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RIB VAULTS IN 12TH-CENTURY RELIGIOUS ARCHITECTURE IN THE NORTH-WEST OF ITALY

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Romanesque architecture in North-West Italy was mainly characterized by the use of ribbed vaults, with diagonally reinforced arches used in some important monastic sites where the architectural choices became more specific and accomplished. The diocese of Vercelli seems to be the area where rib vaults were developed; some examples are the church of San Bernardo in Vercelli and the solutions implemented in the Badia of Dulzago and partly in San Nazzaro Sesia. Novarese architecture underwent a considerable period of experimentation during the first quarter of the 12th century: Novara cathedral, consecrated in 1132 (and destroyed in the middle of the 19th century), is the most evident and relevant example of pillars with diagonal lesenes, an alternate system of support, and ribbed vaults with diagonally reinforced arches. Similar solutions were also adopted in Vercelli cathedral, which also no longer exists. To trace the technical and architectural changes in rib vaulting, it was necessary to investigate the main Cistercian sites opened during the 12th century: in particular those located in Lucedio, Tiglieto, Staffarda and Casanova, and in Rivalta Scrivia, and also Canonical of Vezzolano, where the first forms of experimentation of ribbed vaults, especially in the sections and laying of ribs, reached full maturity.

Keywords: Rib vaults, religious architecture, medieval monastery

The study of ribbed vaults in 12th-century churches is of great interest and novelty due to certain architectural solutions that took shape in the middle decades of the century, reaching full maturity towards the end of it. Romanesque architecture in North-West Italy is characterised by the use of the rib vault introduced into some important monastic sites, where architectural choices made during the century were completed¹.

A highly innovative element of 11th century architecture was the use of arches extending out from the intrados of the vaults, initially limited to the perimeter of the ribs and to longitudinal and transversal elements. The first diagonal ribs began to appear towards the second half of the century. They had a rectangular section and completed the supporting structure of the panels²: the torus section developed at the end of the century, linked largely to the improve of monastic sites.

There was a long debate regarding the effective structural function of ribbing which innovated the medieval construction techniques, and even today, despite advances in research, it isn't easy to find a univocal answer.

It seems clear that ribs help support the vaults, guaranteeing better static involvement of the piers, but some

collapses have proven that they are not sufficient to maintain the vault's stability. In some cases, the diagonal rib has detached itself without causing the vault to fall. The debate opened by Artur Kingsley Porter with a series of studies (from 1911) and taken up by Pol Abraham³ analysed certain destructions of French cathedrals during the First World War, shedding doubt on the first interpretations supplied by Viollet le Duc⁴. The poor static contribution made by ribbing seems to have been confirmed, while ribs played a central role in the complex construction phases. The mesh created by the diagonal ribbing helps support the vaults, acting as a sort of permanent centring. Their creation allowed a "chain" construction sequence, where the craftsmen removed the supports of one span and worked on the next one, while the vaults were complete in the first one using lighter wooden supports, hung from the ribbing⁵. Diagonal arches also took on the role of joint covers, regulating the frequent deformations of the vaults.

The study investigates an extensive area which, between the 11th and 12th centuries, was split between the archdiocese of Vercelli, with the dioceses of Novara, Turin, Acqui and Asti (fig.1).

^{*} I would like to thank Carlo Tosco, Arturo Calzona, Giorgio Milanese and Simone Caldano for their help and advice on the subject.

¹ CH. SAPIN, *La pierre et le voûtement, innovation dans les techniques de construction des églises en Bourgogne au XIe siècle*, in *L'innovation technique au Moyen Âge*. Société d'Archéologie Médiévale, Caen, 1998, pp. 179-185; P. BERNARDI, *De la forme nouvelle aux nouvelles applications de la forme: une brève histoire de la croisée en Provence*, in *Ibidem*, pp. 224-229; E. SIMI, *Il deambulatorio del duomo di Anversa. Il problema cronotipologico e stilistico nel processo di evoluzione delle volte a crociera ogivali nell'area europea*, in *Annali della Facoltà di Lettere dell'Università di Macerata*, II (1969), pp. 223-310.

² C. TOSCO, *Architettura*, in F. CRIVELLO (ed.), *Arti e tecniche del Medioevo*, Torino, 2006, pp. 14-36; A. RHEIN, *Etude sur les voûtes des déambulatoires*, in *Bulletin monumental*, LXXXII (1923), pp. 255-90.

³ A.K. PORTER, *Lombard and Gothic Vaults*, New Haven-London, 1934; P. ABRAHAM, *Viollet Le Duc et le rationalisme médiéval*, Paris 1834; M. AUBERT, *Les plus anciennes croisées d'ogives. Leur rôle dans la construction*, in *Bulletin monumental*, 1-2 (1937); P. VERZONE, *L'origine della volta lombarda a nervature*, in *Atti del IV convegno nazionale di storia dell'architettura*, Milano, 1939, pp. 52-64; C. E. ARMI, *Design and Construction in Romanesque Architecture*, Cambridge, 2004; ID., *The Brick System of Romanesque Architecture. The Lombard Band and Its Transformation in Catalonia and France*, Roma, 2017; S. LOMARTIRE, *Sistemi voltati nell'architettura del primo IX secolo*, in A. SEGAGNI MALACART, L. SCHIAVI (eds.), *Architettura dell'XI secolo nell'Italia del Nord. Storiografia e nuove ricerche*, Pisa, 2013, pp. 199-214.

⁴ E. VIOLLET-LE-DUC, *Dictionnaire de l'architecture française du XI^e au XVI^e siècle*, Paris, 1854-68.

⁵ TOSCO, *op. cit.* (n. 2), p. 29.

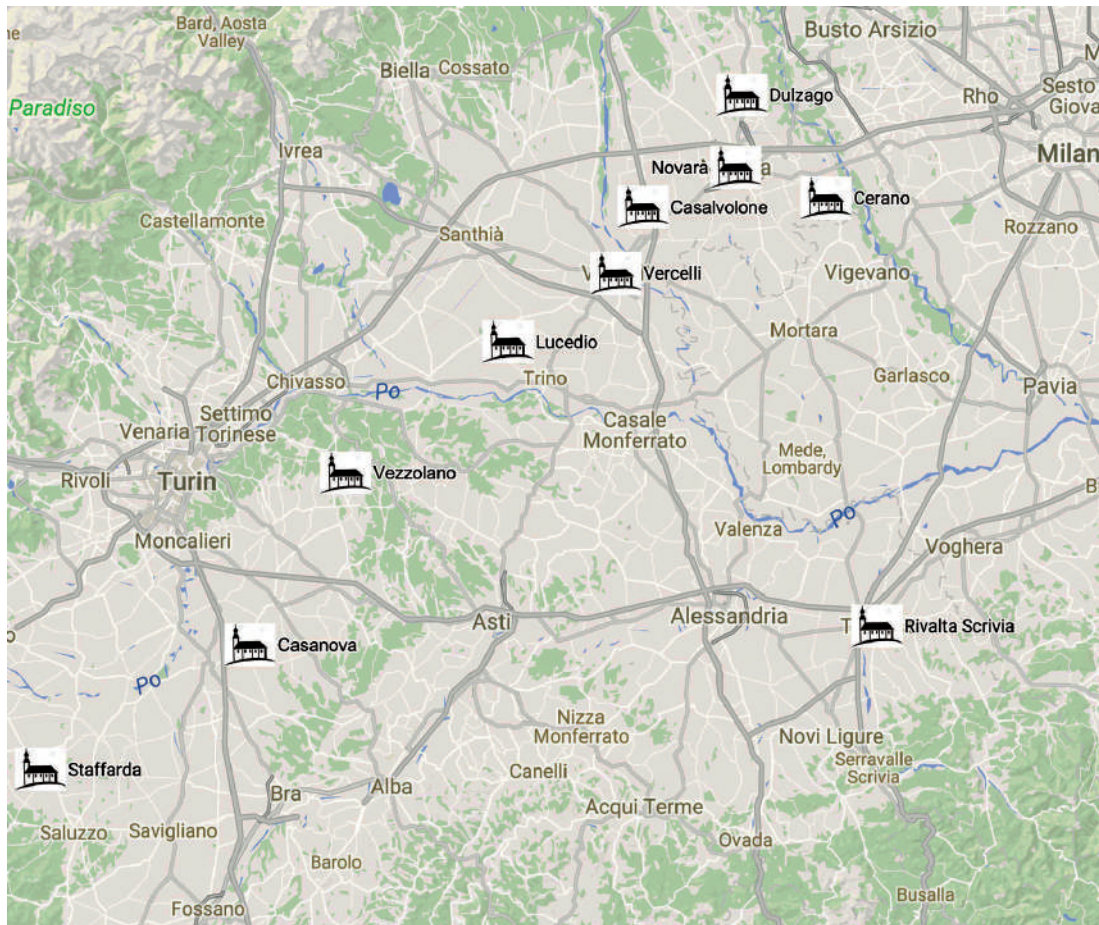


Fig. 1. Map with the sites mentioned throughout the text.

The research has made it possible to identify certain spheres in which the first forms of rib vault systems were experimented in the 12th century:

1. the construction sites of Novara and Vercelli cathedrals and the more complex and articulate sites of the urban parish of Sant'Evasio in Casale Monferrato, datable to the mid-12th century;
2. a series of smaller religious buildings scattered throughout the Novara and Vercelli territory, outside the main towns, where research on construction systems reaches heterogeneous forms that seem not to be dictated by a common design vision but to be more the result of the transferral of masons (first decades – second half of the 12th century);
3. the complex monastic sites, particularly those of the Cistercians, where the construction systems matured considerably following the specialisation achieved by the sites and the master-builders (mid-12th - early 13th century).

CATHEDRALS AND URBAN PARISHES OF THE ARCHDIOCESE OF VERCELLI AND NOVARA

The first experiences of rib vault construction systems with reinforcements are found in the 12th-century Romanesque cathedrals of Piedmont in North-West Italy. Unfortunately, the destruction of the buildings in Novara and Vercelli makes the analysis extremely complex and, in the case of Casale Monferrato, the extensive reconstructions carried out in the 19th century cancelled the old vaulted roof of the church.

Novara cathedral, consecrated in 1132 (and destroyed in 1857-1869), is the most evident and relevant example of the coexistence of pillars alternated with diagonal lesenes, and ribbed vaults with diagonally reinforced arches, reproduced in different scales throughout the huge diocese⁶. The old cathedral was a three-nave building, the central nave being divided into three spans, and the side naves into eight, each one with two transepts⁷. An alternate system of pillars and

⁶ T. MITTA, *La cattedrale di Novara consacrata da Innocenzo II il 17 aprile 1132*, in *Novarien.*, 3 (1969), pp. 45-50; G. ANDENNA, "Honor et ornamentum civitatis". *Trasformazioni urbane a Novara tra XIII e XVI secolo*, in M. L. GAVAZZOLI TOMEA (ed.), *Museo Novarese. Documenti, studi e progetti per una nuova immagine delle collezioni civiche*, Novara, 1987, pp. 50-55.

⁷ The cathedral was destroyed in the mid-19th century to be replaced by the new building designed by Alessandro Antonelli, consecrated in 1869.

F. ROSSO, *Alessandro Antonelli 1798-1888*, Milano, 1989, pp. 213-215; M. G. VINARDI, *La ricostruzione delle cattedrali: il duomo di Novara*, in *Novarien.*, 31 (2002), pp. 25-46. Sulla cattedrale antica G. FASSÒ, *Il Duomo antico*, in *Monografie novaresi*, Novara, 1877, pp. 99-136; G. CARITÀ, *Itinerario architettonico*, in G. ROMANO (ed.), *Piemonte romanico*, Torino, 1994, pp. 136-138; C. LAVATELLI, *Il corredo plastico del duomo romanico di Novara. Progetto per un catalogo*, in *Novarien.*, 33 (2004), pp. 111-141; F. BERGAMASCHI, *Il duomo romanico di Santa Maria in Novara: fonti documentarie, narrative, iconografiche*, in *Ibidem*, pp. 43-109.

roofs, in an asymmetrical system, featured throughout the church interior: the first and third central spans corresponded to three side spans, while the second opened onto two side spans.

Romanesque builders concentrated specifically on the system of vaults that covered the church interior (fig. 2). «The problem of creating a ribbed structure over a hypostyle nave, unsuitable for receiving oblique stress, was solved by taking the weight off the columns and resting the ribs on the main vaults on four large pillars, installed in a median position along the naves»⁸. Some historical iconographies, including drawings by Angelo Colla dated 1864, which portray the interior of the cathedral, have made it possible to reconstruct the roofing elements of religious spaces: the central nave had reinforced rib vaults, separated by acute transversal arches, while the side spans and the matroneum had simple ribbed cross vaults⁹. The diagonal nerves of the vaults over the central nave had a rectangular section, indicated by drawings and by archive documents¹⁰ (fig. 3). A cross vault of this type can be found in the hall of the episcopal palace next to the cathedral: both the palace and the cathedral were rebuilt by bishop Litifredo, using the construction techniques applied in the church¹¹.

Cross vaults with diagonal ribbing with a flat section correspond to a model that became popular in Northern Italy, thanks to the expertise developed by builders in the construction of vaulted roofing.

The canonical church of Santa Maria Maggiore in Vercelli is documented by a series of iconographies and reliefs created before its destruction in 1777, and by certain descriptions and fragments of the old building, which allow its partial reconstruction¹². The building reconstructed in the mid-12th century was consecrated on 17th June 1148, by pope Eugenio III¹³.

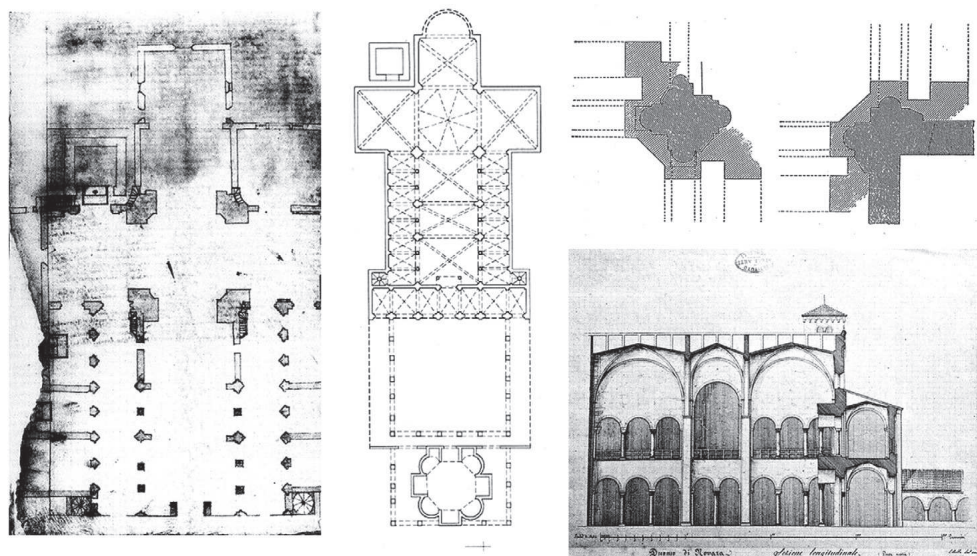


Fig. 2. Novara. Drawings of a Romanesque cathedral: planimetry by Martinelli (1725, *Archivio Storico Diocesano - Novara Diocesan historic archive*); planimetry by F. Osten, (from *Die Bauwerke in Lombardei vom 7 bis zum 14 Jahrhundert*, Darmstadt, no date, table XIV); Section of the transept intersection (additions made in the Baroque period shown with wide dashed line, Fassò, *Il Duomo antico*, 1877); longitudinal section (*Duomo di Novara - Sezione longitudinale (Parte antica)*, black Indian ink drawing, signed and dated "E. Mella dal vero 1856", Fondo Mella, *Archivio dell'Istituto di Belle Arti di Vercelli*, n. 381).

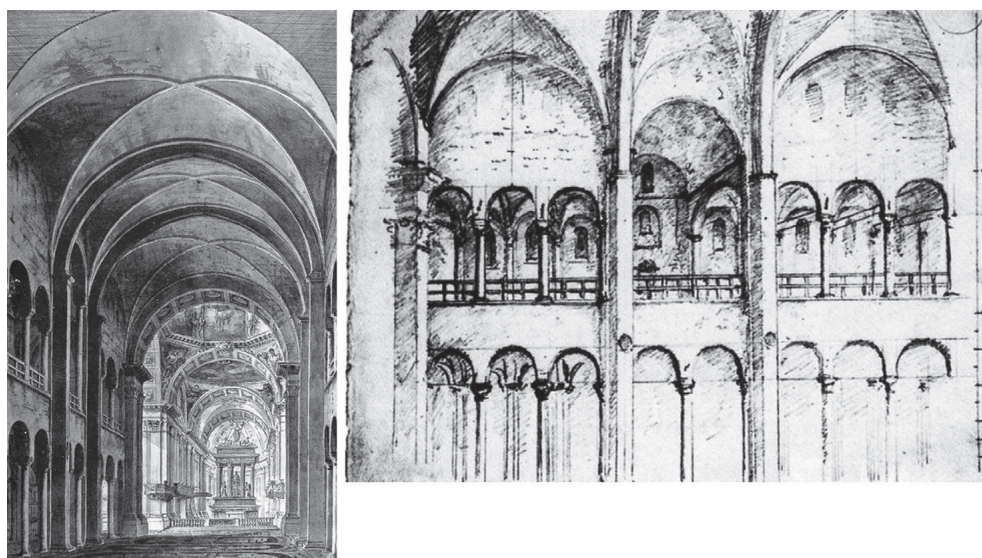


Fig. 3. Novara. Drawings of the Romanesque cathedral: interior with the central nave covered by a rib vault, and perspective drawing of the nave by Angelo Colla (1864). Watercolour (*Archivio Storico Diocesano*); Sketch (*Archivio di Stato di Novara, Disegni, VI, n.11*).

The three-nave church with protruding transept and presbytery, ending in a semi-circular apse, was preceded by a two-levels narthex, with a gallery above the side naves. The vaults of the central nave had crossed nerves with a

⁸ C. TOSCO, *La cattedrale di Novara nell'età romanica: architettura e liturgia*, in A.C. QUINTAVALLE (eds.), *Medioevo: l'Europa delle cattedrali*, Milano, 2007, pp. 268-286; P. VERZONE, *Il duomo, la canonica ed il battistero di Novara*, in *Bollettino storico per la provincia di Novara*, XXVIII - fasc. III (1934), pp. 6-79.

⁹ The absence of diagonal ribs is clearly distinguished in the preparatory drawings by Angelo Colla. *Archivio di Stato di Novara, Disegni*, cartella VI, 10.

¹⁰ C. F. FRASCONI, *Lettere ad un amico intorno alla dissertazione del Sig. Canonico Francia*, in *Archivio Capitolare di Novara, Fondo Frasconi*, manoscritto XV/6, fol. 137: «The arches of this church are perfectly semi-circular, and not pointed, like those typical of gothic architecture, and the crosses of Saint Andrew are large and rectangular, unlike gothic crosses, which are small and round».

¹¹ The ribs are 43 cm wide and extend from the intrados per 28-30 cm. C. TOSCO, *op. cit.* (n. 8), p. 280.

¹² F. CONTI, *Altare e cattedra dell'antica S. Maria maggiore di Vercelli*, in *Bollettino Storico Vercellese*, 1, 61 (2003), pp. 9-30; ID., *Il portale romanico della cattedrale vercellese di S. Maria Maggiore*, in *Bollettino Storico Vercellese*, 54 (2000) p. 13-40; S. CAMPISI, *Giovanni Antonio Ranza e l'antica basilica di S. Maria Maggiore di Vercelli*, in *Giovanni Antonio Ranza nel bicentenario della morte (1801-2001)*, Vercelli, 2002, pp. 135-159.

¹³ G. A. RANZA, *Il primo ingresso dei vescovi di Vercelli*, Vercelli, 1779.

square plan, while the side naves had simple cross vaults. The alternate system of pillars defined the development of the church with two spans in the central nave and four in the side naves. The geometry of the vaults, according to Paolo Verzone, still featured round arches: the author attributed the construction of pointed reinforcement arches, like those in Novara cathedral, to a later phase¹⁴. Rib vaults with diagonal nerves also had to be present in the roof of the transept in the median part of the portico. The semi-piers positioned against the wall, next to the side naves, were made up of a half-column over a lesene with a two-tone alternation of bricks and stone, as documented by the remaining one conserved in the basement of the Pasta Palace built over the old cathedral. The supports of the central nave seem to have a complex section resulting partly from work carried out in the early 18th century, but not clearly defined in the documents conserved¹⁵.

For the parish church of Sant'Evasio in Casale Monferrato, the reconstruction of the phases and the construction system of the roof are particularly complex. The numerous stratified phases of the first buildings can be found underneath the 19th century works, which are based on the architectural structures and the building's decorative elements. Recent studies have proposed concordant solutions for the plan of the church and for the succession of medieval sites, while there is still some uncertainty with regard to the vaulted ceiling¹⁶.

From what we can see under the roof, the church originally seemed to have a structure with no ribbed vaults: the slender lesenes, made with the same type of masonry as the atrium, are not really compatible with a vaulted system¹⁷.

The new ribbed vaults in the longitudinal body of the church, which was reworked in the 19th century interventions by Mella, have been attributed to the reconstruction of 1215¹⁸. At the end of 1859, the building site was completed with «the reinforcements of vault embellished and enlightened with a string-course and bar all around»¹⁹. This description documents the presence of old reinforcements taken and varied in section with the creation of a different moulding. In his memoirs, the canon Rho remembered «it should be noted that these ribs were originally square in section but since their edges cast a shadow which would have spoiled the

effect of the decoration, Mella decided to have the corners cut off, leaving them as you see them now»²⁰.

If these rectangular reinforcements were to be attributed to the early decades of the 13th century, we would find ourselves in the presence of an architectural element long-since superseded, in many sites, by the torus ribbing used in Casale in the central cross brace of the atrium.

RURAL AND SUBURBAN CHURCHES IN THE DIOCESES OF VERCELLI AND NOVARA

The subsequent evolutions of the ribbed vault with reinforcements seem to have taken place in the Vercelli and Novara areas, following the early experiences of groin vaults in the previous century²¹. Examples can be found in various rural churches, also with discontinuous solutions.

The plan of the San Giulio di Dulzago is rather complex: the three naves are divided into three spans characterised by a different plan, created in separate construction phases. The second central span, dating back to the first half of the 12th century, is covered with a ribbed vaulting. The ribs have a considerably raised rectangular section and are very thick. A rich painted decoration added in modern times prevents a correct reading, but historiography tends to attribute it to the original conformation (fig. 4)²².

San Benedetto Abbey in Muleggio still presents the original structure, which can be seen despite additions and transformations. The nave consists of two spans covered by ribbed vaults, like those of the extensions of the transept. Compound semi pillars made up of a quadrangular nucleus, a half-column and two corner lesenes, form the support for the vault system. The building dates back to the last quarter of the 12 century²³.

The cemeterial church of San Pietro in Casalvolone has a longitudinal plan with three naves, each with four spans. The roof and support system is quite articulate: the third span is covered by a ribbed vault, supported by the diagonal lesenes of the pillars. The other spans present groin vaults separated by transverse arches. These complex solutions are symptomatic of a progressive site manned by craftsmen with different construction skills. Of the two phases identified by Verzone, that linked to the bishop Riccardo (1117-1122) should

¹⁴ Based on the indications of Giovanni Antonio Ranza. P. VERZONE, *L'architettura romanica nel Vercellese*, Vercelli 1934, pp. 70-81, in particular p. 75.

¹⁵ *Ibidem*, p. 75 e fig.102.

¹⁶ *Il duomo di Casale. Storia, arte e vita liturgica* Novara, 2000, in particular C. TOSCO, *L'architettura del duomo di Casale: la struttura dell'atrio*, pp. 87-106; S. LOMARTIRE, *Architettura e decorazione nel duomo di Casale: orientamenti di lettura*, pp. 69-86. Furthermore the studies of A. PERONI, *L'atrium voué de Saint-Evasio à Casale Monferrato*, in CH. SAPIN (dir.), *Avant-nefs et espaces d'accueil dans l'église entre le IV^e et le XII^e siècle*, Paris, 2002, pp. 378-385; ID., *Osservazioni sul S. Evasio di Casale nei suoi rapporti con l'arte romanica lombarda ed europea*, Casale Monferrato, 1974, pp. 233-252; M. L. VESCOVI, 'Monferrato' medievale. *Crocevia di culture e sperimentazioni*, Verona, 2012, pp. 53-86; F. CERVINI, *L'atrio del duomo di Sant'Evasio a Casale Monferrato: prospettive di ricerca dopo il restauro*, in A. C. QUINTAVALLE (ed.), *Medioevo: arte lombarda*, Milano, 2004, pp. 170-188.

¹⁷ S. LOMARTIRE, *op. cit.* (n.16), p. 80.

¹⁸ E. ARBORIO MELLA, *Elementi di architettura romano-bizantina detta lombarda*, Torino, 1885; T. KIROVA, *Metodologie d'intervento nei restauri della metà dell'Ottocento in Piemonte: il Duomo di Casale Monferrato*, in *Rivista di Storia, Arte e Archeologia per le Province di Alessandria e Asti*, LXXXVI (1977), pp.83-138.

¹⁹ M. C. VISCONTI, *Gli interventi ottocenteschi nella cattedrale*, in *Il duomo di Casale op. cit.* (n. 16), pp. 229-248.

²⁰ *Memorie intorno ai restauri della chiesa cattedrale di Casale*, by canon Giovanni Rho, in T. KIROVA, *op.cit.* (n. 18), pp. 105-137.

²¹ S. LOMARTIRE, *op. cit.* (n. 3), pp. 199-214; P. VERZONE, *op. cit.* (n. 3); P. VERZONE, *op. cit.* (n. 14), ID., *L'architettura romanica del Novarese*, Vercelli 1936. On the territory of the Novara, see also M.L. GAVAZZOLI TOMEA, *op. cit.* n.6).

²² G. ANDENNA, *Origini della canonica regolare di San Giulio*, in R. BOTTINI, G. POLETTI (eds.), *Badia di Dulzago. Contadini, Signori e Santi: storia di un'abbazia*, Badia di Dulzago, 1991, pp. 21-32; F. PORTALUPPI, *La Badia di Dulzago*, Pavia, 1987.

²³ P. VERZONE, *op. cit.* (n. 14), pp. 49-51 and chronological table.



Fig. 4. Dulzago (Novara) Church of San Giulio. Second central aisle covered by a ribbed vault with rectangular ribs.

be that to which the more articulate compound pillars and the ribbed vault refer²⁴. It is possible to trace architectural affinities between San Pietro di Casalvolone and the church of Ognissanti in Novara, particularly regarding the type of supports, but in last case, the cross vaults are groins without the use of nerves²⁵.

The church of San Pietro di Cerano was begun during the episcopate of Litifredo (1123-1151) and completed between the third and last quarters of the 12th century; the theory that has emerged from the latest studies is that the cross vault system was limited to the side naves and had no ribs²⁶. In the atrium of the abbey of San Nazzaro Sesia (1125-1150), ribbed vaults must have been envisaged given the supports in the diagonal recesses by the supports installed to hold the groins. The hypothesis of the use of ribbed vaults also for the central span of the transverse part, which no longer remain, seems also to be confirmed by the latest studies²⁷.

The presence of rectangular section nerves with accentuated mount arches on cross vaults is found in similar forms in other constructions in the Vercelli area, such as the church



Fig. 5. Vercelli Church of San Bernardo. Interior with rectangular-ribbed vault covering the nave.

of San Bernardo di Vercelli (from 1164). The documents do not mention subsequent renovations work on the roof of the longitudinal body²⁸. The building retains a continuous structure of supports with almost square central spans: those at the sides are elongated, covered by cross vaults with rectangular section ribs supported by square pillars with semi-columns (fig. 5).

THE MONASTIC SITES: CISTERCIAN AND CANONICAL

The ensemble with the most significant wealth of ribbed vaulting system and technical solutions is that of the monastic and canonical sites activated during the 12th century: in particular, the Cistercian sites of Lucedio (diocese of Vercelli), Rivalta Scrivia (diocese of Tortona), Staffarda and Casanova (diocese of Turin) and the Canonical of Vezzolano (diocese of Asti).

The vaulted system technology was the great constructive innovation developed in the Cistercian sites and the first foundations are configured as bearers of new architectural know-how.

The monastery of Lucedio near Vercelli is mentioned from 1123²⁹. In the abbey complex, recent restoration of the monastic buildings has enabled new readings of some spaces that were inaccessible before; the use of cross vaults with

²⁴ P. VERZONE, *op. cit.* (n. 21), vol.2, pp. 89-90; M. G. CERRI, *Casalvolone – S. Pietro al cimitero: relazione di restauro*, in M. L. GAVAZZOLI TOMEA, *op. cit.* (n.6), pp. 103-117; A. M. MALOSSO, *La chiesa di San Pietro al cimitero a Casalvolone*, in A. M. Malosso, M. Perotti, D. Tuniz (eds.), *La pianura novarese dal romanico al XV secolo: percorsi di arte e architettura religiosa*, Novara, 1996, pp. 153-157.

²⁵ M.G. PORZIO, *Il complesso di Ognissanti di Novara*, in *Segni e tracce di architettura romanica nel novarese*, Novara, 2001, pp. 147-162.

²⁶ P. TOSCANI, *La chiesa di San Pietro di Cerano nel contesto dell'architettura novarese e vercellese del XII secolo*, in *Novarien.*, 43 (2014), pp. 323-351.

²⁷ S. CALDANO, *Architettura religiosa a San Nazzaro Sesia (XI-XV secolo)*, in M. CALDERA, V. MORATTI (eds.), *L'abbazia di San Nazzaro Sesia. Guida ai percorsi architettonici e figurativi*, Novara, 2013, pp. 43-84.

²⁸ A. MEGLIO, *La chiesa di San Bernardo a Vercelli*, Vercelli, 2005.

²⁹ *L'abbazia di Lucedio e l'ordine cistercense nell'Italia occidentale*, (Atti del III Congresso Storico Vercellese), Vercelli, 1999, in particular R. COMBA, *Identità cistercensi delle origini nel primo quarto del XII secolo*, pp. 7-24.

rectangular and torus section ribs in the monastery contributes to making important references for the chronology of the use of this architectural technique between the 1170s and the early decades of the following century.

Recent restoration of the chapel under the bell tower (originally the southern extension of the transept and the only remaining part of the medieval church) have highlighted certain architectural details ascribable to the first installation of the church. The arches right in the middle, with painted collars, support the groins, defined with large rectangular section nerves. They are undoubtedly the oldest example of this roof system remaining in the Lucedio complex, and can be ascribed to the first installation of the church (1150s-60s)³⁰ in agreement also with the hanging arch frieze on the exterior wall of the transept.

The Cistercian abbey of Staffarda, founded in 1135 in the marquisate of Saluzzo³¹, is a significant example for the solutions implemented in the vaulted structures; in the church, the first part of the monastic complex to be built, each span is different from the others due to the geometry of the vaults (barrel, cross with or without ribs) and due to the profiles of the groins (rectangular, double flanked torus, torus with sharp edge and simple torus in the portico). The evolution of the architectural choice followed and determined the advancement of the chronology between the 1150s and '80s³². The church has three naves, ending with three oriented apses, with a pseudo transept, not protruding from the plan, positioned in the penultimate span. The rectangular spans of the church are arranged transversally in the central nave and longitudinally in the side naves. The bundle piers are made up of a square nucleus with four semi-columns on the sides. The arches of the brace and the groins of the ribbing are installed on the supports (fig. 6).

The arches are semi-circular, some with a slightly lowered arch, with no pointed elements. A slightly pointed profile can be seen in the sails of the central nave, in the presbytery above the cross of the transept.

In the east block, a combination of solutions is implemented between the barrel vaults in front of the apses and those covering the pseudo-transept, and the cross vault without ribs in the first span of the north side nave.

The whole longitudinal body is covered with cross vaults with ribs in varying sections, also used in the side naves as far as the transept. The profile of the nerves is rectangular in the vaults of the side naves and in the first two spans of the central nave. Where joining the longitudinal body and along its entire length, the diagonal ribs take the form of a double torus with a slight incave in the central part. The whole surface of the nerves is painted in shades of red and white or light blue and red.

Thanks to architectural analysis, it is possible to attribute the construction of the church of Staffarda to the mid-12th



Fig. 6. Staffarda (Cuneo) Abbey of Santa Maria. Longitudinal section of the church with rectangular or torus rib vault.

century, as documented by a deed dated 1154 which mentions the church as having been built³³. It is probable that the main structure was built, without the completion of the roof. The vaults of the first two groins present an older composition and structural arrangement, with a smaller mount, defined by the use of diagonal ribs with a rectangular section and star-shaped keystones, while in the following three towards the façade, the nerves have a torus profile and end in the centre with figurate keystones. The extradoses of the vaults also have high convex profiles in the centre. The use of rectangular ribs in the church of Staffarda is ascribable to the last construction phase towards the 1170s-80s. Torus section ribs were imported from France and became popular in architecture in Lombardy thanks to Cistercian mediation, and those at Staffarda seem to have been the first in Piedmont.

More mature solutions are found in the sites of the two Cistercian abbeys of Santa Maria of Casanova and Rivalta Scrivia. In the abbey of Casanova, near Turin, the use of diagonal ribbed vaults is found along the whole longitudinal

³⁰ C. TOSCO, *Architettura e scultura cistercense a Lucedio*, in *L'abbazia di Lucedio*, op. cit. (n. 29), pp. 365-405.

³¹ R. COMBA E G. G. MERLO (eds.), *L'abbazia di Staffarda e l'irradiazione cistercense nel Piemonte Meridionale*, Cuneo, 1999.

³² C. TOSCO, *La prima architettura cistercense e la chiesa di Staffarda*, in R. COMBA E G. G. MERLO, op. cit. (n. 31), pp. 171-207; S. BELTRAMO, *L'abbazia cistercense di Santa Maria di Staffarda*, Savigliano, 2010; S. BELTRAMO, E. DONADIO, A. SPANÒ, *Stratigraphic Analyses, Historical Evidences and 3D Documentation Tools. Deepening Built Heritage. New researches for historical building sites in Staffarda*, in A. Ippolito, C. Inglese (eds.), *Tangible and Intangible Cultural Heritage. Analysis, Conservation and Restoration*, forthcoming.

³³ F. GABOTTO, G. ROBERTI, D. CHIATTONE (eds.), *Cartario dell'abbazia di Staffarda fino all'anno 1313*, in *Biblioteca Società Storica Subalpina (XI-XII)*, Pinerolo, 1901, I, p. 22, doc. 11.



Fig. 7. Casanova (Turin) Abbey of Santa Maria. Interior of the central nave with pointed rectangular and tore rib vaults.

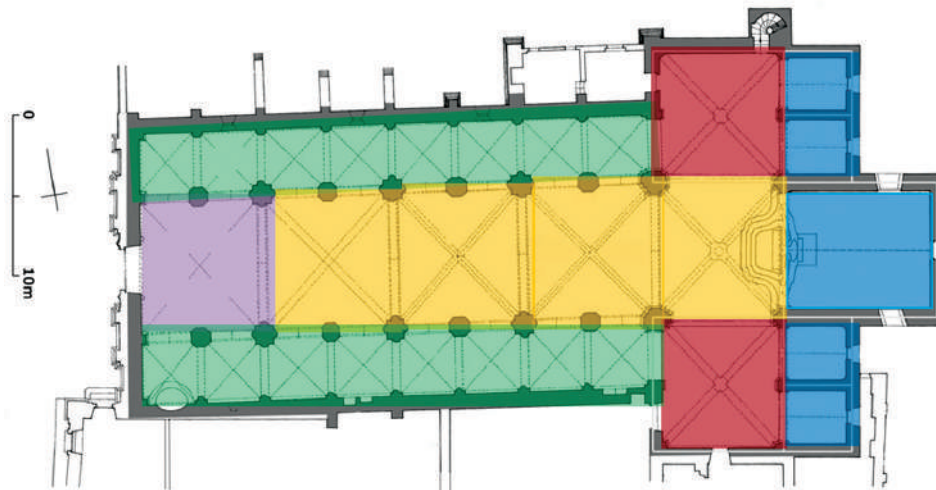


Fig. 8. Casanova Abbey of Santa Maria. Planimetry indicating the vault type: pointed barrel vault (blue), groin vault (green), rib vault (yellow), modern-age groin vault (purple).

body of the church in the central nave, under the vault and the two spans of the transept (fig. 7).

The church was built stating with an orthogonal plan, with no curved elements, with a flat apse and a protruding transept with open chapels along the extensions. The naves of the church were built after the eastern block, in a phase which marked not only a chronological detachment but also a technological one. At plan level, the measurements show a clear shift in axis towards south, near the entrance to the transept.

It is interesting to see how, in the naves, the builders adapted the alternate system of supports characteristic of the Lombard Romanesque style to the Cistercian modular system. The supports of the naves follow the traditional

division into strong pillars and weak pillars, alternatively polystyles and octagons. At vertical level, there is a slight difference in height in the side vaults compared to that of the central nave.

The vaults of the church were built using different techniques, but all the longitudinal and transversal major arches (apart from the sub-arches in the side naves) present a pointed profile. In Casanova, we find systematic use of the pointed arch, which is new in subalpine territory.

Different models of vault are supported by these arches. On the apse and the side chapels, we find split barrel vaults (now covered in the intrados by baroque stucco decorations), according to a characteristic solution used in Cistercian sites based on the Burgundy style. The use of the rectangular rib in the cross vaults of the extensions of the transept allows attribution of a chronology linked to the early site phases (fig. 8).

The longitudinal body and the cross vault were built in a single phase: the vault of the presbytery seems similar to those of the three successive spans of the central nave, created in an ongoing intervention. The vaults are supported by torus ribs, with a bilobate section, with sandstone keys, and present an accentuated convex curve (fig. 9).

The construction phases can be set chronologically, correlating the material data to the document sources. The site was opened between 1148 and 1152, after the settlement in Casanova of the first Cistercian community, of monks from Tiglieto³⁴. In 1160, a

solemn consecration by the archbishop Pietro di Tarantasia is reported by the documents. Sources seem to be quite explicit and convergent, allowing attribution to 1142-1160 of the first three construction phases, which comprise the eastern block and the roof of the apse and chapels. Work recommenced in the next decade, probably after a halt, with the construction of the longitudinal body, continuing with the residential and community service structures. The work was carried out in compliance with a “building block” system, which characterised Cistercian sites and is well documented in the order’s architectural practices.

The Cistercian abbey of Santa Maria in Rivalta Scrivia, near Tortona, was built on a previous monastic site. The monk Ascherio applied to the apostolic legate Guillaume de

³⁴ R. COMBA, P. GRILLO (eds.), *Santa Maria di Casanova. Un'abbazia cistercense fra i marchesi di Saluzzo e il mondo dei comuni*, Cuneo, 2006; in particular N. CERRATO, *Santa Maria di Casanova. Il contributo dello scavo archeologico alla conoscenza di un'abbazia cistercense fondata dai Marchesi di Saluzzo*, pp. 243-252; C. TOSCO, S. BELTRAMO, *Il cantiere cistercense a Casanova*, pp. 63-73; A. SCOLARI, *Il complesso monastico, in Casanova. Arte e storia e territorio di un'abbazia cistercense*, Carmagnola, 1990, pp. 44-45.



Fig. 9. Casanova Abbey of Santa Maria. Rib type: rectangular and bilobate.



Fig. 10. Rivalta Scrivia Abbey of Santa Maria. Rib vaults covering the intersection between the transept and longitudinal element (photo credit: Marco Gattinoni).

Champagne, archbishop of Reims and first Cistercian monk of Chiaravalle near Milan, who attended the transaction with the Cistercians, prior to 1177, with the effective passage to dependence on Lucedio in 1180³⁵.

The construction of the church and the monastic complex must be attributed to this phase of full compliance with the *Ordo cisterciensis*³⁶. The Cistercian site of Rivalta Scrivia brought to completion all the architectural solutions implemented empirically at Staffarda and matured in Casanova. The use of the pointed arch reveals solutions with no uncertainties and the ribs of the cross vaults take on a perfectly semi-circular profile.

The church of Santa Maria has a *Bernardine plan* with a flat central apse and two chapels for each branch of the transept, which also has the same termination. The regularity of the plan and the distribution of the spaces in the transept form an immediate reference, also in terms of size, to Casanova. In Rivalta Scrivia too, in the

different phases that led to the construction of the church, there is a clear detachment between the body of the naves, the transept and the apsidal area. The choices implemented in previous Cistercian sites in North-West Italy are perfected here: the alternating support system, based on the Lombard style with strong and weak pillars, reaches full definition, with the difference in height of the vaults between the central and side naves. The strong pillars are polystylar and made of stone in the first spans, while they have an orthogonal section and are made of brick in the last span towards the west.

The apse with the central pointed arch barrel vault present also on the chapels of the transept repeats the solution already seen in Casanova; the sharp cross vaults with rectangular ribs at the end of the side branches of the transept also follow a well-known scheme. The longitudinal body, comprising the central cross, is characterised by the use of the torus rib; the keystone is made of stone, while only sporadic lithic ashlar are found in the transversal and longitudinal arches (fig. 10).

According to the documents the possible attribution of the works reveals two separate architectural interventions, starting from the eastern apse block of the church and the first monastic buildings on the same side, ascribable to the early 1180s³⁷. The transept was then completed, along with the construction of the vaults, while the first part of the block of the naves was laid out. The first decade of the 13th century witnessed the gradual completion of the longitudinal body, with the construction of the supports, and a second phase for the construction of the vaults with torus nerves in the central nave. The two side naves appear to be part of the same building site, with uniform vaults and pillars (fig. 11).

³⁵ S. BELTRAMO, *Rivalta Scrivia tra storia e restauro: l'architettura cistercense dell'abbazia di Santa Maria*, in *Novinostra. Rivista della Società Storica del Novese*, anno XXXIX, n. 1, pp. 46-73, n. 2, giugno 1999, pp. 9-39, n. 3, pp. 28-53; *L'abbazia cistercense di Santa Maria di Rivalta Scrivia. La storia, l'arte, i restauri*, Tortona, 2013.

³⁶ To date, in the sporadic archaeological digs carried out during the late 12th century restoration, no significant traces of the pre-existing complex have emerged. A. CROSETTO, M. T. SARDO, *Tortona, fraz. Rivalta Scrivia. Abbazia di S. Maria*, in *Quaderni della Soprintendenza archeologica del Piemonte*, 17 (2000), p. 176.

³⁷ C. TOSCO, S. BELTRAMO, *op. cit.*, (n. 34).



Fig. 11. Rivalta Scrivia Abbey of Santa Maria. Transverse arches and torus-profile rib vaults. Polystyle pillars of the transept aisles.



Fig. 12. Vezzolano (Asti) Abbey of Santa Maria. Interior of central nave with jubé (photo credit: Marco Gattinoni).

The canonical of Santa Maria of Vezzolano, which in XII century was located in the diocese of Vercelli, is a very interesting case study, due to the construction techniques

reveals an architecture which still owes much to the experimentation of its components, and a succession of sites with specialised craftsmen, as can be seen by the precision of the

used in the medieval site, rich in constructive and decorative layers that have still to be fully analysed³⁸ (fig. 12).

The original plan of the church was presumably on three naves, one central and two lateral naves, with a previous sculpted pier dividing the interior space³⁹. The east nave, towards the cloister, was plugged to make space for the monastic complex⁴⁰; in fact, the wall blocking off the side nave towards the church differs in terms of texture and framework from that in the other, older parts of the church. The frescoes on the western prospect of the cloister, datable between 1240 and 1290, confirm a closure of this space, which originally belonged to the church, in the early decades of the 13th century⁴¹. From an architectural point of view, the vaults that cover the west wing of the cloister are the same as those of the opposite nave of the church: they are groin vaults with no raised ribs like that in the first span of the south-east nave, the only one still open towards the inside of the building⁴².

The structure of supports and the vaulting system of the central nave is the same in the three spans: rib vaults with diagonal rectangular-section reinforcements with alternating blocks of brick and stone, picking up the two-tone theme used throughout the church (transverse arches, supports and ribs) and in the cloister. The section of the ribs presents an accentuated profile and a considerable thickness. The keys are made of sculpted stone; in the first span towards the façade, the central stone ashlar elongates, forming the first stretches of the raised groins.

The skeleton of the vault (arches and ribs) is supported on unmoulded ledges and capitals, coinciding with the profiles of the parts above them; there are no linking elements in the corners and each element seems to be separate. The vault of the side nave towards the northern apse also presents a solution with rectangular ribs (fig. 13).

This continuous changing of shapes and solution, also adapted in the pillars,

³⁸ The first aristocratic foundation dates back to 1095. A.A. SETTIA, *Santa Maria di Vezzolano. Una fondazione signorile nell'età della riforma ecclesiastica*, in *Biblioteca Storica Subalpina*, CLXXXVIII (1975), in particular pp. 175-186; ID., *Ritorni a Santa Maria di Vezzolano*, in *Biblioteca Storica Subalpina*, CCXXV (2013). P. SALERNO (ed.), *Santa Maria di Vezzolano. La facciata, le volte*, Torino, 1991, pp. 16-19.

³⁹ P. SALERNO (ed.), *Santa Maria di Vezzolano. Il pontile*, Torino, 1997.

⁴⁰ The façade now seems to present an articulation which would confirm this theory that does not, however, agree with the first scholars who examined it. A. BOSIO, *Storia dell'Antica Abbazia e del Santuario di Nostra Signora di Vezzolano*, Torino, 1872; A.K. PORTER, *Lombard Architecture*, New Haven, 1913; A. MOTTA, *Vezzolano e Albugnano. Memorie storiche religiose artistiche illustrate*, Milano, 1933.

⁴¹ E. RAGUSA, P. SALERNO (eds.), *Santa Maria di Vezzolano. Gli affreschi del chiostro. Il restauro*, Torino, 2003.

⁴² According to Paola Salerno, fine raised ribs painted red are present in some of the spans but they hold no architectural importance. *Ibidem*, p. 10.

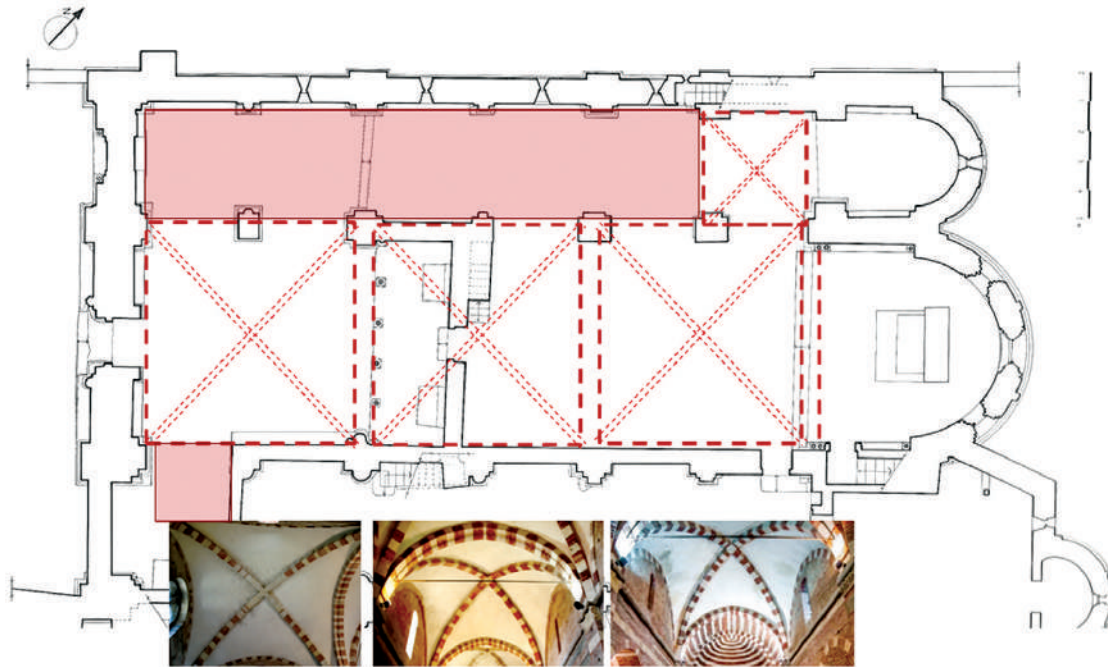


Fig. 13. Vezzolano Abbey of Santa Maria. Planimetry with vault types: simple groin vault (full pink hatch), rib vault (dashed vault projection).



Fig. 14. Vezzolano Abbey of Santa Maria. Ribbed vaulting system in the central nave.

composition of the mixed walls, the sculpting of the stones and their positioning.

Document sources offer no help in reconstructing the progression of the building site: in the absence of any definite claims of construction, it seems possible to attribute the main site to the decades of the second half of the 12th century, when the religious community had been consolidated and obtained acknowledgements from outside, such as papal and imperial protection (1148 and 1159) during the

moreover, burials were arranged inside the cloister and the church, beneath the portico of the pier. The French artistic style of the sites of Vezzolano can also be seen in the architectural and pictorial choices, with an articulate programme of architectural solutions that use different supports, such as complex openings, architectural and sculptural decorative elements and cycles of frescos. The use of the pointed arch is of outstanding importance. It used extensively within the church and also in the older parts of the cloister⁴⁵ match-

governments of the provosts Andrea and Guido⁴³. In-depth studies carried out on the rood screen during its restoration and around the date of 1189, painted under the frieze celebrates the closure of the site in completion of the decoration⁴⁴, have also contributed to our knowledge, without providing a unitary interpretation. The long site phase of the church can be dated to the 1160s and 70s, before the definition of the pier. The new arrangement of the church, with the movement of the *jubé*, can be seen with the reuse of the third nave, walled off and used by the cloister. The new extension of the cloister took on an important role as regards the assignment of commissions by the local aristocracy, particularly by the *Radicata San Sebastiano*, who financed frescoes celebrating funerals, transforming the cloister into a sort of private space between the 1230s and 40s;

⁴³ The bull of pope Eugene III dated 1148 and the diploma of Federico I dated 1159. E. DURANDO (ed.), *Cartario dei monasteri di Grazzano, Vezzolano, Crea e Pontestura*, in *Cartari minori*, I, Pinerolo 1908, doc. 6 (16 giugno 1148), p. 9; *Ibidem*, doc. 12, pp. 15-16. A.A. SETTIA, *Vezzolano: il primo secolo di vita*, in P. SALERNO, *op. cit.* (n. 39), pp. 39-45.

⁴⁴ In particular, on sculptures and the date of the *jubé* G.G. FISSORE, *Le scritte epigrafiche del pontile*, and T.A. HERMANÈS, E. PAGELLA, A. RAVA, *Vezzolano e Losanna. Due cantieri a confronto, appunti e riflessioni*, in P. SALERNO, *op. cit.* (n. 39), pp. 47-52; 79-85. A detailed study on the screens of Northern Europe is provided by J. E. JUNG, *The Gothic Screen. Space, Sculpture and Community in the Cathedrals of France and Germany, ca. 1200-1400*, New York, 2013.

⁴⁵ It is of the utmost importance to continue with the studies on the cloister with accurate surveys and stratigraphic analyse of the different wings.

ing the shape of the rectangular nerves used in the church (fig. 14).

The canonical complex site marks a turning point in the research and innovation of the architectural techniques, proceeding at the same pace as the Cistercian abbeys. Some of the solutions used in Vezzolano can be found also in the Canonical of Corvegna⁴⁶, where a greater maturity, also in terms of chronology, can be found in the vaults and the geometries of the ribs within the spaces used by the religious community.

CONCLUSIVE CONSIDERATIONS

The research offers a very interesting view of the evidences carried out on the architectural and technological system of ribbed vaults and the pointed arch in the 12th century in North West Italy.

While the first experiences in Vercelli and Novara, linked to the construction sites of the cathedrals, seem to have had an immediate and early impact upon the area, which we now can see only partially in some parish churches, a significant technical evolution was reached in the sites of the Cistercian abbeys and the canonical of Vezzolano. French masons played an important role in disseminating increasingly complete and articulate architectural themes and solutions through their connections to the abbeys. The points of unification seem to be the abbey of Lucedio, with its fragmentary elements of the medieval church, and the installation of San Bernardo in Vercelli. The passage of master mason between the Cistercian sites determined the consequent appearance of similar solutions at Staffarda, both with regard to the vaulted system: here we find a first brief testimony of the pointed profile in the transversal arch of the cross vault. All these sites are still linked to the 1250s and 60s, where the use of the pointed arch was not yet fully expressed.

The abbey of Casanova (post 1142-ante 1170) and the canonical of Vezzolano (60s-70s, ante 1189) are the first examples of systematic use of the pointed arch in North West Italy⁴⁷. In the church of Rivalta Scrivia, the phases of which are datable between the 1180s and 90s, the masons had acquired a mature ability to build the lancet arch. It now seems certain that the first experiences of the pointed arch

in this area are the result of the knowledge of local craftsmen entwined with the knowledge of their French colleagues.

It is not easy to follow a chronological order for the sections of the ribs: the long duration of the use of the rectangular profile shows that it was deeply rooted. Rectangular ribs continued to be used for the whole 12th century, but were gradually replaced by those with a curved section towards the end of the century.

The abacus of the ribs created for the cases studied offers evidence of the progress of work in the Cistercian abbeys; the simultaneous presence of rectangular nerves, those with two lobes, tore or with more articulate sections, is proof of the continuing update of the masons at work. The constant presence of ribs in the cross vaults of central naves and their occasional presence in side naves, bears witness to a site organisation capacity and a gradual increase in confidence in the construction of vaulted architectural systems. In fact, ribs are used in side naves only in sporadic and limited cases (e.g.: at Staffarda and Vezzolano); in Casanova and Rivalta Scrivia, they were considered superfluous in the construction of the minor vaults.

Ogival ribs with a tore section became very popular in the early decades of the 13th century in monastic buildings; chapter halls in particular feature a consolidated know-how, which leads to decorative and sculptural elements with greater complexity and executive skill in the keystones of the arch and in the capitals. Attention and precision in the geometric design of the torus rib can be seen in the first ashlar of the arch, where the profile shows a pointed, almond-shaped section, which gradually becomes round.

The progression of the types of rib also determines an increased capacity for craftsmanship in the production of the single element; in most cases examined, the ashlar is made of brick, apart from the stone key. Torus and almond-shaped profiles indicate growing standardisation in production, simplified by the use of moulds to bake bricks.

At the beginning of the 13th century, the pointed arch and the shaped torus rib became very common: starting with the chapter halls, these new architectural and technical solutions came to full maturity in the site of Sant'Andrea in Vercelli, thanks to the presence of French masons in the construction of the abbey from 1219⁴⁸.

⁴⁶ R. BORDONE, M.A. ARDUINO, *Villanova d'Asti, campanile e castello di Corvegna*, in L. PITTARELLO, *Le chiese romaniche delle campagne astigiane. Un repertorio per la loro conoscenza, conservazione, tutela*, Torino, 1998, pp. 202-210; C. TOSCO, *Architettura per un ospedale*, in R. BORDONE, G. CARPIGNANO (eds.), *La prevostura di Corvegna: passato e futuro di un monumento astigiano*, Asti, 2001, pp. 55-60.

⁴⁷ The use of the pointed arch had already been applied to big sites of the cathedrals in Central Northern Italy, such as Pisa and Modena. For an updated bibliography C. TOSCO, *L'architettura medievale in Italia: 600-1200*, Bologna, 2016.

⁴⁸ M. SCHILLING, *La chiesa abbaziale di Sant'Andrea a Vercelli: tradizione lombarda e gotico francese*, in A. C. QUINTAVALLE, *op. cit.*, (n. 16), pp. 189-198; EAD., *Victorine Liturgy and Its Architectural Setting at the Church of Sant'Andrea in Vercelli*, in *Gesta*, 42, 2 (2003), pp. 115-130; F. CERVINI, *Scultura del Duecento a Vercelli*, in V. NATALE, A. QUAZZA (eds.), *Arti figurative a Biella e Vercelli. Il Duecento e Trecento*, Biella, 2007, pp. 61-82.