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Quis dubitet hominem coniungere caelo?

a cura di
Elio Antonello

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An archaeoastronomical investigation on the Templar churches built in Piedmont, in the North West of Italy

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Abstract. The focus of this work is to define the methodology of planning and of construction of the Templar churches built in Piedmont, in the North West of Italy, in order to define the criteria of the astronomical orientations and of the geometry used by the 'masters of work' of the Templar Order in drafting the project. One of the most important road travelled by the pilgrims coming from the Northern Europe to Rome was the 'Via Francigena' or 'Romea', that connected the main places of spirituality of the time, and that consisted of a bundle of routes. A branch descended from the Great St. Bernard, passed through Aosta, Ivrea, Santhia, Vercelli and continued to Pavia and central Italy to reach Rome. The 'Via Liburnasca' linked Turin and hence the 'Passi' of the Val Susa (Moncenisio and Monginevro) with Vercelli, a town crossed by the most well-known branch of the Via Francigena. In this work we present the results of our statistical analysis of the architectural alignments of a group of Templar churches located in Piedmont, someone lying along the Via Liburnasca, measured 'in situ' by the authors in the spring and summer 2015. Subsequently an appropriate statistical study was carried out in order to infer their distribution function with the aim to perform an appropriate archaeoastronomical analysis. Several statistical methods have been employed. Basic tests have been performed with automatic data classification, in order to find natural clusters. The K-means and the Circular K-means (CK-means), have been tested. We have used the Kolmogorov-Smirnov test to analyze the orientation data distributions. The architectural alignments that we measured in two Templar churches, applying a rigorous methodology, reveal that the use of astronomical references at the horizon represents the most viable rationale and outlines the existence of orientation patterns that the Templar Knights used for planning their churches, which can be connected with the 'Equinoctial Cycle' religious calendar, and the 'Solstice Cycle' religious calendar. At present the research is still in progress.

1. Introduction

1.1. A brief history of the Templar Order

The Poor Knights of Christ and of the Temple of Solomon, *Pauperes commilitones Christi templique Salomonis*, a religious military order of knighthood was originally founded to protect Christian pilgrims to the Holy Land, and subsequently the order assumed greater military duties during the 12th century. In 1119, the French knight Hugues de Payens approached King Baldwin II of Jerusalem and Warmund, Patriarch of Jerusalem, and proposed them to create a monastic order for the protection of these pilgrims. King Baldwin and Patriarch Warmund agreed to the request and probably at the Council of Nablus in January 1120 the king granted the Templars a headquarters in a wing of the royal palace on the Temple Mount in the previous Mosque of Al-Aqsa. The Temple Mount had a mystique because it was placed above what were believed to be the ruins of the Temple of Solomon. Thanks to the significant contribution by Bernard of Clairvaux, at the Council of Troyes, 1129, the Templars were given a proper Rule, and in 1139 Pope Innocent II's papal bull *Omne Datum Optimum* exempted the Order from obedience to local laws. Templars began to accumulate a substantial landed base in the West, not only in France, Provence, Iberia and England, where they were first known, but also in Italy, Germany, Dalmatia, Cyprus from 1191, and Morea from 1204. By the late 13th century they may have had as many as 870 castles, preceptories and subsidiary houses spread across Latin Christendom. On Friday 13 October 1307 King Philip IV ordered de Molay and scores of other French Templars to be simultaneously arrested. Pope Clement then issued the papal bull *Pastoralis Praeeminentiae* on 22 November 1307, which instructed all Christian monarchs in Europe to arrest all Templars and seize their assets. Pope Clement finally agreed to disband the Order, citing the public scandal that had been generated by the confessions. At the Council of Vienne in 1312, he issued a series of papal bulls, including *Vox in excelso*, which officially suppressed the Order, and *Ad providam*, which turned over most Templar assets to the Hospitallers. The elderly Grand Master Jacques de Molay and Geoffroi de Charney, Preceptor of Normandy, were declared guilty of being relapsed heretics and sentenced to burn alive at the stake in Paris on 18 March 1314.

1.2. Templar Liturgical Calendars

The Templar churches considered can be divided into two main groups, those acquired as a result of donations and that preserve the original geometry and orientation, and those built ex-novo by the Templars, thus with geometric Templar criteria and Templar orientations. The Templars for their religious functions and rituals used a liturgical calendar of the Order of the Temple. It consisted of two distinct annual cycles, both based on the Julian calendar, officially used in the context of Christianity. The first is the 'Equinoctial Cycle', which starts the liturgical year on March 25th, in correspondence of the Annunciation to the Virgin Mary, or the Incarnation of Christ, and evolves throughout the year celebrating 39 liturgically important dates. Easter, Ascension and Pentecost, are movable feasts so they could not match specific dates throughout the year calendar.

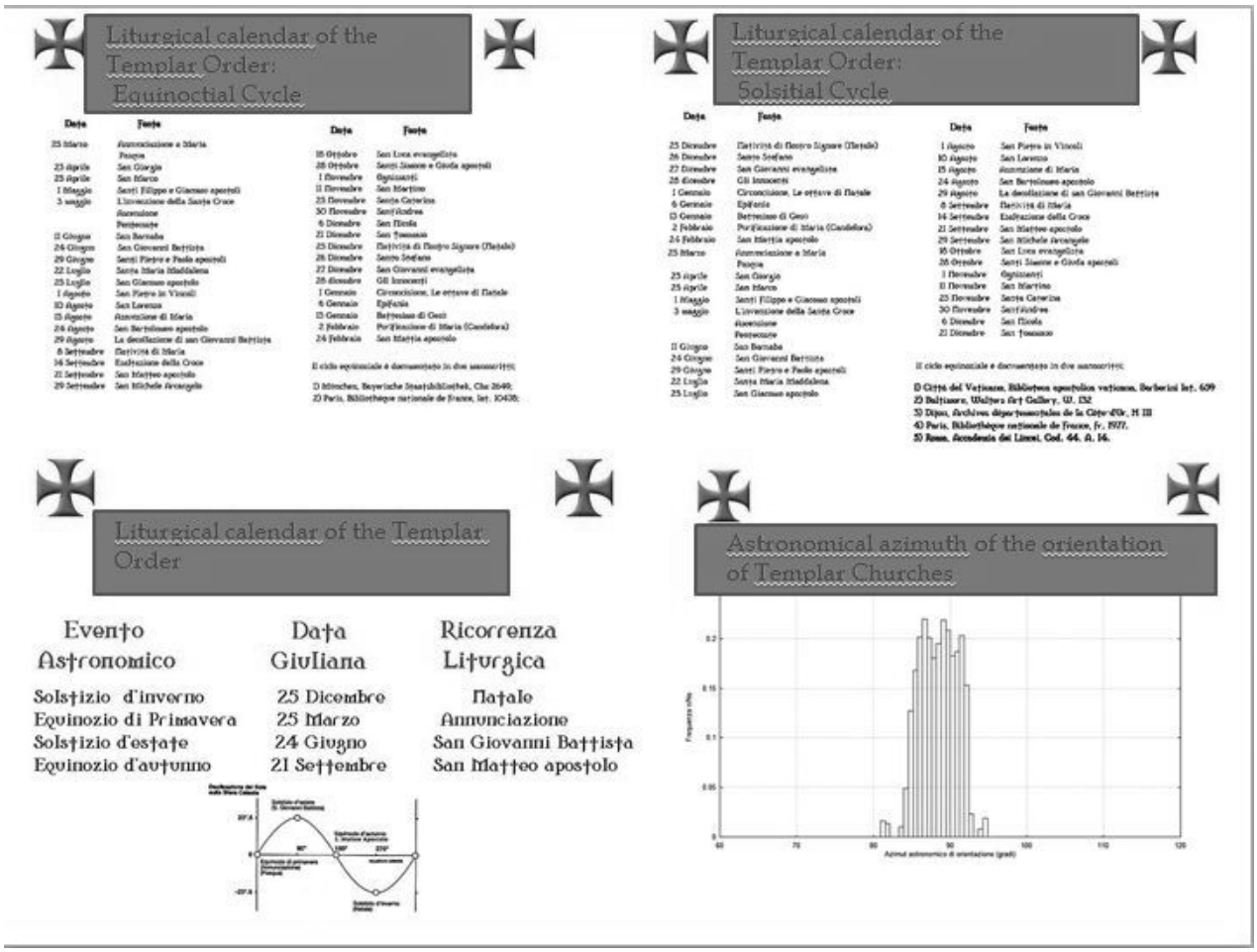

Fig. 1. 'Equinoctial Cycle', and 'Solstitial Cycle', in the Templar Calendar.

The second liturgical cycle of the Templars was the 'Solstice Cycle', which started the liturgical year on the winter solstice and 25th of December with the celebration of Christmas. Also in the solstice cycle

Easter, Ascension and Pentecost are movable feasts so they could not match specific dates throughout the year calendar. The astronomical orientation criteria of the churches built by the Templar Order provided that the axis alignment of the aisle on sight was aligned towards one of these targets: the point of the sunrise on calendar day of 21st March (Equinox)[1] ; the point of the sunrise on calendar day of 25th March (Annunciation); the point of the sunrise on the calendar day of Easter; along the equinoctial line obtained by gnomonic methods.

2. Sources and documents

2.1. Santa Maria d'Isana, Livorno Ferraris (Vc)

The church of Santa Maria d'Isana probably dates from the 12th century and was rebuilt on a probable pre-existing one, after the Po Valley earthquake of 3 January 1117, by the Order of the Templars who had installed, it this site, their 'mansion'. The severe earthquake damaged a wide area, and was perceived in Cologne (Germany) and Piacenza (Italy), and caused the collapse of several buildings. The 1117 earthquake is probably the strongest event which occurred in northern Italy during the historical period. Although its eco and perhaps its effects were felt in a vast area of central and southern Europe (i.e., from Reims to Montecassino), its epicenter is still uncertain and strongly debated, and it is presently placed near Verona by the Italian seismic catalogue (Gruppo di lavoro CPTI, 1999). In a document of 1208, the Mansio Templi is listed as one of the owners of the properties bordering on a piece of land in *loco Levurni* which belonged to the monastery of Rocca delle Donne. The existence of this house is confirmed in a deed of 1222 in which the domus Sancte Marie de Ysana was put under the protection of Giacomo de Mellacio together with those of Vercelli, Novara and Ivrea. Subsequently the preceptors of the house, Gerardo and Giovanni, attended the capitula of 1268 and 1271. In his published version of the documents issued on these meetings, Ezio Trota (1984) wrote that they were in charge of the houses of Luvino and Linnitio, whereas the deed actually reads domus de Livurno and domus de Livuno. In 1298 the *ecclesia Sancte Marie de Exana*, which *subest milicie Templi*, paid a tithe of forty lire. The last attestation of this

[1] As it is well known, the orientation to the spring equinox was usually, but not always, adopted for christian churches even after the Nicaea council; such an indication was reiterated by pope Sylvester II (11th century).

house (that stood on the route of the Via Francigena) in the Templar period dates to the end of January 1310, when the inquisitor Ottone da Milano handed over the management of the house to the vicars of the bishops of Ravenna and Pisa. After the dissolution of the Order the house was passed on to the Knights of St. John and became part of the commendam of Verolengo. The church that belonged to the Temple still exists today and is well conserved. It is the best surviving example of the architecture of the Order in North-west Italy and the style of building dates it to the middle of the 12th century. The *Domus* d'Isana depended on the priory of St. James Templar of Vercelli, and was important for its strategic position on the roads of those times. In fact it stood on the ancient Via Liburnasca, a medieval road traveled by pilgrims, crusaders and merchants that connected Turin and then up the Mont Cenis with Vercelli, a town crossed by the Via Francigena, originating in Ivrea. They created this settlement in Isana, as it was the midpoint between the cities of Vercelli, Casale, Ivrea, on the main street Liburnasca.

Fig. 2. Entrance and South façade of the church of Santa Maria d'Isana.

2.2. The Chapel of San Giacomo (Santa Maria) di Ruspaglia (TO)

The church, located in San Giusto Canavese (TO), rises up in a terraced area where the clay layer around the chapel was completely removed by the excavations of a nearby furnace in 19th century. The surrounding terrain therefore is currently lower by about 3 meters than it was at the time of the church building. According to a document dating back to

August 1174, Count Guido the Great of Biandrate gave a land in the site of Ruspaglia to the Knights Templar. For a long period of time, from the territory of Ruspaglia the Templars and Hospitallers directed and oversaw the spiritual and temporal interests of many of the people of the surrounding plains. In fact, still today some places have purely Templar names, such as Mason in Foglizzo and Commandery in San Giusto.

Fig. 3. The Chapel of San Giacomo (Santa Maria) di Ruspaglia.

3. Archaeoastronomical analysis

In this work we present the results of our analysis of the architectural alignments of the two Templar Churches. The data on the orientations are based on measurements made by us on site during various stages, from spring 2014 to August 2015, to monitor and control the results obtained by us. The complete mapping of the area was carried out using the GPS satellite tracking system with a portable Garmin Etrex that uses the WGS84 coordinate system; the azimuths of orientation were measured with two compasses, a Konus and a Silva. We used also a clinometer for estimating directly the heights of the mountains located on the opposite

site. The error of a single measurement is about 0.5° for the azimuth and 0.5° for the local horizon height. The azimuth measured with a magnetic compass was corrected for the magnetic declination, obtained from the site http://www.ngdc.noaa.gov.

3.1. Santa Maria d'Isana

The value of the astronomical azimuth of the axis of the nave, corrected for the magnetic declination, is 83.7°±0.5°. The equinoctial orientation reuires that the azimuth of orientation of the axis of the nave be equal to 90°. The analysis of the orientation data of many Templar churches built in Europe shows a distribution histogram centered on a value of the astronomical azimuth that is slightly lower by a few degrees than the expected value of 90°. We can argue that the astronomical target of the orientation of the Templar churches was the sunrise on the standard calendar day of 21st March (Equinox) or the sunrise at the dawn of calendar day of 25th March (Annunciation). In this hypothesis, and after the analysis of the documents in which it is proposed that the church was rebuilt after the terrible earthquake of 1117, we can begin to analyze the configuration when the astronomical target of the orientation of the church was the sunrise on 25th March of the Julian calendar. Using astronomical simulation softwares (Skymap) and softwares specially developed by us (A. Gaspani), our computations show that the astronomical azimuth of the sunrise on 25th March, over the centuries between 1000 A.D. and 1300 AD, has a value between 83.8°±0.5° and 82.6°±0.5°. On 25th March 1117, the astronomical azimuth of the rising sun on the local horizon was 83.4°±0.5°. Statistics deal with the deviations between the measured and the theoretical azimuth as random variables, so it becomes necessary to apply more sophisticated techniques. In order to estimate the cross correlation between the orientation of the axis of the nave of the church and the astronomical target, we applied some techniques dealing with the statistical Analysis of Circular Data (Azimuths) (Fisher 1995). We then defined the vector cross-correlation coefficient R between the target **v** and the alignment **u** as a scalar product: R = (**u***__v__/| u|*| v|); since **u** and **v** are unit vector, $R = \cos(\theta)$, where θ is the angle given by the difference between the measured azimuth and that of the target, so we obtain the cross correlation coefficient R between the alignment of the building and our target, by the relation (Proakis 1989): $R = \cos(\theta)$, R=|1| if θ=0° in the case of perfect correlation and R=0 if θ=±90° if there isn't any correlation between the processed directions; if θ=±180° we have R= -1 and the

vectors are anti-related. We obtained a minimum value R = 0.9998 (because we are working with confidence limits 97%); This is the correlation between the two vectors within the range of an angle 0.27°. That means that the two of orientations are well correlated. The correlation coefficient R has a well-defined bond with the probability P(R) = sin(θ), that the alignment and the target are randomly related to each other and that therefore they are not two different aspects of the same thing. In our analysis taking in account the correlation coefficient R obtained we have estimated a probability P(R)= 0.0047. This shows that the maximum value of the probability to obtain a correlation coefficient R=0.9998 only by chance is P(R)=0.0047, so in this case there is the correlation between the direction of the axis of the nave of the church and the astronomical target. Furthermore, by calculating the date on which it falls on Easter Sunday we found that in the year 1117 fell on Sunday, March 25.

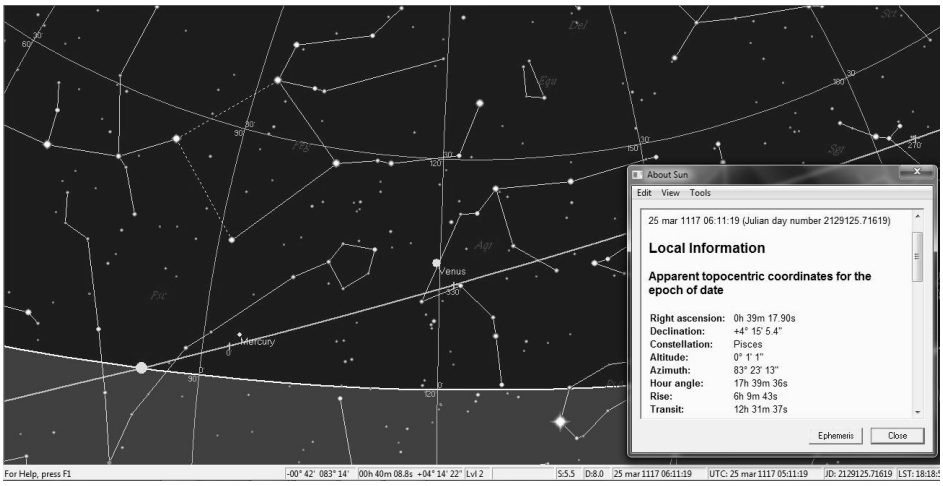

Fig. 4. 25th March Sunrise "Santa Maria d'Isana".

Fig. 5. The church of "Santa Maria d'Isana" at the sunset in March 21, 1117.

Fig. 6. The church of "Santa Maria d'Isana" at the sunset March 19, 2016.

At the sunset on March 19, 2016 we observed the light entering through the mullioned window on the upper part of the west side (above the entrance) and fully illuminating the wooden statue of the Madonna. The azimuth of the sun was 263.13° and the height of 6° degrees.

3.2. The Chapel of San Giacomo (Santa Maria) di Ruspaglia

The measured value of the astronomical azimuth of orientation of the axis of the nave of the church, corrected by the magnetic declination, is 96.0°±0.5°. The church is built on an embankment and the height calculated by the local horizon is 2°30'**.** The Templar churches were often dedicated to Our Lady, and oriented to the rising sun at the equinox. We supposed that the observations to establish the orientation of the apse of the church of Ruspaglia were carried out in the day of the equinox of September 1174. We have calculated that the value of the azimuth of orientation of the rising sun when the sky was observed in the day of the September 23, 1174, that was believed the Autumn Equinox, at the local horizon, was 96.2°±0.5°. The Julian year is, therefore, on average 365.25 days long. Consequently the Julian year drifts over time with respect to the tropical (solar) year; the calendar year gains about three days every four centuries compared to observed equinox times and the seasons. This discrepancy was corrected by the Gregorian reform of 1582.The solar year related to the astronomical year, over the centuries had accumulated a small delay each year until you get to about 7 days in the twelfth century.

We have calculated the real date of the Autumn equinox in the year 1174 A.D. and it was September 16th. In this way, the azimuth of the rising sun measured to plan the construction of the church is different from the correct one, because the equinox day was September 16, 1174, that is seven days before and in this date the true value of the astronomical azimuth of the rising sun on the local horizon was 90.0°degrees.

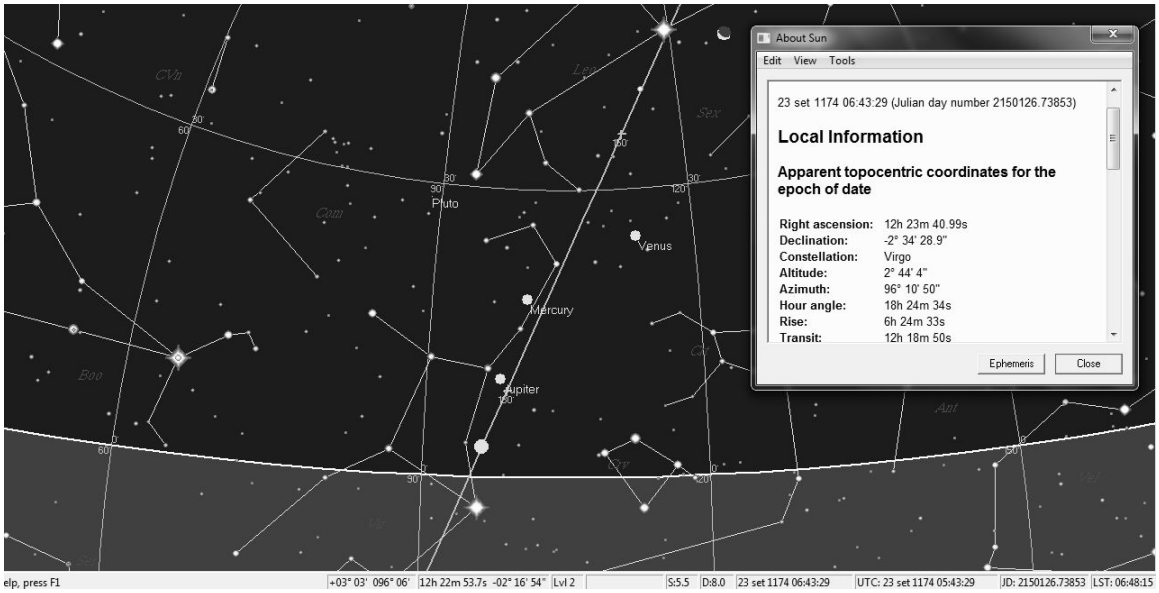

Fig. 7. 23 September 1174 Sunrise "Santa Maria (San Giacomo)", Ruspaglia.

To estimate the cross correlation between the orientation of the axis of the nave of the church and the astronomical target, we have processed the data using the statistic for circular data (Proakis,1989) and we obtained a minimum value R = 0.9999 (because we are working with confidence limits of 97%). This is the correlation between the two vectors within the range of an angle 0.18°. That means that the two of orientations are well correlated. Taking into account the correlation coefficient R obtained we have estimated a probability by chance P(R)= 0.00314. This shows that the maximum value of the probability to obtain a correlation coefficient R=0.9999 only by chance is P(R)=0.00314, so in this case there is a good correlation between the direction of the axis of the nave of the church and the astronomical target.

During the Middle Ages, the building of a temple had to respect strict rules as regards both the entry-apse axis orientation as the period when the foundation must have been celebrated. The building of a church had to respect a number of symbolic rules because it was the place that offers on earth the Christian mystical conception of the universe; also the year in

which the work needs to commence was carefully chosen, depending on the particular astronomical events to which was attached great significance.

What is interesting today to remember, then, it is that none of the places of worship built up to 1500 A.D. was founded according to random criteria, but each was built following the methods of construction, and especially guidance, provided in the Apostolic Constitutions written in the first centuries of Christianity and other similar texts.

Conclusion

According to the archaeoastronomical study we propose that: 1) the church of S. Maria Isana was planned in such a way that the axis was oriented towards the sunrise on 25th March 1117, the day of the Annunciation to the Virgin Mary and also the date of Easter. The church was planned following the rules of the entry-apse axis orientation typical of the Templar criteria; 2) the building of the Church of St. Maria of Ruspaglia was planned to be oriented towards the sunrise on the day of September 23rd, 1174.

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