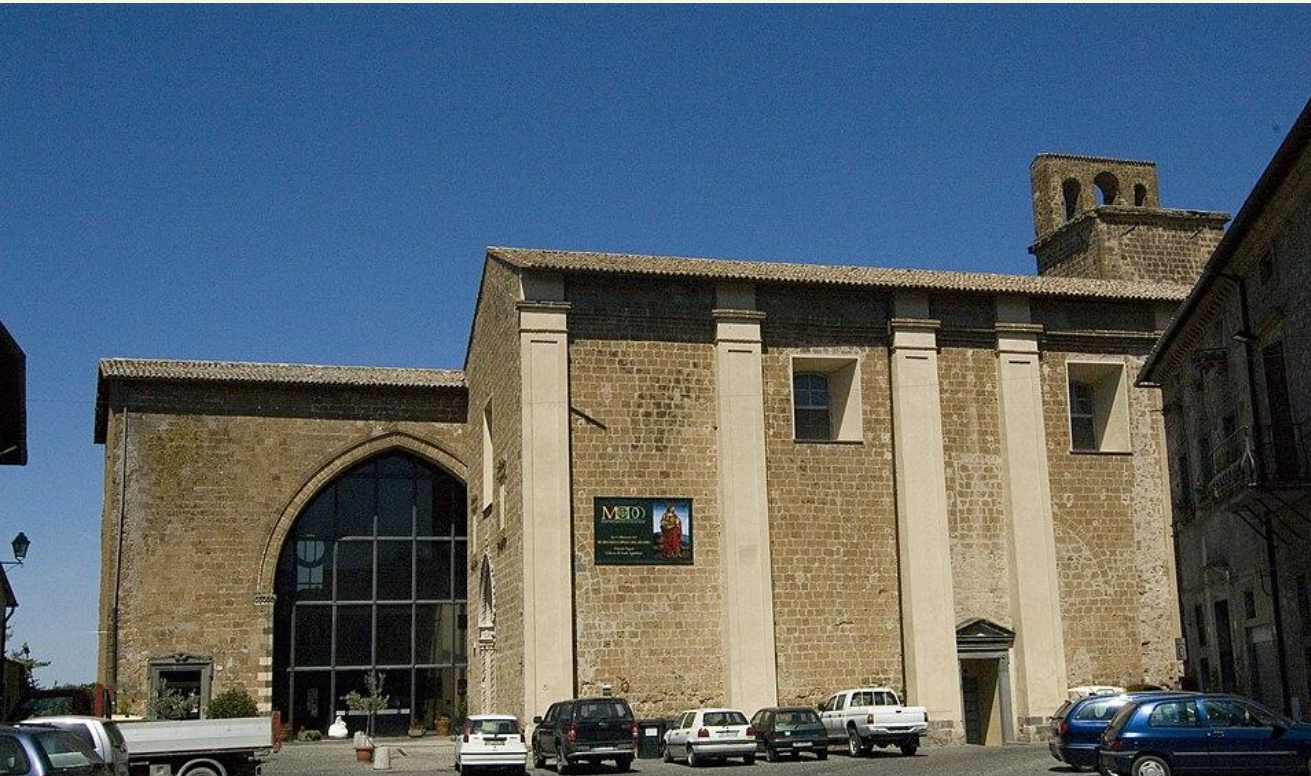
In the mid-13th century, the Augustinians settled on the Rupe, occupying the church of Santa Lucia, which had belonged to the Abbey of SS. Severo and Martirio. It was a single-nave church with side altars and a rectilinear apse with a large *bifora*, a mullioned window in the center.

The Augustinians decided to enlarge their site, essentially building another church at a 90° angle, so that the old church would become the transept of the new large complex.

But they only completed the construction of the presbytery of the new church, which is now used as a restaurant. Thus, they remained in the church of Santa Lucia, which was modified in the early 18th century, taking on a late Baroque and Neoclassical appearance. The church had been used as a garage for vehicles from the nearby Air Force barracks, which had occupied the entire convent.













## SAINT FRANCIS CHURCH

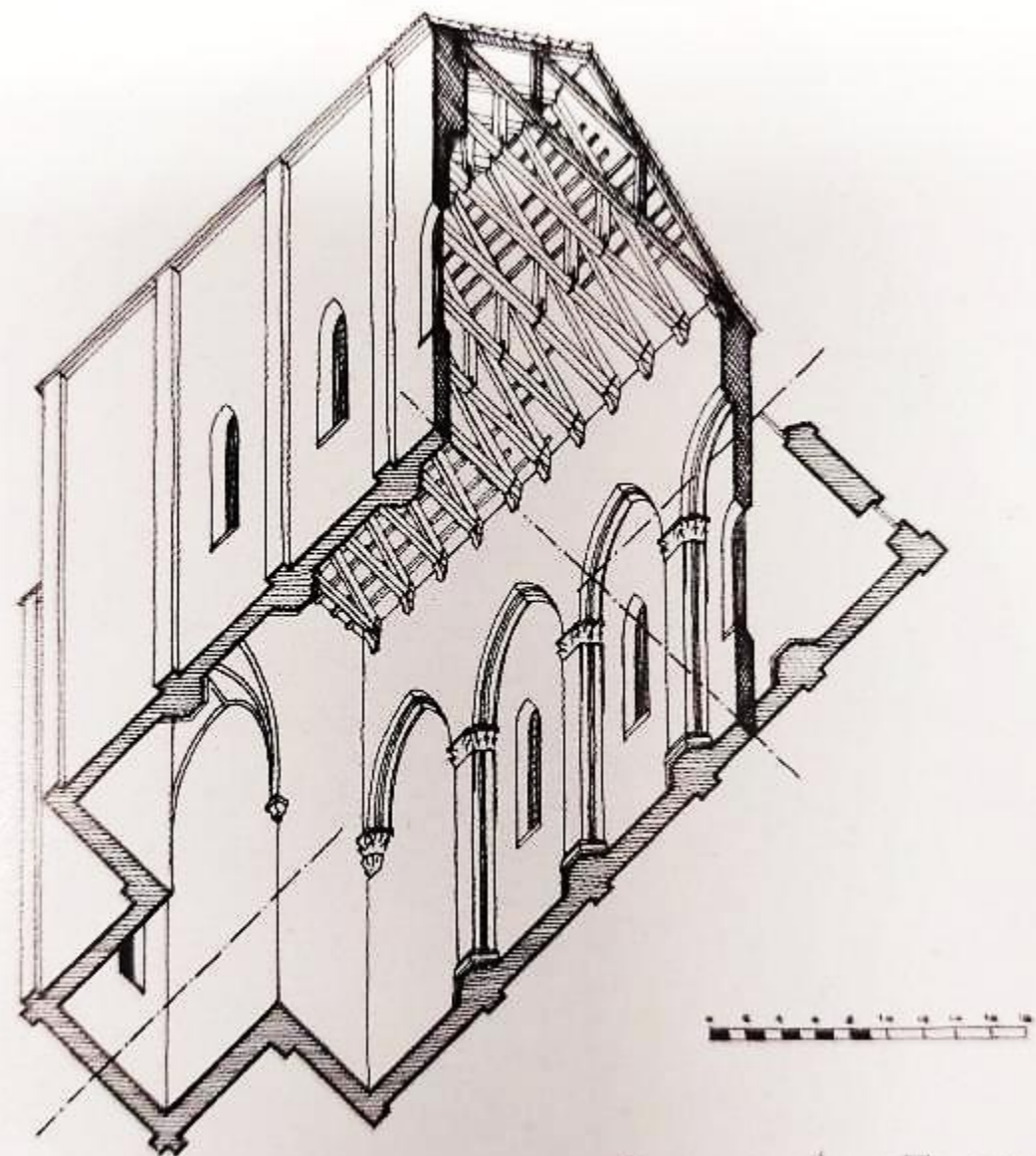
Dates back to around 1265. Like many other mendicant churches, it was designed as a large hall covered by a roof supported by wooden trusses, and a square presbytery. The great width of the nave, 22 meters, the widest of all the churches of the mendicant orders, caused serious problems with the stability of the trusses, because the tie beam, or chain, due to its considerable weight, was subjected to more bending than tensile stress.

It was replaced many times until, at the end of the 18th century, it was decided to reduce the width of the church, essentially transforming it from a single nave to three, making the central nave much narrower. The church took on an appearance somewhere between late Baroque and Neoclassical.

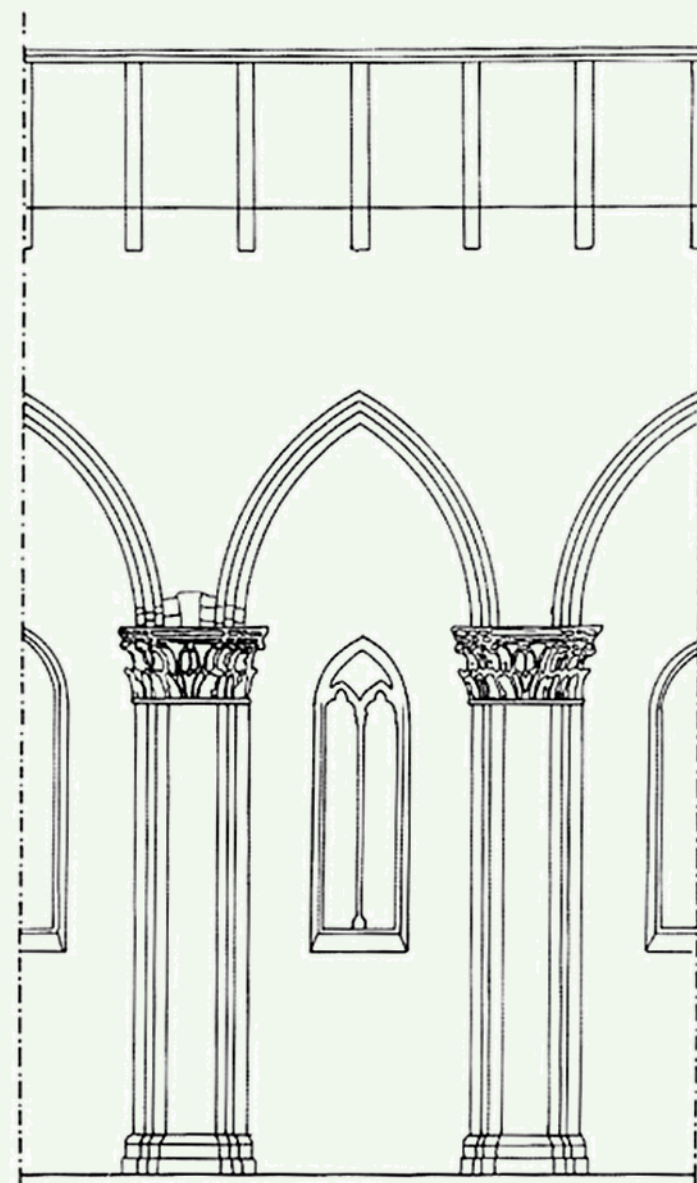
The work involved the roofing, which was made of laminated wood with metal chains, and the roof slab of corrugated sheet metal. But the slope of the roof was very steep, which caused the tiles to slip and thus allowed numerous rainwater to enter.

The church has been closed for about twenty years, and its state of preservation today is very worrying.





ORVIETO, SAN FRANCESCO  
RICOSTRUZIONE



0 5 10 m









Note that the slope of the roof was very steep, which led to the tiles slipping.





The slipping of the tiles created many cracks, resulting in the entry of rainwater





Rainwater infiltrations and cracking of stuccos









Birds of all kinds enter through the now glassesless windows, and the entire floor is covered in their droppings. A toad even!





The circular truss that supports the roof above the dome: very dangerous situation especially due to the limited size of the wooden elements





The chapel of San Matteo, with frescoes of the stories of the saint, by Piero di Puccio, 14th century.



## THE PALACE OF THE SEVEN LORDS (DEI SIGNORI SETTE) AND THE TOWER CALLED *DEL MORO*

It was built at the heart of the city, at the intersection of the main streets of the *Crux Viarum*, namely the Mercanzia, now Corso Cavour, and the other axis of the Via del Duomo and Via della Costituente.

It was the seat of the Signori Sette, the consuls of the guilds: in practice, it was the place where executive power was exercised, that is, the governance of the city, especially with regard to public works. The palace has an L-shaped plan, with the Torre del Moro as the hinge on both sides. The palace was completed in 1319, but with the end of municipal liberties resulting from the governorship of Cardinal Albornoz, after 1364 the palace, like the Palazzo del Popolo, was abandoned, no longer having a civic function.

At the end of the 19th century, designed by Paolo Zampi, the post office was organized on the ground floor.

The current project has made all the spaces functional, creating spaces for exhibitions and other cultural events. On the ground floor, along Via della Costituente, a structure has been created that exploits the medieval modular spaces for a library. The lower section of the Torre del Moro has been equipped with an elevator; the route then continues as stairs up to the terminal terrace.















THE TOWER CALLED *DEL MORO*







## MANCINELLI THEATER

It was designed by architect Virginio Vespignani, who had just completed the Teatro dell'Unione in the nearby city of Viterbo. The rich decorative works, carried out by a team of artists led by Angelini and Fracassini, were significant: grotesques, landscapes, gilded stucco, and a large elliptical vaulted ceiling. A perfect theatrical machine, inaugurated in 1866.







In addition to restoring a natural sounding board that had been ignorantly abolished after the Second World War, the restoration involved all the fresco and stucco decorations; all the upholstery was renewed with modern and fireproof fabrics, and all the systems, including the safety ones, were installed.











The *Ridotto* of The Mancinelli Theater



## MONALDESCHI PALACE

The Monaldeschi family has always been one of the most important in Orvieto, along with the Filippeschi and the Simoncelli families, and also controlled a large portion of the territory nominally belonging to the municipality. In the mid-16th century, Sforza Monaldeschi entrusted the design for his new, large palace to Simone Mosca, a Florentine architect who had been commissioned to design the Cathedral Factory. The most interesting area is the corner, where inside is the so-called Sala della Caminata, or fireplace room, featuring a series of frescoes depicting Sforza's military exploits. They were completed in 1584, with Cesare Nebbia as artistic director, but several other artists also contributed. In addition to the interior decorations, all the exterior plasterwork and the 16th-century portal have been restored.

Unfortunately, the palace, which housed the State School of Art, later renamed the Liceo Artistico, has been unused for nearly twenty years. This has led to a serious deterioration of the complex, as has also occurred with the church of San Francesco. Indeed, the failure to use these structures always leads to serious conservation risks.









## FAINA PALACE

The palace dates back to the mid-19th century: it was built on pre-existing 17th-century structures, with a neo-16th-century layout.

The work focused on the museum layout; in terms of masonry work, the entire second floor and the entire roof were renovated, including the replacement of the original roof terrace. Two museums; on the ground floor, the Civic Museum, spread across three large rooms, houses the antiquities collected during the 19th century by the municipality of Orvieto. It displays the most significant Etruscan artifacts from Orvieto's archaeological heritage, including many Etruscan sarcophagi. Among other Etruscan relics, noteworthy are the Venus of Cannicella, the Cippus with a Warrior's Head, the Pietra Campana sarcophagus, and the pedimental decoration of the Tempio del Belvedere.







The upper floors display pieces from the Faina Collection, and the rooms have retained their original noble palace appearance, with display cases housing archaeological collections. The exhibition begins with a rich coin cabinet and continues with artifacts characteristic of Chiusi and Attic black-figure and red-figure vases. Among the former, three exceptionally valuable amphorae attributed to Exekias, the greatest Attic black-figure ceramicist, stand out. On the second floor, the antiquities are arranged typologically and chronologically: prehistoric and protohistoric materials precede bucchero, Attic black-figure and red-figure pottery, and Etruscan bronzes; three rooms are dedicated to Etruscan ceramics.

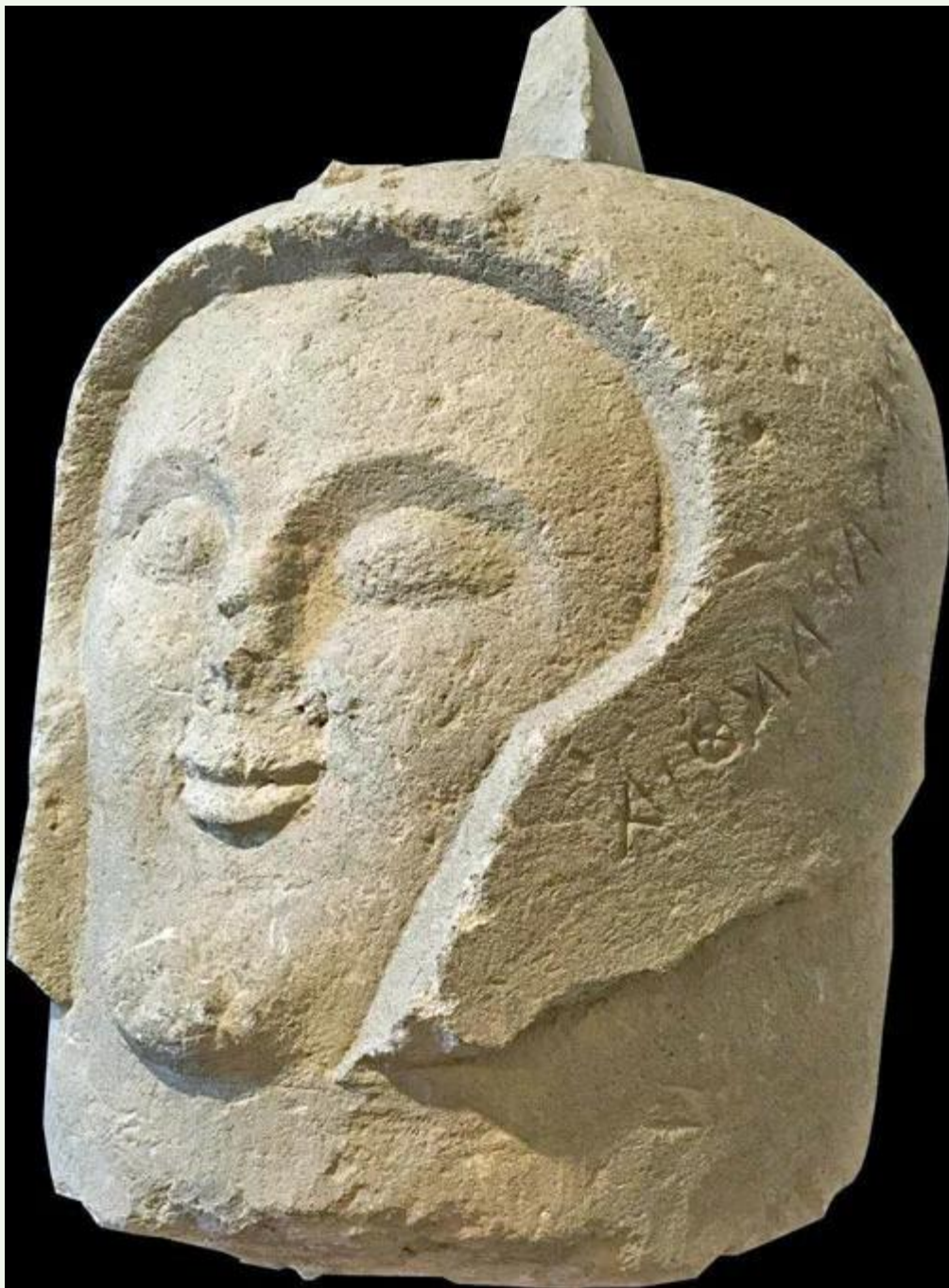
A feature of the second floor is a gallery that offers a unique view of Orvieto Cathedral.

















## The so-called *Orvieto Snatch*, the Mugging of the restoration works in the Cathedral

Opposition to the awarding of the works on the Orvieto Cathedral to the Concessionaria Bonifica sparked a massive mobilization among intellectuals and artists.

Leading the movement of opinion were the local historical-artistic director, Giusi Testa, Federico Zeri and the journalist Fabio Isman.

Faced with this opposition, the Ministry chose to remove from the works awarded to Bonifica a series of grants in cathedral, that had managed by the Soprintendenza dell'Umbria.

LEGGE 20 giugno 1991, n. 193 *Provvidenze per i restauri del Duomo di Orvieto e a favore dell'Opera del Duomo di Orvieto.* (Gazzetta Ufficiale n.153 del 02-07-1991)

*3.494 milioni annui per il triennio 1991-1993, utilizzando parzialmente le disponibilità di cui al capitolo 8113 dello stato di previsione del Ministero per i Beni Culturali e Ambientali.*

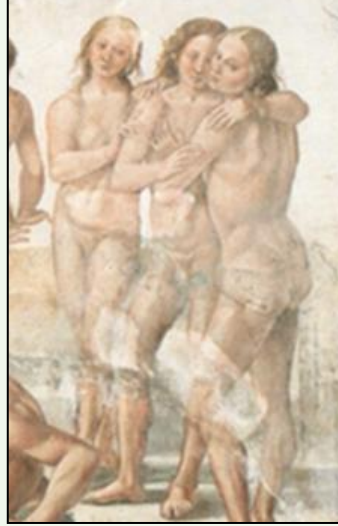




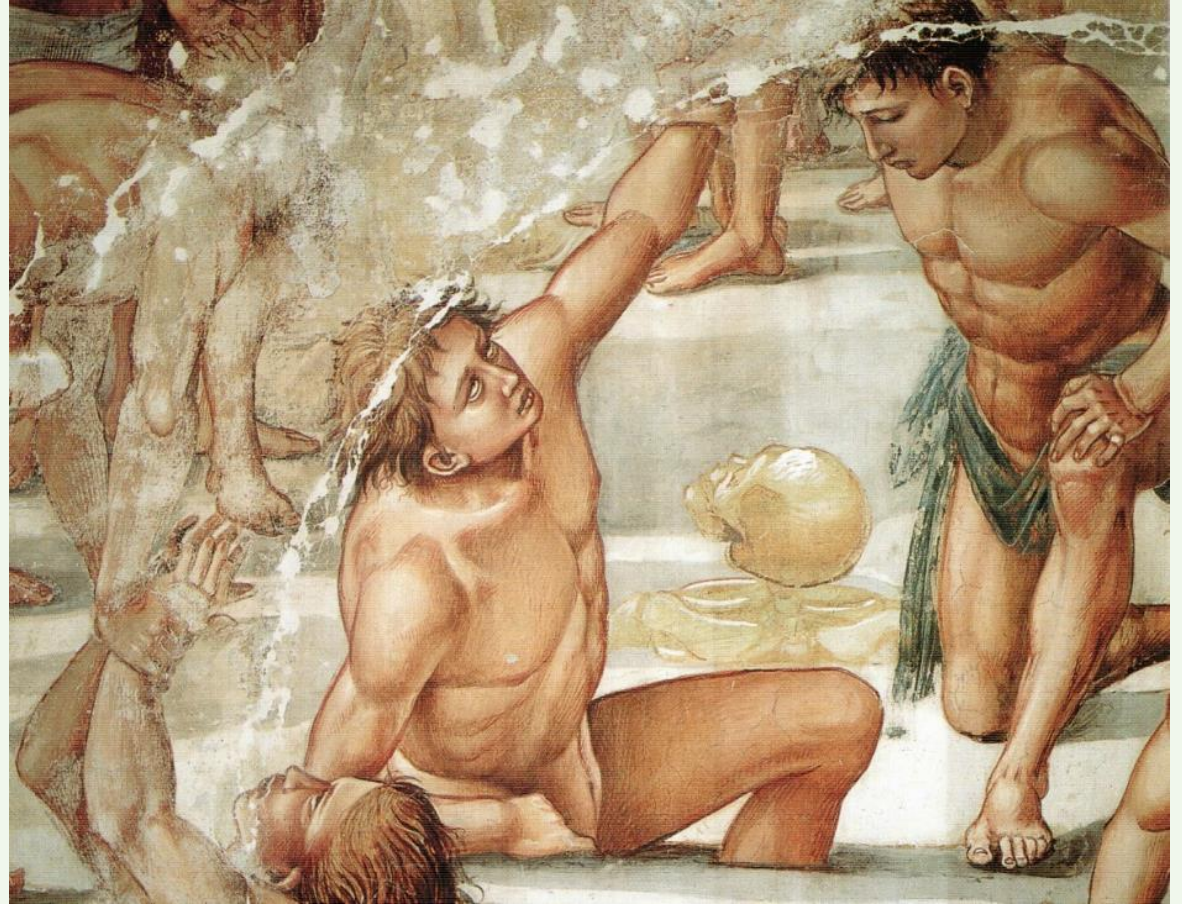
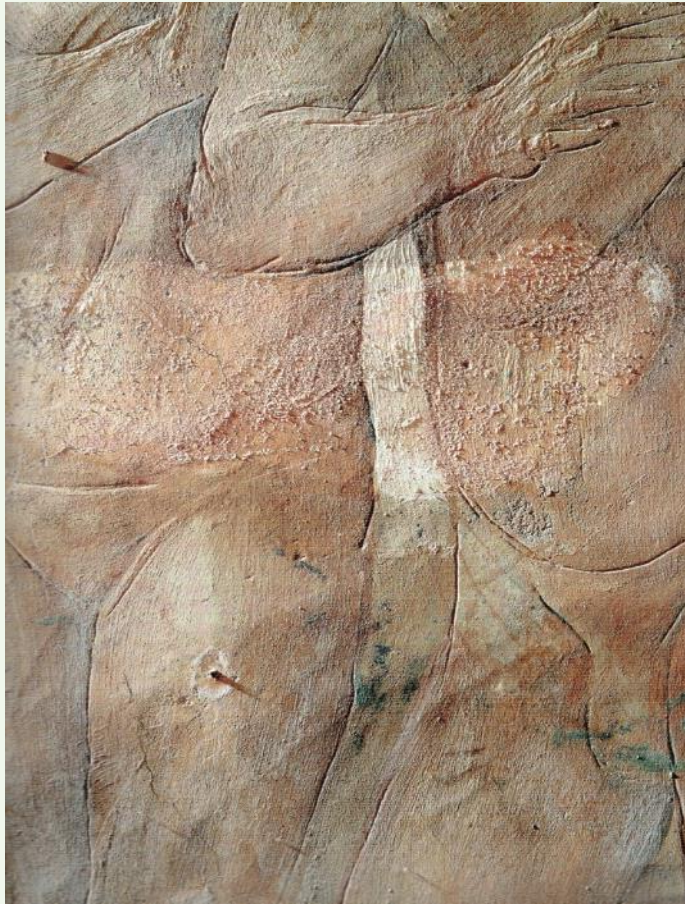
The complete restoration  
of the Chapel of San Brizio







Biological attacks by microorganisms (pink algae *Cyanophyta Sarcina*), whose roots were crumbling away at the frescoed plaster. The cause was the complete soaking of the right wall, a full three meters wide.



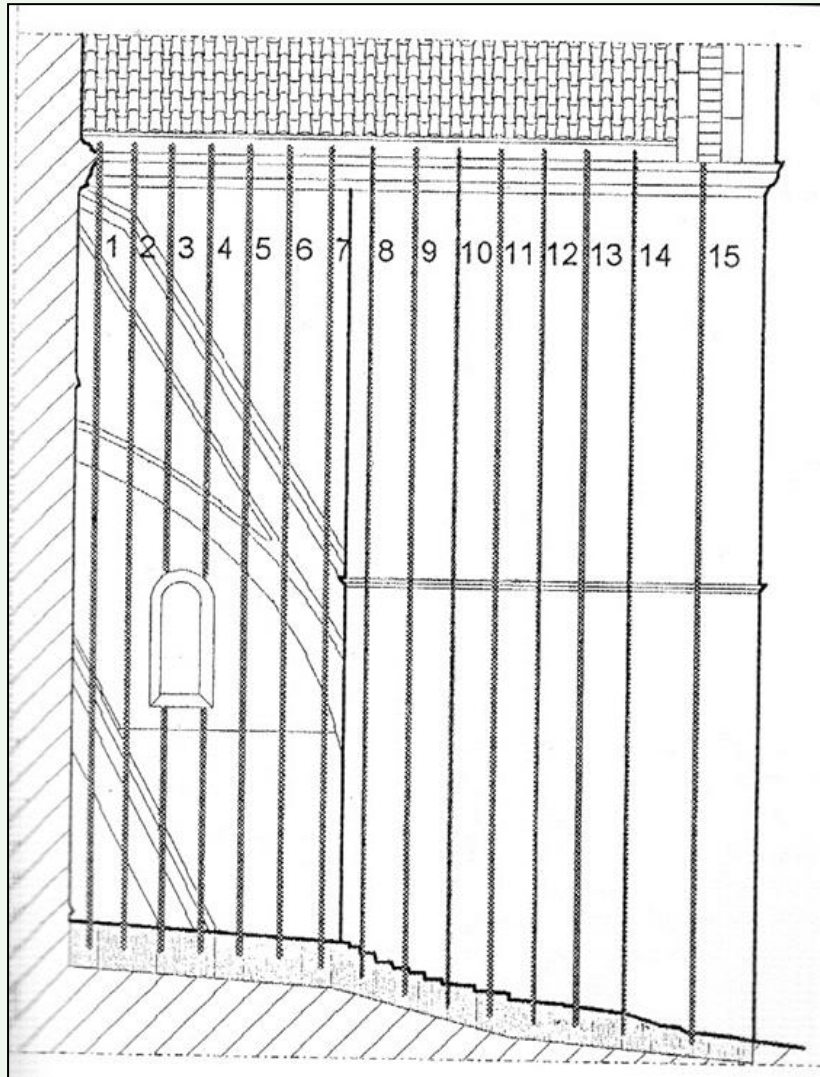


## The creation of ventilation chimneys

15 VENTILATION CHIMNEYS

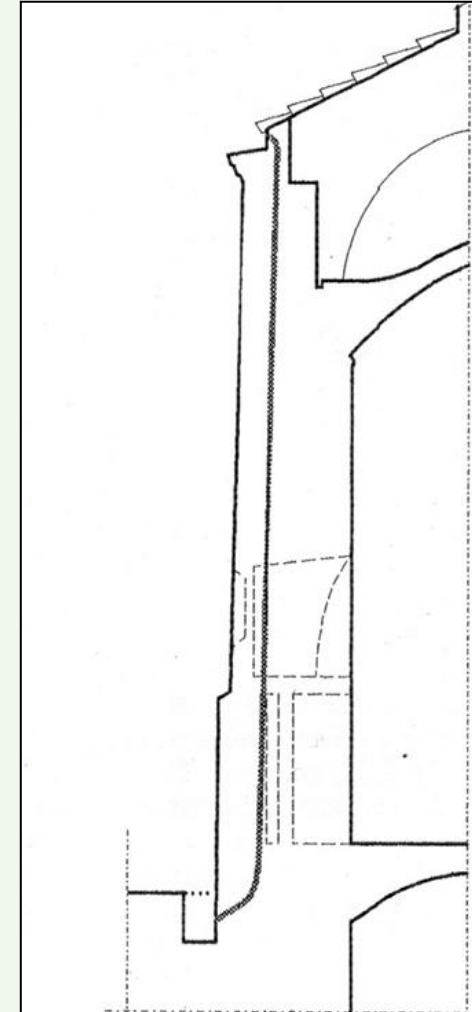
200mm diameter

High-speed, vibration-free dry drilling

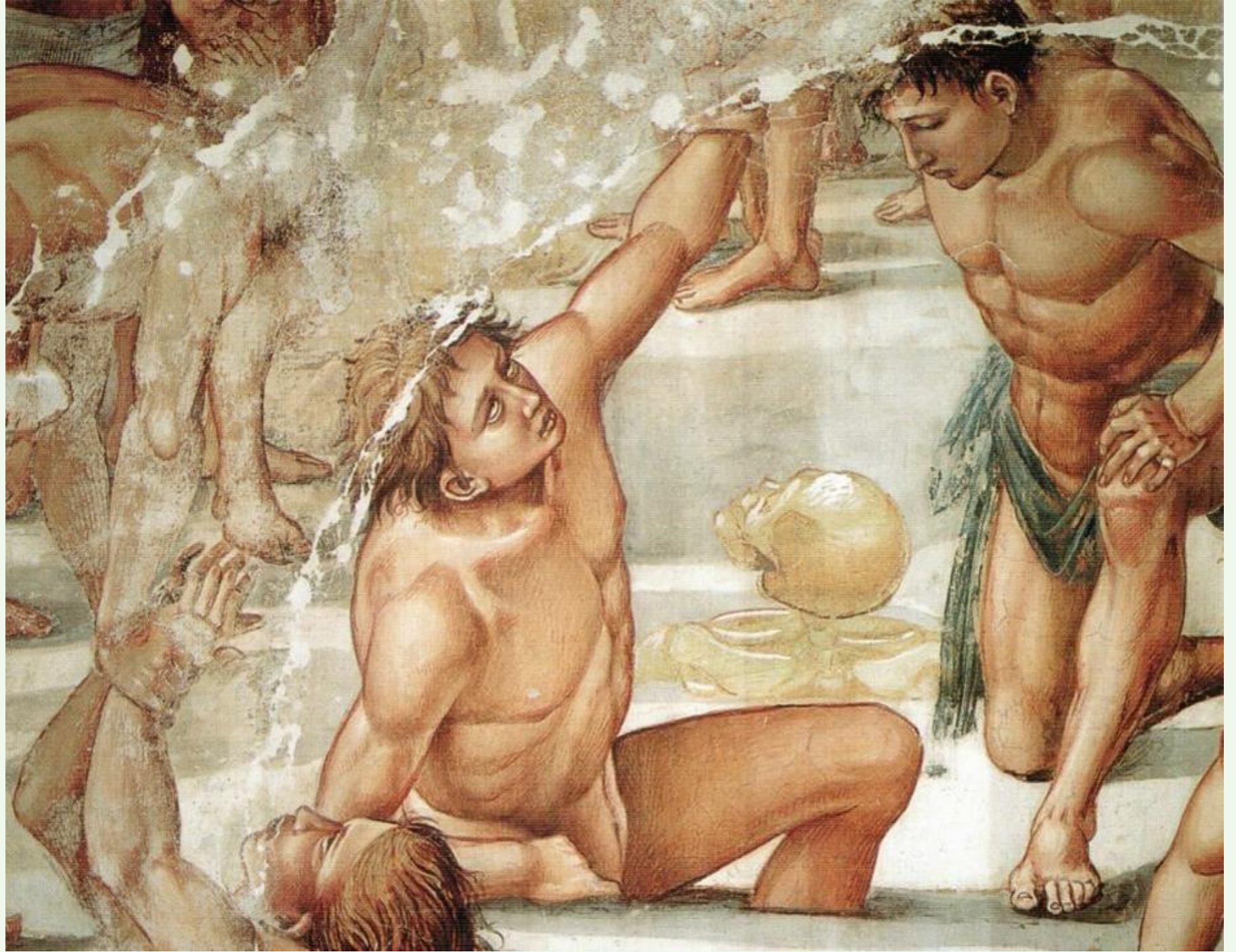


Expected steam release: 3.5 g/m<sup>3</sup>/h

Expected year for reaching  
an acceptable value (10%): 2030





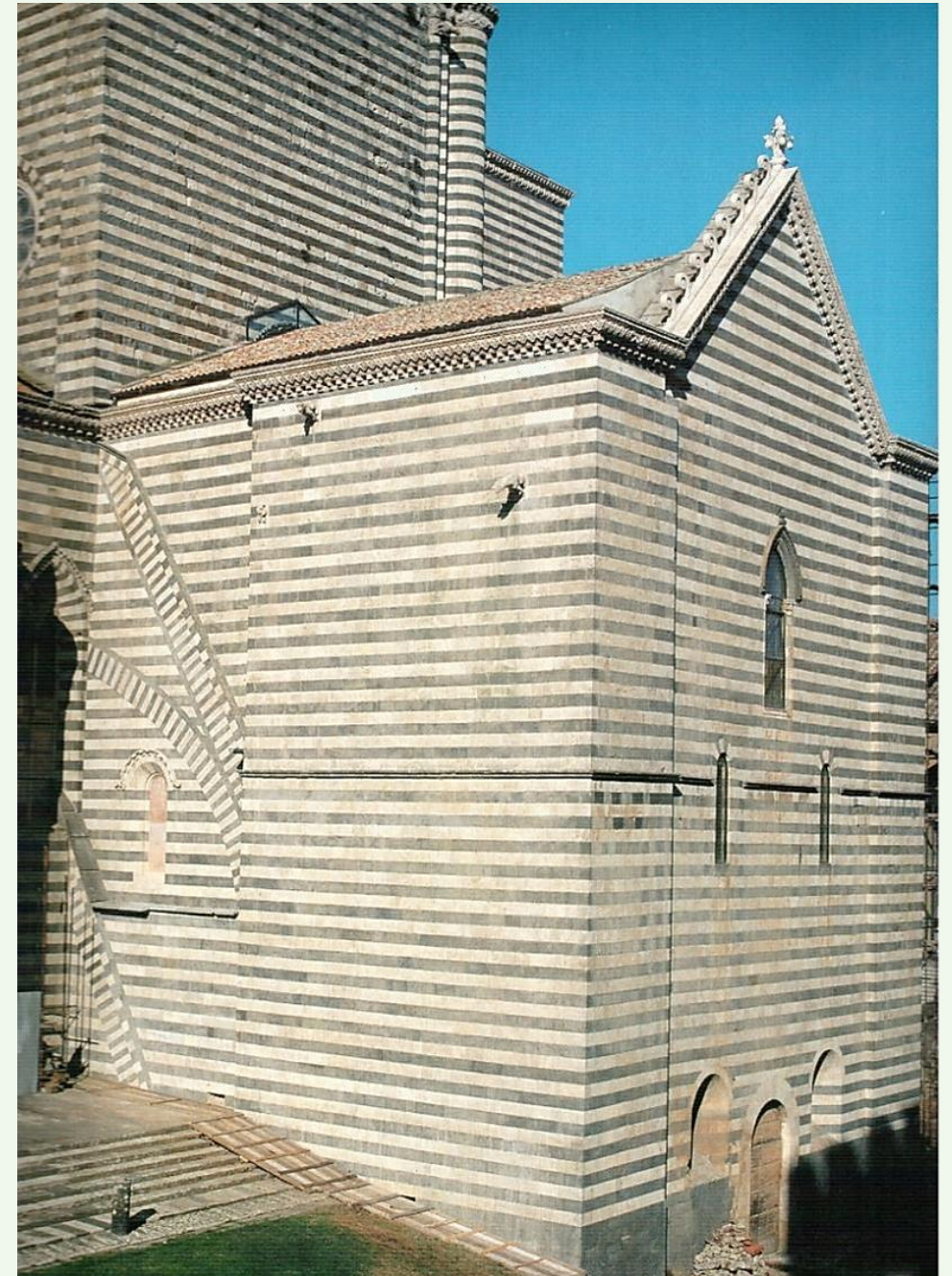
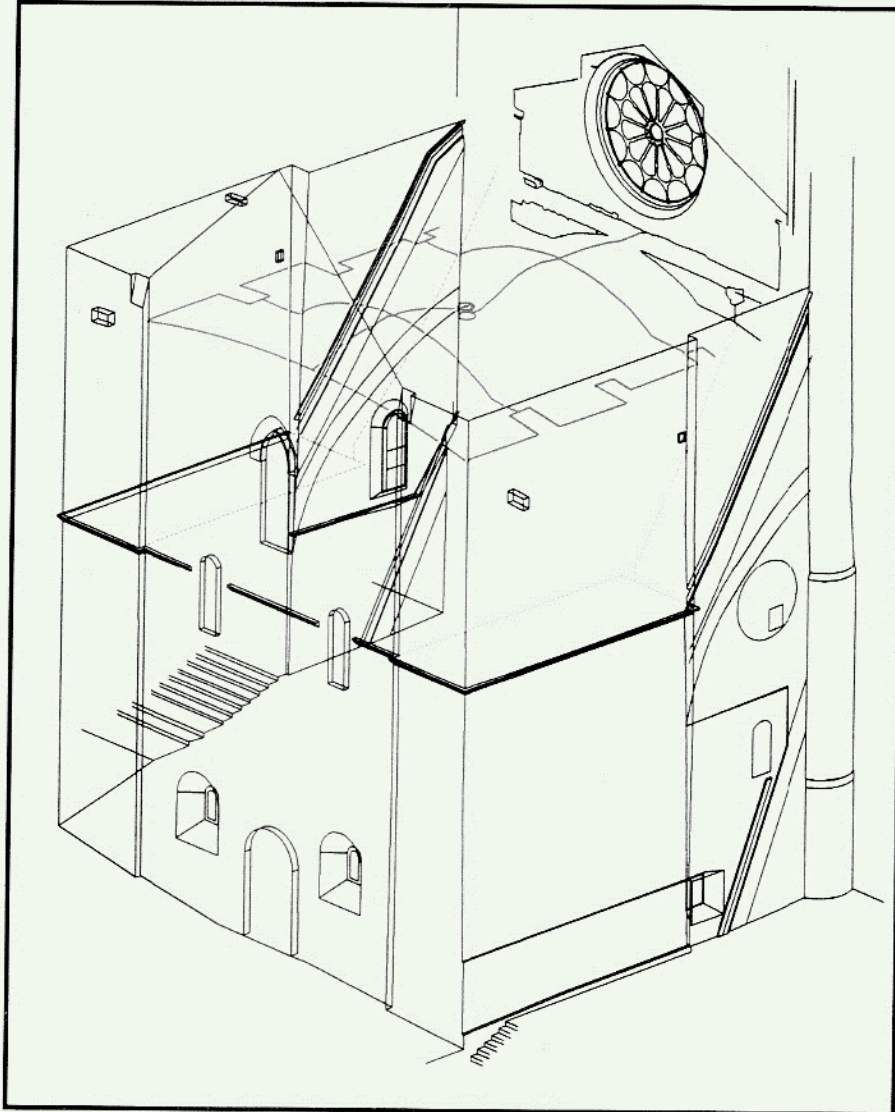




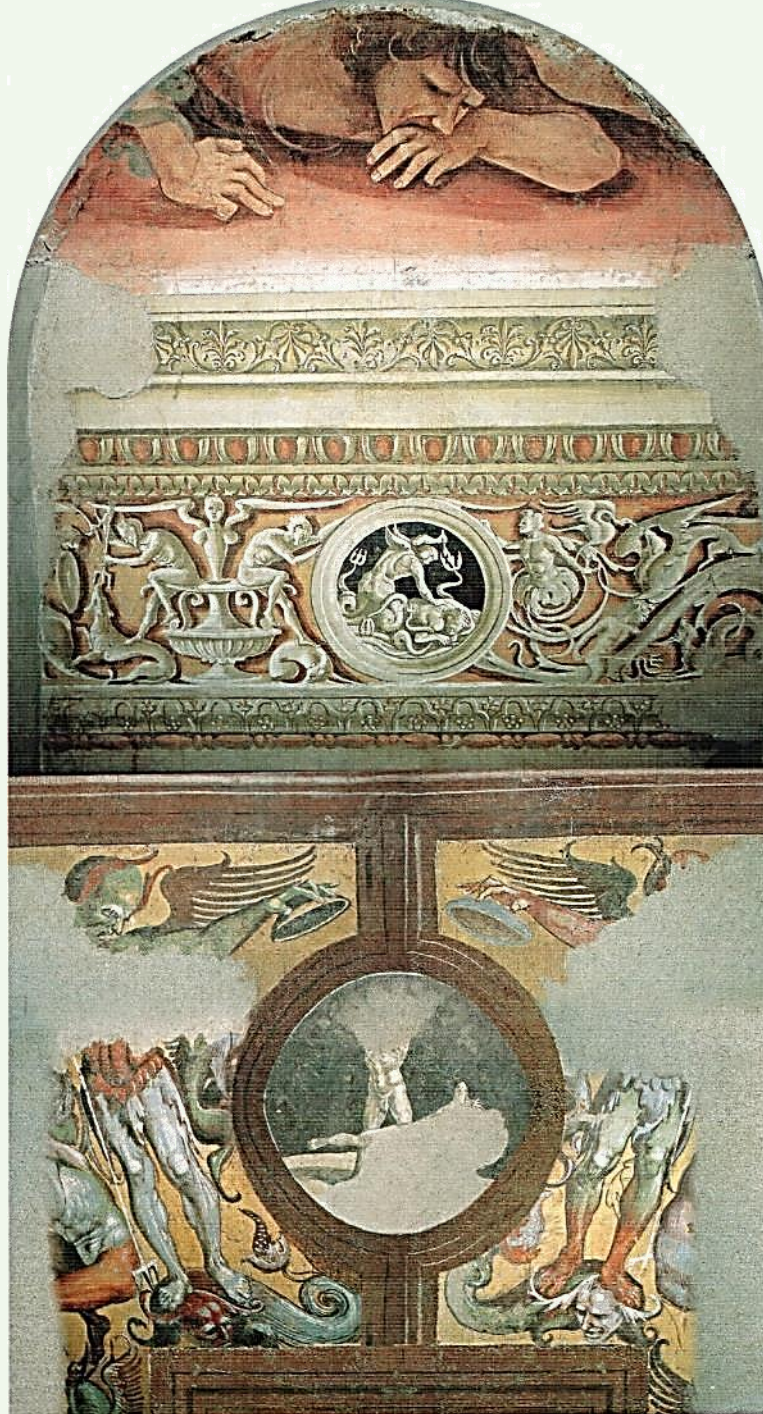




## Hydraulic repairs to the roofs of the Chapel of San Brizio







The discovery of new pictorial scenes  
by Signorelli, hidden behind the 18th century altar



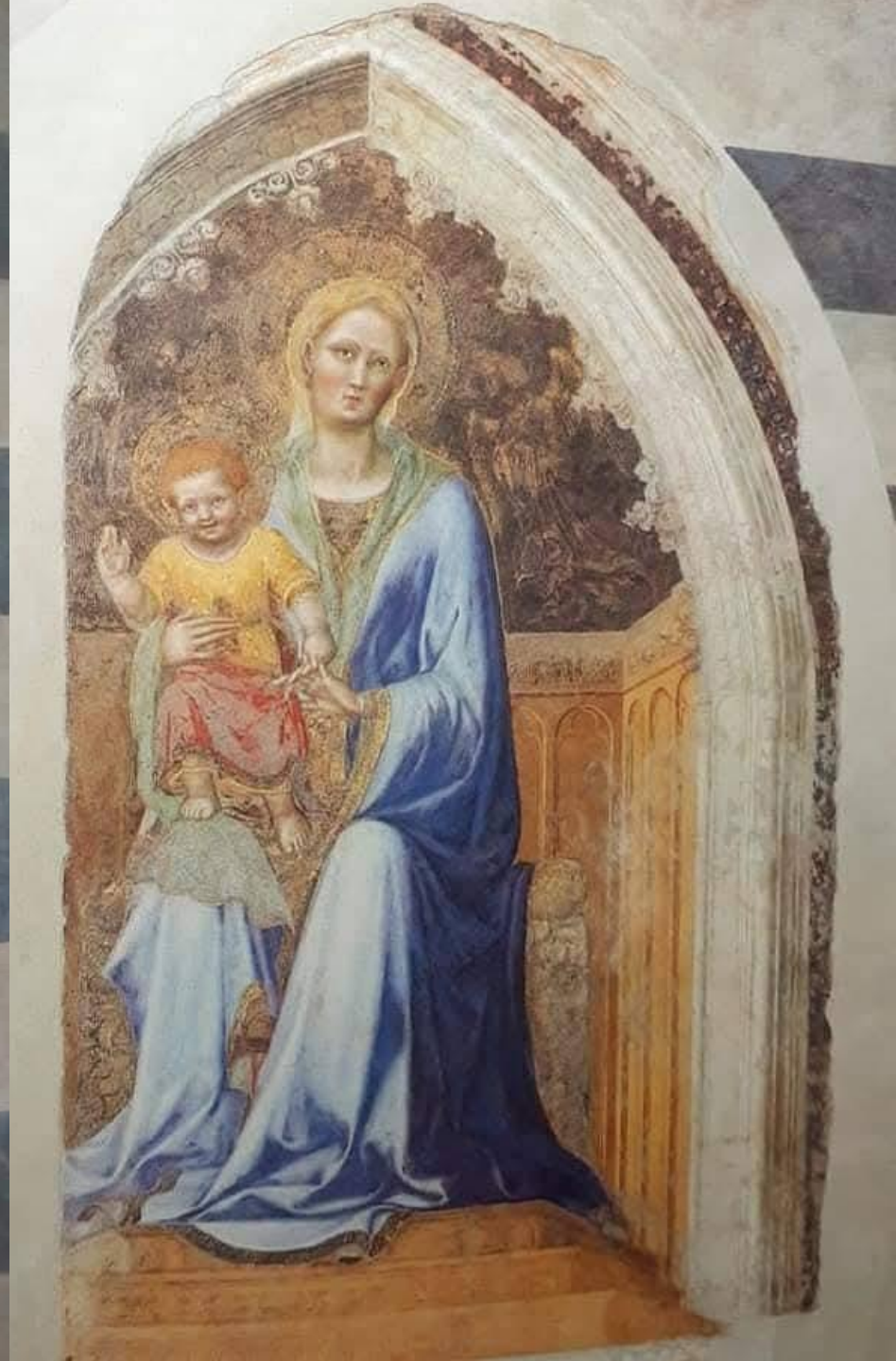
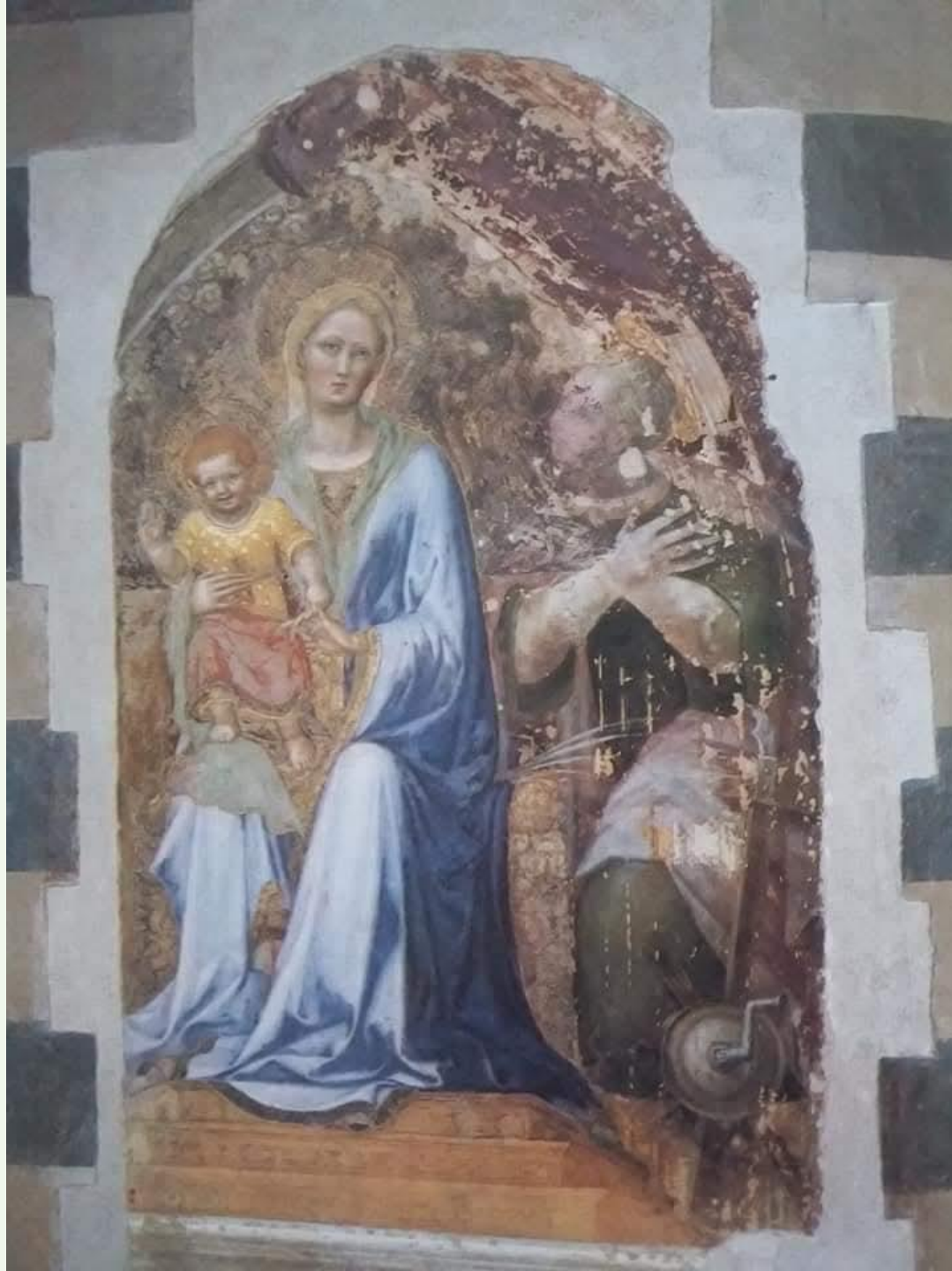


Cain ?





The restoration of  
Gentile da Fabriano's  
Maestà









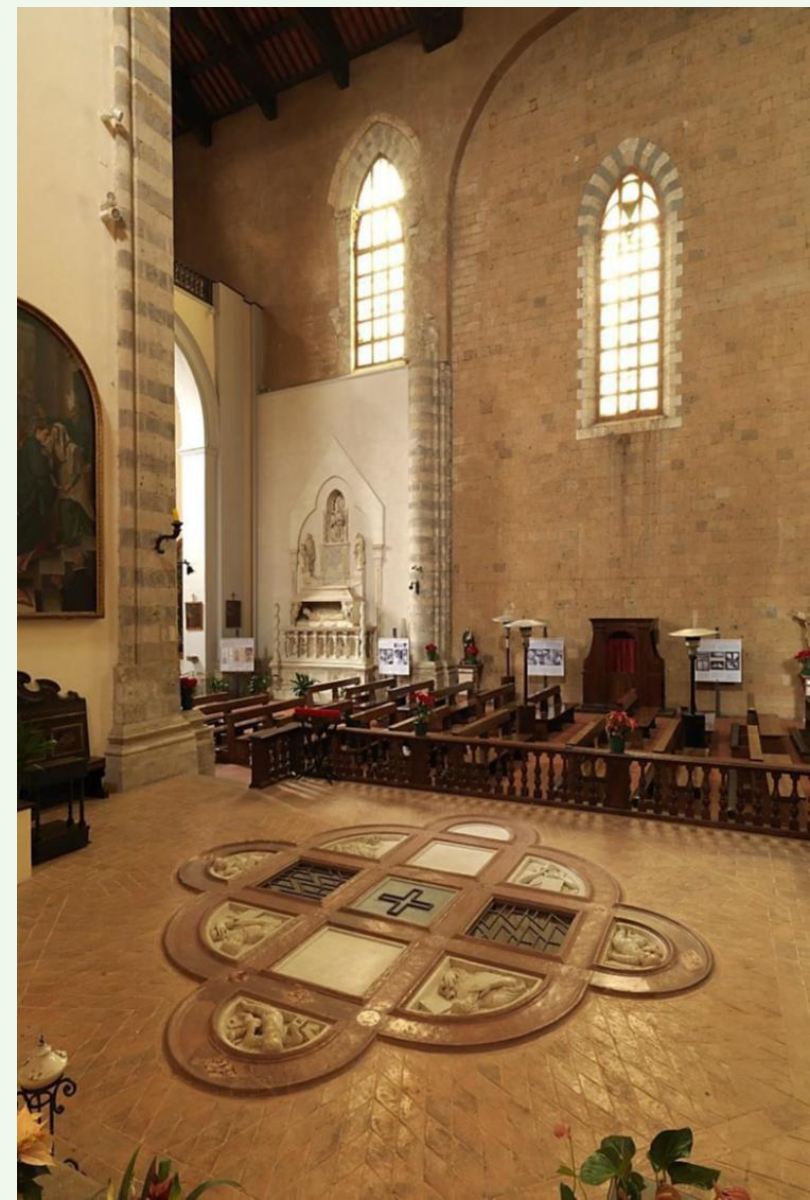
## The last law

LEGGE 23 luglio 1997, n. 242  
Rifinanziamento della legge 29 dicembre 1987, n. 545,  
per il consolidamento della Rupe di Orvieto e del Colle di Todi.

Restoration work on artistic and cultural heritage assets, with  
priority given to completing projects already underway and to  
be completed



Orvieto, Church of San Domenico





Tab. D: I restauri compiuti dalla soprintendenza/ 1.


Orvieto (legge 242/97)

Edificio	Importo (milioni/lire)	Descrizione dell'intervento
Convento di San Francesco (Biblioteca Comunale)	2370	Completamento consolidamento ala Sud-est, 1. stralcio Biblioteca, nuovo corpo scala, muri piano terra e 1. piano, torre campanaria.
Museo dell'Opera del Duomo	700	Progetto d'allestimento a Palazzo Soliano, struttura lignea multilivello nel salone.
Palazzo Comunale	800	Sistemazione due saloni principali, sicurezza ambienti pensili, restauro decorazioni.
Rocca dell'Albornoz	400	Consolidamento angolo Sud-est, spalti e camminamenti.
Duomo	4280	Facciata, affreschi della tribuna e del coro.
Palazzo Simoncelli (Museo della ceramica)	300	Decorazioni murarie interne.
Chiesa del Carmine	370	Restauro sale adiacenti alla chiesa.
Chiesa di S. Domenico	700	Copertura e restauro opere d'arte
Palazzo Clementini	400	Coperture e facciate.
San Giuseppe	100	Facciata esterna.
S. Maria della Cava	60	Facciate esterne e copertura.
Palazzo dei Sette	300	Scala e ascensore per la Torre del Moro.
Monastero di San Paolo	550	Consolidamento e restauro dell'ala quattrocentesca del monastero.
Palazzo Faina	500	Sistemazione del prospetto su via Pedota.


In milioni di lire. Fonte: Soprintendenza ai Beni Artistici e storici dell'Umbria.



Todi (legge 242/97)



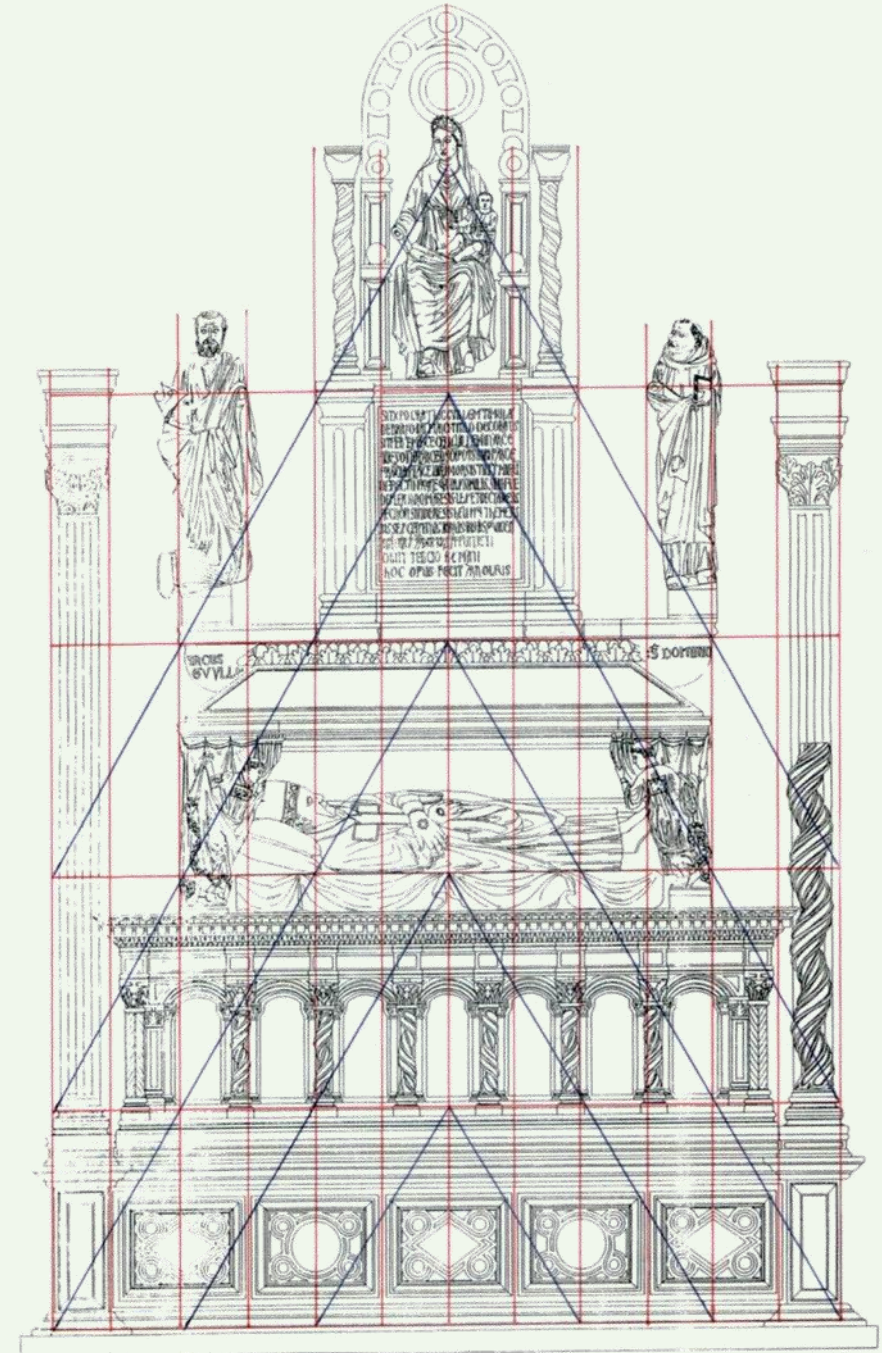
Edificio	Importo (milioni/lire)	Descrizione dell'intervento
San Fortunato Chiesa e convento	1400	Restauri portone, navate, chiostro e coro, e del convento (Liceo classico), nonché, a valle, della zona danneggiata dal sisma 1997.
Palazzi Comunali	600	Porticati e paramenti della facciata, affreschi della Sala del Consiglio, parapetto scalone.
Monastero delle Lucrezie	170	Impianti nella zona del teatro a completare i lavori architettonici.
Mura urbiche	800	Messa in sicurezza e restauro di un tratto a Porta Fratta.
Fonti Urbiche	250	Pulitura, consolidamento e restauro delle Fonti Cesia e Scarnabeco.
Chiesa di Sant'Antonio abate	380	Completamento del primo lotto, e lavori architettonici e storico-artistici del secondo.
Santa Maria della Consolazione	900	Progetto unitario (anche con un miliardo ex Legge 61/1998), consolidamento strutture verticali, cerchiatura cupola, rest. esterni.
Chiesa del Crocefisso	500	Consolidamento cupola, monastero e aree affrescate (il progetto ingloba 300 milioni provenienti dalla Legge 61/1998).
Duomo	300	Restauro materiali lapidei nella zona esterna (archi romanici).
Chiesa di San Nicolò	300	Ripristino della chiesa romanica e trasform. in cinema, consolidamento e restauri.
Palazzo dei Priori	292	Sistemazione del cortile e dei percorsi verticali
Oratorio della Misericordia	200	Restauro delle coperture e delle superfici architettoniche esterne.



In milioni di lire. Fonte: Soprintendenza ai Beni Artistici e storici dell'Umbria.



Orvieto, Church of San Domenico.  
Funerary monument of Cardinal De Bray.  
Arnolfo di Cambio, 1284





Orvieto, Convent of San Francesco.  
Restoration and renovation of the  
new Orvieto Public Library, named  
after Luigi Fumi











Public Library reading room









Todi, Church of San Fortunato





Todi, Church of Santa Maria della Consolazione

Progetto strutturale	Dott. Ing. Massimo Mariani
Collaborazione al progetto strutturale	Dott. Ing. Berardino Buonforte Dott. Ing. David Gubbiotti Geom Luca Ranocchia
Progetto architettonico	Dott. Arch. Raffaele Davanzo (Soprintendenza per i BB.AA.AA.AA.SS. Umbria)
Collaborazione al progetto architettonico	Geom. Liliano Formica
Anni	2000 - 2001
Committente	Soprintendenza per i BB.AA.AA.AA.SS. Umbria
Direzione dei lavori	Dott. Arch. Raffaele Davanzo
Consulenza strutturale alla Direzione dei lavori	Dott. Ing. Massimo Mariani
Collaborazione alla direzione dei lavori	Geom. Liliano Formica
Impresa esecutrice	SACEN s.r.l. (Napoli)
Direttore tecnico dell'impresa	Dott. Umberto Battista

Da *TRATTATO SUL CONSOLIDAMENTO*,  
a cura di Paolo Rocchi, Mancosu editore, Roma, 2003

INTERVENTI DI CONSOLIDAMENTO

FASCIATURE INTERNE

Per il posizionamento delle fasciature interne è stato necessario il montaggio di una impalcatura all'interno del tempio per poter raggiungere ambedue le quote interessate dall'intervento. Le fasciature interne sono state rese solidali alla muratura per mezzo di perforazioni armate ( $\varnothing = 35\text{ mm}$ ) con barre filettate di acciaio inox ( $\varnothing = 28\text{ mm}$ ) e con la saturazione dei fori per mezzo di resine epossidiche bicomponenti ad alta viscosità (Fig. 10). Sugli ancoraggi sono state eseguite quattro prove a trazione per sfilamento fino al raggiungimento di un carico  $N = C \cdot L \cdot 5\text{ kg cm}^{-2}$  dove:  
 $C$  = circonferenza dei fori  
 $L$  = lunghezza dei fori.

La disposizione longitudinale dei fori sulle fasce è stata eseguita a quinconce per evitare fenomeni di svergolamento durante la fase di avvitaratura e tiraggio dei dadi. È stata, inoltre, eseguita la saldatura in corrispondenza di ogni foro, di una piastra ( $100 \times 100\text{ mm}$ ) forata ( $\varnothing = 32\text{ mm}$ ) di acciaio inox AISI 304 di rinforzo. Tutte le saldature necessarie sono state di Classe I a filo continuo e rifinite con acido per l'eliminazione degli aloni delle bruciature al contatto.

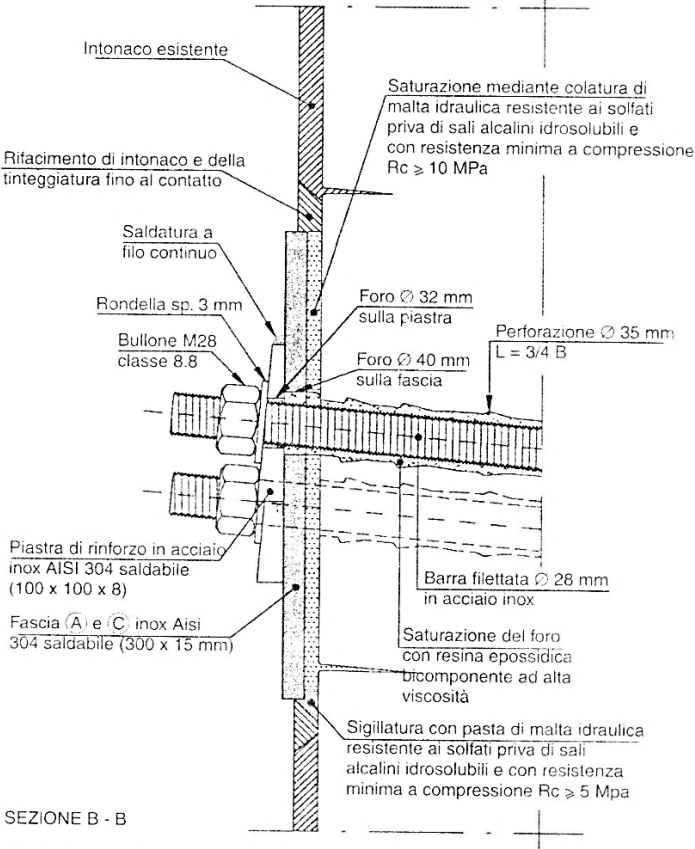
Gli spazi presenti fra muratura e fascia sono stati sigillati mediante colatura di malta idraulica resistente ai solfati, priva di sali alcalini idrosolubili e con resistenza minima a compressione  $R_c \geq 10\text{ MPa}$ .

FASCIATURA ESTERNA

Per il posizionamento della fasciatura esterna non è stato necessario l'utilizzo di impalcature; la zona interessata dall'intervento è infatti raggiungibile per mezzo della scala interna. Tutti i materiali sono stati portati in quota con l'ausilio di un ascensore. La fasciatura esterna è stata eseguita al livello della base del tamburo e messa in tensione per mezzo di quattro tenditori provvisori (Fig. 11) con forza di trazione finale almeno pari a  $F = 300\text{ kg cm}^{-2}$ . Per favorire la messa in tensione della fascia sono stati utilizzati "cuscinetti di scorrimento" (Fig. 12) costituiti da parallelepipedi di neoprene e lastre di PTFE (TEFLON), vulcanizzate al neoprene ( $s = 1,5\text{ mm}$ ) e incollate tramite sostanze non aggressive sia alla parete che alla fascia, in modo da favorire lo scorrimento in fase di trazione da parte dei tenditori (Figg. 13, 14). La messa in tensione della fascia è stata effettuata nel periodo estivo, in modo tale da poter effettuare la saldatura degli elementi di raccordo della fascia per la restituzione della continuità a livello dei tenditori con dilatazione termica già avvenuta. Anche in questo caso, gli spazi presenti fra muratura e fascia, ad avvenuto posizionamento, sono stati sigillati mediante colatura di malta idraulica resistente ai solfati, priva di sali alcalini idrosolubili e con resistenza minima a compressione  $R_c \geq 10\text{ MPa}$ .



Fig. 11. Apparecchio di tensionamento della fascia esterna "B".



SEZIONE B - B

Fig. 10. Fasciatura interna. Particolare



# CONSOLIDAMENTO DEI DANNI PROVOCATI DAI SISMI INIZIATI IL 26 SETTEMBRE 1997 (ANNI 2000-2001)

L'intervento ha previsto le seguenti opere (Figg. 8, 9):

- fasciatura interna a livello della base della cupola per mezzo di una fascia in acciaio inox AISI 304 (300 x 15 mm) saldabile, fascia "A";
- fasciatura esterna a livello della base del tamburo per mezzo di una fascia in acciaio inox AISI 304 (220 x 15 mm) saldabile, fascia "B";
- fasciatura interna a livello delle absidi per mezzo di una fascia in acciaio inox AISI 304 (300 x 15 mm) saldabile, fascia "C";
- saturazione delle lesioni interne ed esterne tramite malta idraulica resistente ai solfati, priva di sali alcalini idrosolubili e con resistenza minima a compressione ( $R_c \geq 10 \text{ MPa}$ ).

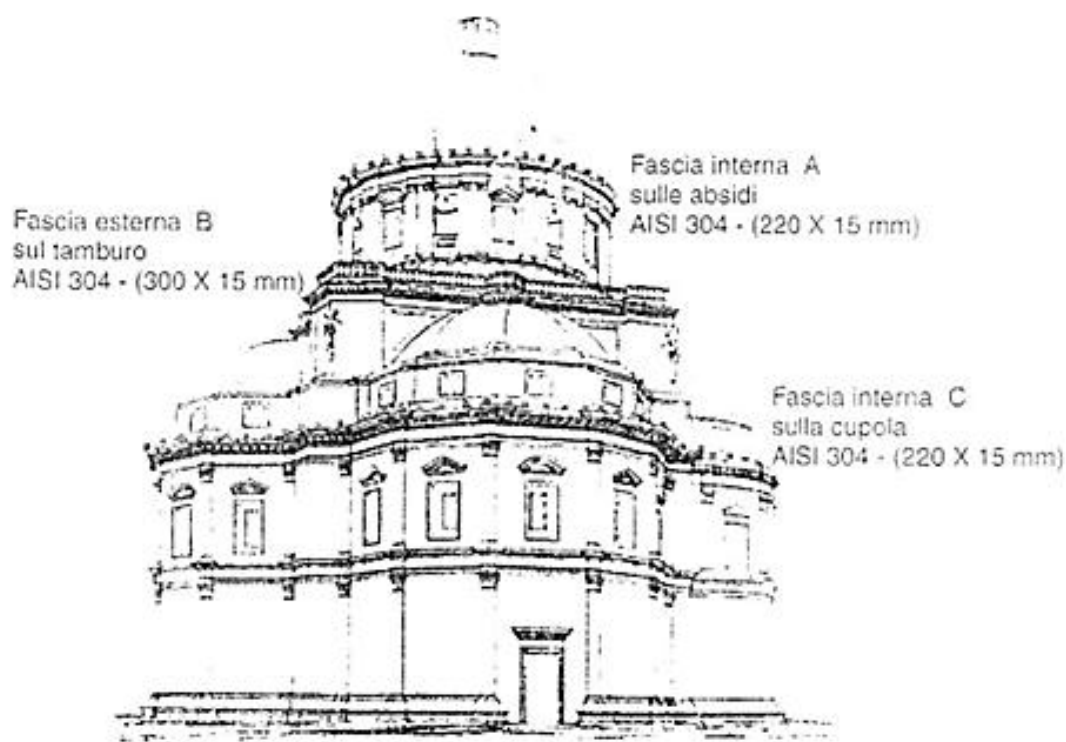


Fig. 8. Disposizione delle fasciature d'acciaio "A" - "B" - "C".

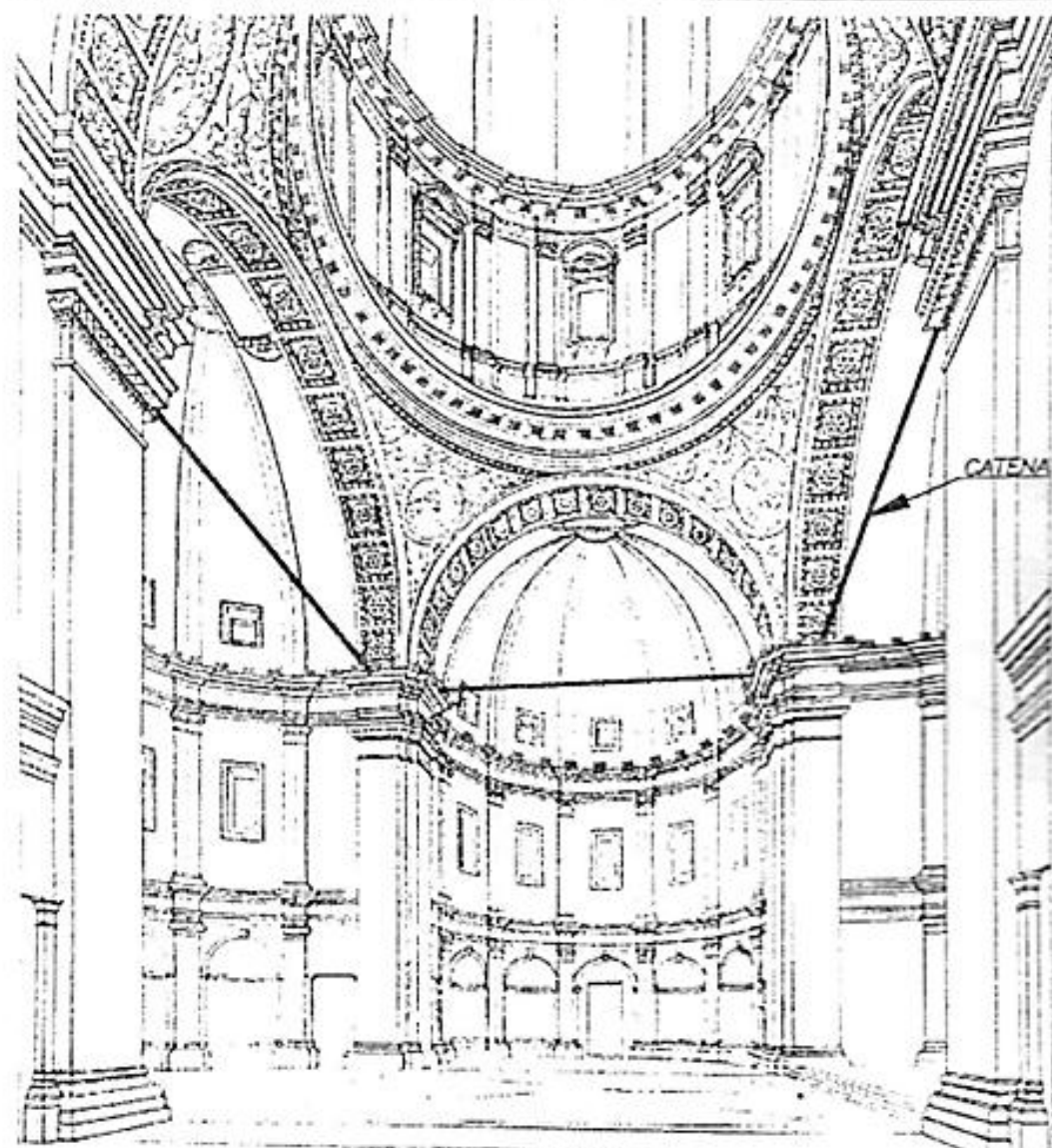
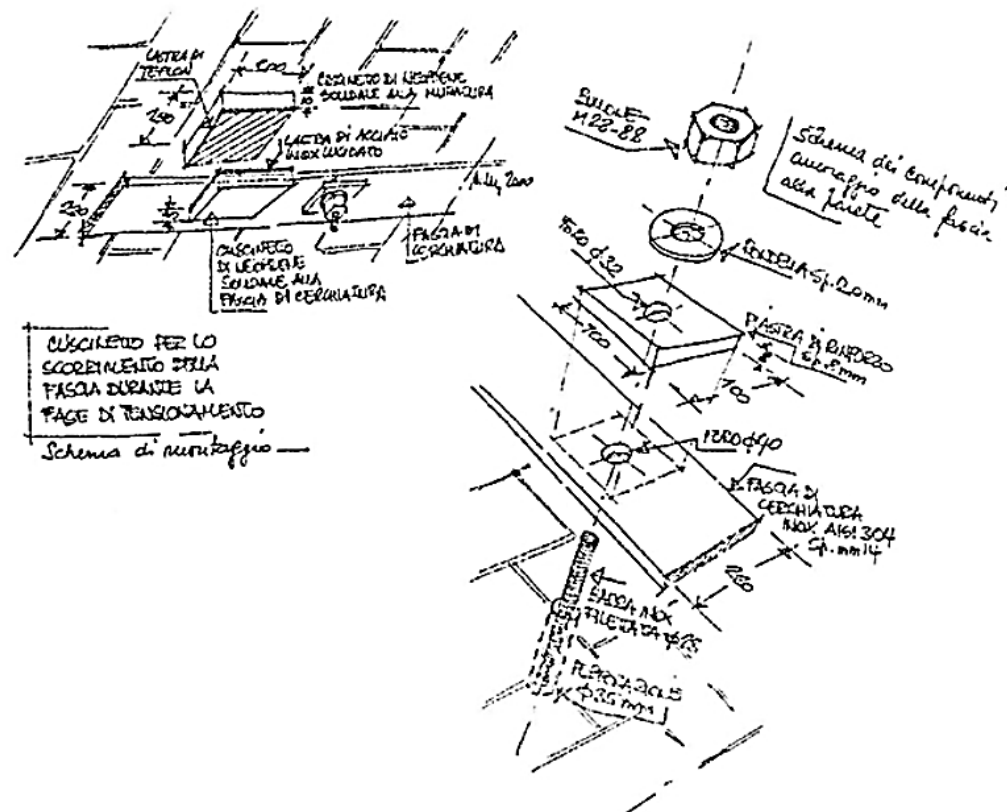


Fig. 9. Disposizione delle fasciature d'acciaio "A" - "B" - "C".





**Fig. 12. Cuscinetti di scorrimento della fascia esterna "B"**

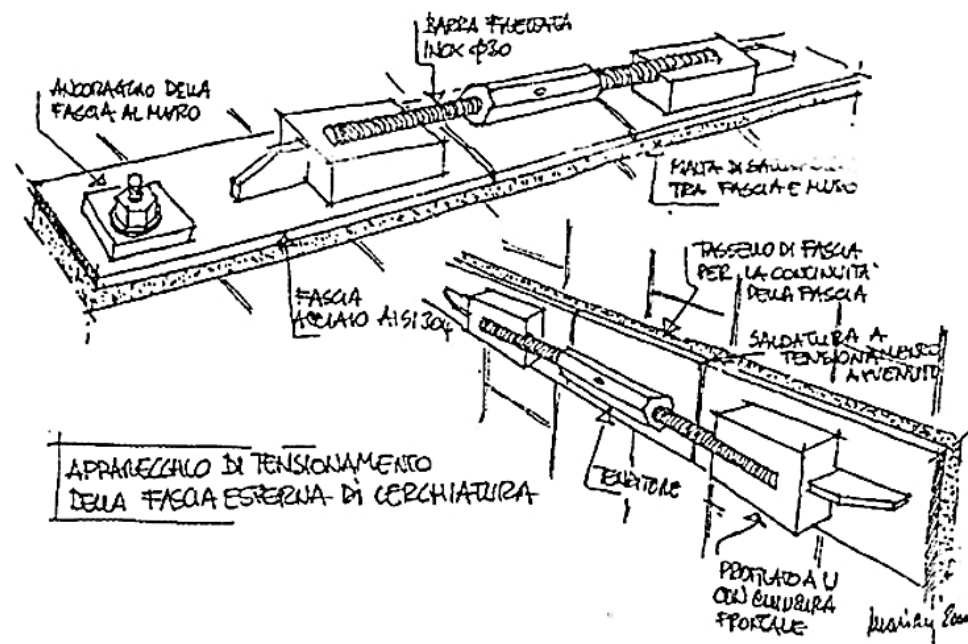
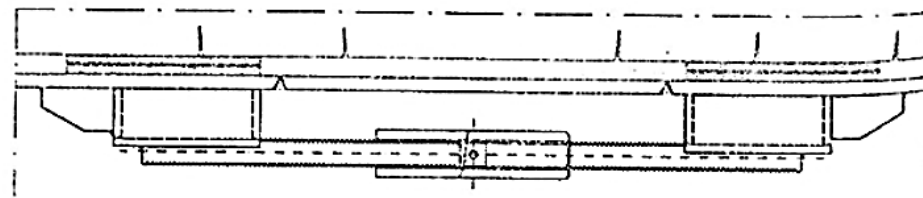


Fig. 13. Apparecchio di tensionamento della fascia esterna "B" con inserimento dell'elemento di giunzione



*Fig. 14. Apparecchio di tensionamento della fascia esterna "B". Vista dall'alto*





## **THE FUTURE**

**How many more pearls need we add to complete the precious necklace of restoration work on Orvieto's historic and artistic heritage buildings?**

**Perhaps just three would be enough:**

- **the church of San Francesco;**
- **the Monaldeschi Palace;**
- **the Piave Barracks.**













**Thank you all for your attention**