

Domed buildings in the twelfth century. The monastery of “Santa Maria de Moreruela”

¹ Campano Calvo, J.L.*

Salamanca University. Polytechnic High School of Zamora. Construction and Agronomy Dept. Construction Engineering Area. Zamora. Spain.
e-mail: jlcam@usal.es

² Del Rio Merino, M.

Universidad Politécnica de Madrid. Escuela de Arquitectura Técnica. Dept. of Architectural Buildings and Control. Madrid. Spain.

Abstracts

The monastery of “Santa Maria de Moreruela”, whose origins according to many historians date from the twelfth century, is the first of the Cistercian enclaves built on the Iberian Peninsula. It is now in ruins and is considered one of the great examples of the cultural heritage of the province of Zamora.

This paper aims to raise awareness of how the Cistercian churches were designed, the contribution of the Castilian quarries to their construction, and the development of the vaults over the time passed from their inception until the completion of the work, using this Monastery as an example.

European culture came to Castile with the appearance of the Romanesque style from the hands of the French Benedictine monks; later, Cistercian monks introduced the Gothic style. Thus, the vaults have evolved from the Romanesque rounded vault to the Gothic ogive, the changes being attributed to structural elements and also to the design of thinner walls with more lights.

In the case of the Monastery of Moreruela, this has a basilica church plan, which is typical of the twelfth century, with the same design as that built by the Cistercian order in the French Midi, who along the years of construction changed the design of their arches and vaults.

The most significant vaults of the church of the Monastery of Moreruela, whose styles changed as they were built during several phase,, are classified and displayed in the order in their construction:

Header. Transept. Central nave. Aisles

Introduction

The Monastery of Santa Maria de Moreruela, is located in the locality of “Farm of Moreruela”, Zamora, situated not far from “the Route of the Silver”. At the northwest is Sanabria, with the monastery of San Martin de Castañeda and not far from the Monastery, about six kilometers are the ruins of Castrotorafe.

From the architectural point of view it has been considered by some historians, like the first Cistercian establishment in Spain. The beginning of the construction of the church coincided with a period of juxtaposition of Roman and Gothic forms that gave rise in the 12th century to the Cistercian constructions. Presently, the rest of the Monastery is under the denomination “controlled ruin”.

The White Monks did not create an own architectonic style in this age, although certainly they realized similar constructive elements in all the monasteries, with very austere rules dictated by the Order.

About the stone masonry of the church, we tried to investigate pathological processes that underwent the different constructive elements from the Monastery throughout the years. It caused the fall of the vaults of the cruise of the church and later the collapse of the central and lateral aisles, until the total ruin was caused in which it is at present.

In the study carried out, we have studied and drawn the design and drawing up of the plant of the church, the vaults of the stonework that existed and the materials used in the construction.

We have centered the study in the investigation of the existing vaults and in their possible reconstruction. We study their behavior when they are put under a normal state of loads and also the professional characteristics that the medieval stonemasons had.

DESIGN

The construction foremen of Cluny understood that the design of the churches, had to be planned down with a general scheme, so that later it could be reproduced and measured by anyone in the construction. This scheme had to be applied to the future constructions being able to change the size. Regarding the system of measures used, in this stage of end of the 12th century, they continued maintaining and applying the same previous metric systems with an original metrology and a correct compositional analysis. Much documentation does not exist on the measurement systems used in the Middle Age (Anas and Canas)

The churches were designed by means of drawings (plan and vertical section) on the bases of a theoretical geometry drawn up with squares and compasses or "*fabrorum geometry*." It was based on arithmetical operations of addition and subtraction of modules or fractions of Anas and Canas (Bechman) (Pag 13). It was codified by means of graphical schemes, whose vertices constituted cord knots to translate more abstract geometric relations. The main points of the building were related by means of geometric figures easy to work with, without the need to use numbers or measures. The twig was used, the capitoline foot, compass and squares, systems of triangulation to measure or to fit distances (Ruiz de la Rosa, José Antonio, Traza y simetría de la Arquitectura. En la antigüedad y Medioevo. Public Universidad de Sevilla, 1987, pag 291)

The drawing up one of the church of Santa Maria de Moreruela responds to a basilical plant, typical of the 12th century, that through the years, in their construction the constructive models were changing. The model of the church is the same as the foundations of the "Order of the French noon", translated in basilical constructions of three aisles with barrel vaults, multiple apses and a presbytery of great depth.

The sacred space of the set of the head along with the transept, has a French influence and acts as a space of transition to the aisles of nine sections. It is covered with a barrel vault with double arcs, which are not the prolongation of the barrel vault of the presbytery constituted with unique section. In the collateral aisles is used the rib vault with one extended stone masonry, sustained by ribs without a hardly projection of the key. The arms of the cruise of two sections are covered with a barrel vault.

The lighting of the central aisle and the presbytery is direct. This forces to fit to the heights of the aisles and ambulatory with respect to the main springing, to locate the large windows in the separation space.

The transept contributes to a solution of eight part vault, taking the diagonals of the ribs of the pillar capitals, where also the pointed arcs of the transept are placed. The other ribs of the vault start in the key of the arcs of the transept or in the high brace located in the key of the triumphal arc. The vault produces an effect of continuity between the pilasters and the covering that is only interrupted by a capital of the back-to-back column to the pilaster.

The eight-part vault of the church of Morerueta, according to all the indications, served like reference for some of the constructions of the area, like the monastery of San Martin de Castañeda.

The stability of the structure is given by the relation between thickness of wall and the span to save (MAINSTONE) pag 60. The Cistercian structure of the church of Morerueta is covered with heavy vaults on doubled ribbed arcs, that are in the surroundings of the threshold of 8 m., and represent a relation between wall and the span of value 1 to 4.

LAYOUT

The geometry *fabrorum* or practice was the basis for the design of the monastery church of Morerueta: the generation of basic elements according to axes and widths, the proportions in integer numbers of the construction element and the division of the grid in parts.¹

The layout of the floor plan of the church begins in the head with the representation of a square, **BBDD**, of seventy Castilian feet, whose diagonals intersect at a point **O**, the center of the transept. The side **BD** is divided into four parts and takes one of the diagonal of the square from vertex **B** to the center point **O** to give **G**. The vertex **B** is joined with **G** with a line which cuts **BD** at a point **L**. Drawing the parallel to **BB** by the line **L** gives us the upper arm of the transept. The line of the lower arm is formed by the same procedure starting with the vertex **D**. The length of the arms results when another parallel square to the first is drawn, one whose side has a length of one hundred Carolingian feet. The meeting of the sides of the square with the lines of the arms results in the length of these.

The apse cylinder preceded by a straight line has its center in **1**, which also serves as the center of the circle where the apsidioles fall. In the design of Morerueta there were two axes; the first one for the layout of the header and the arms. The second one, parallel to the first one and discentered, is the result of taking the axis of symmetry of the distance between the shell walls closure of the aisles.

The extension of the line joining the point **B** with **H** in their encounters with the line of envelope, gives the termination point for the delineation of the lateral wall envelope of the aisles of the church.

The arc of circumference with center **H** and radius **HJ** cuts the line of the axis at the point **K**, end of the chorus of the monks and start of chorus of the converted ones.

PRESENT STATE OF THE MONASTERY

At present the church of the Monastery, in spite of its state of controlled ruin is spectacular, by the game of vertical lines and volumes of the head. That is the better conserved part. Today the startings of the nine pilasters of the three ships marked on the ground can be seen. The arm of transept of the north side conserves parts from the vault of medium barrel vault. The head forms the apse, an ambulatory and seven absidioles placed in tangent circle among them and describing a pointed arc in plan. All the set of the head, articulates with two pilasters with back-to-back columns, crowned by a triumphal means arc point and little columns in the angles of the pilaster. From their capitals the ribs of the vault of transept start.

The apse is composed by a straight presbytery, set with a vault with an average tube shape and an absidal cylinder also set with a vault with ribs of quarter of sphere. The ribs of triple profile converge in the key of the vault and they are gotten off in braces of the lantern. Eight columns rise in excess large stone bench and sustain the closing of the absidal cylinder. The columns allow two accesses of union with the ambulatory, closed by double pointed arcs. Between the row of columns and the closing of the apse is the ambulatory. Five absidioles are opened in the wall, and are separated between two by back-to-back semi-columns that sustain together with the main-body columns the structure of vaults. The vaults of the presbytery are of edge and trapezium the rest. The absidioles framed with pointed middle arcs lodge the furnace vaults.

The union between the presbytery and transept is realised through a doubled middle arc point with a brace located in the key of the arc. This serves to correct the greater difference of level of the pointed arcs of transept.

In the ends of the arms of transept the entrance of two chapels with pointed arcs within the wall of reduced dimensions is opened. The north arm of the transept is set with a vault of gun tracked on ribbed arcs. The South arm joins the same vault but its ribbed arcs is doubled. The transept was covered with a eight-part-ojive vault with pronounced ribbing, on ribbed pointed arcs and doubled of the same characteristics of the existing one in the monastery of San Martin de Castañeda also located in the province of Zamora.

From the transept the plant of the church is basilical. It is composed by a central nave and two lateral aisles. The pilasters of the central nave are in cruciform line with contracted semicolumns that are interrupted by a brace before arriving at the ground and they close with doubled and pointed ribbed arcs. These are the ones in charge of resisting the spandrel of the barrel vault to cover it.

The lateral aisles of smaller height serve as abutments of the central nave. Passage occurred towards the central aisle between the pilasters that separate both spaces and it was closed with sustained ojive arcs with semicolumns that do not come down to the ground. The lateral spaces were covered with ribbed vaults slightly ojive with ribbings in the encounter. The outer wall of the South aisle is emphasized with nine stirrups of decreasing sections crowning in a cornice with firings.

CONSTRUCTION

The building process of the church, and after a thorough study and analysis of the building elements that exist, should be conducted in three stages:

- Work began on the southern corner of the header with Romanesque ambulatory. It is perceived at that stage that there was an understanding of the Gothic arches and small ogive domes. The straight stretch was done with a barrel dome. The point and half-point arches are mixed.
- The arms and the transept belong to a second stage where the ogive domes were built. The triumphal arch of the header, made of half-point, had to incorporate an element of bracket to adjust its key and thus be able to get the loads of arch ribbing of the transept. At this stage, the half-point arch of the header was connected with the ogive arches of the cruise.
- The building elements of the third stage are gothic with pointed arches.

THE CASTILIAN STONE MASONS

Historically and in the near-Babylonian culture, guilds of builders, architects and builders are included in the Code of Hammurabi (1692 b.C.). Other authors believe that the medieval guilds arise from operators of corporations established by Numa, at 715 b.C., and Roman Collegia Fabrorum.

De La Gourneri alludes to the mythical origin of the stone saying: "nothing is known about whether the art of the famous old trade has been transmitted without interruption, in the workshops of the works, until today, or was lost for some time and was later recreated".

The tombstone signs that appear in the stone building blocks of historic buildings were made by stone masons who worked on construction sites and had different degrees of professionalism. The degree of "learner" was the lowest rank, that after long periods of training and intellectual development, achieved the degree of "official." Subsequently, after another period of improvement, after having shown his/her qualities and skills in the work, the worker received the title of "teacher" ("master"). The "teacher" could come to have several learners, who after six years of apprenticeship, certify with his superior (master of the lodge) that the student had reached the required "métier" rank. According to an old legend, the secrets that the workers had to get to know teachers were lost with the death of Hiram Abif (1).

In the Middle Ages, the stone masons were grouped in craft guilds, and had all their glory in the eleventh century and especially in the twelfth century. They met in lodges as well as they did: blacksmiths, booksellers, silversmiths, etc. However, the stone masons were always a closed and joined group within the lodges, fulfilling these missions, such as saving the old procedures developed or innovative works and hierarchies for all their members within the profession, or enforcing categories that existed in those times. The main rules of these lodges are reflected in what is called the "Statute", which all members must comply with. The oldest known statutes of the Middle Ages are the "Statute of Bologna Stone Masons", dated in 1248.

Within Stone Masons Lodges, political rights were recognized and they had what has been called "the secret doctrine of art" (2). The lodges tried to save and rediscover the secrets of the traces of the factories as they were performing new works, so that the innovations implemented were not disclosed, in exception of their followers or brothers.

The Stone Masons of Moreruela monastery came to Castile from Clairveaux and Citeaux. The lay brothers who exercised the building by La Borgoña were sent to this land, always accompanied by a monk of the Cistercian Order in order to found monasteries.

The first monks arrived in Spain around the year 1131 or 1132 at the request of the Emperor Alfonso San Bernardo. They were given the mission to repopulate and rebuild the monastery of Suso Moreruela (Zamora) (3). Other foundations followed this first mission, between the years 1137 and 1138, such as Valparaiso Monastery, in the town of Peleas de Arriba, between Zamora and Salamanca; Osera Monastery, in Ourense, and later founded La Espina Monastery, in Valladolid. Construction works were carried out by bricklayers and stonemasons under the supervision of the master builder, under the domain of wealth of the abbot of the Monastery. (4)

The “magister operis” or master appears in one of the documents of harmony between the Monastery of Moreruela and the residents of Val de Junzel of 1168; it said: "rebarata atrium imxta in ecclesia Sancte Marie." The swap agreement in 1182 between the monasteries of Sahún and Moreruela by the inheritance of Magrotes (5) is referred as "Felix magister operis." In the year 1200, a donation that is kept on file in the cathedral of Zamora, appears with the name of **Frate Domingo de operi**. In the year 1215, the name of “**Petrus Mori magister operis et conventus de Morerola**” (6) is cited. “**Petrus Mori frade de Morerola ye maestre de la obra**” (7) appears at a later date.

The stone masons who came from Borgoña were grouped in workshops under the supervision of a teacher (master) and not only worked at the Moreruela monastery but also they did in the cathedrals of Salamanca and Zamora, Toro collegiate (8), the monastery of Sahagún, the monastery of Santa María de Sandoval (Villaverde de Sandoval), León and the monastery of San Martín de Castañeda (Zamora).

The trace elements and symbols found in stone abbatial nearby Moreruela monastery were repeated in any work in the region so that we dare to say that these first French stonemasons worked for the land of Castile in the twelfth and thirteenth century. Signs that the stonemasons represented in the stone were personal and in many cases were used to identify the person who had to receive the payment for the work and the professional rank. The shapes of these traces are very diverse: letters, numbers, crosses, geometric figures, symbols of musical instruments, tools, animals or plants.

BIBLIOGRAPHY