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# The astronomical orientation of the San Galgano Abbey

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**Keywords:** Archaeoastronomy.

**ABSTRACT.** San Galgano Abbey is a Cistercian abbey in Tuscany, a few kilometres from Siena. The building of its great church started in 1218. Here we show that the direction of the nave was that of the rising of the sun and of the full moon on 14 March 1218 (Julian Calendar). Probably, it was this rare astronomical event that determined the direction of the future church.

San Galgano was the first early Gothic church built in Tuscany by Cistercian monks. Its building started in 1218, according to the studies made by M. Camille Enlart [1]. Close to the abbey, we can find the Hermitage of Monte Siepi chapel, built between 1181 and 1185, in the place where Saint Galgano had retired to live as a hermit [2]. “At the centre of the Chapel there's a rock in which Galgano embedded his sword. ... Galgano Guidotti, born in the nearest town of Chiusdino, led a dissolute life ... until he converted to Christianity. To symbolize his abandonment of his life as a knight, Galgano plunged his sword into a stone” [2].

Besides Enlart's study, another detailed work was that made by Antonio Canestrelli [3]. In this book, we can find many details on the legend of San Galgano and on the history of the Abbey. For what concerns its architecture, Canestrelli, like Enlart, is stressing several similarities with the Casamari Abbey. Actually, in [4], referring to [5], it is told that the architect of San Galgano could have been donnus Johannes, who had completed his work in the abbey of Casamari in 1217.

Of the Casamari Abbey we discussed in [6]. Casamari is a Cistercian abbey near Veroli, Lazio. The building of the church that we see today started in 1203. In [6], we have shown that a link can exist between the direction of the moonrise on Easter 1203 and that of the nave of the church. That is, the nave of Casamari Abbey is aligned along the direction of the moonrise on 30 March 1203 (Julian Calendar).

Since it is supposed that the architect of Casamari was the same of San Galgano, let us investigate the possibility that the abbey in Tuscany has an astronomical orientation too. We can easily see from satellite images, that direction of the nave of the church has an azimuth, within a degree, of 91 degrees. Then, the obvious astronomical orientation seems that according to the sunrise on equinoxes. However, the alignment is more intriguing, and it is involving the full moon too, as we can determine using software CalSKY and Photographer's Ephemeris.

Before discussing the specific alignment, let us note that, at the site of the San Galgano Abbey, we have the natural horizon slightly different from the astronomical horizon. Therefore, it is better to consider the altitude, on the astronomical horizon, that sun or moon must have to be seen rising above the hills east of the abbey, with an azimuth close to the direction of its nave.

Using the elevation profiles of Google Earth, we find that the altitude must be of about  $1,5^{\circ}$ . This altitude will be used in the simulation by means of the Photographer's Ephemeris.

As we did for Casamari, let us use CalSKY to find the full moon after the spring equinox. It was on 14 March 1218 (Julian Calendar). The equinox was on 12 March. So, let us use the date of this full moon in software Photographer's Ephemeris. Since the software is using a proleptic Gregorian Calendar, the date to insert in it is March 21, 1218. The result of the simulation (screenshots) is given in the Figure 1.

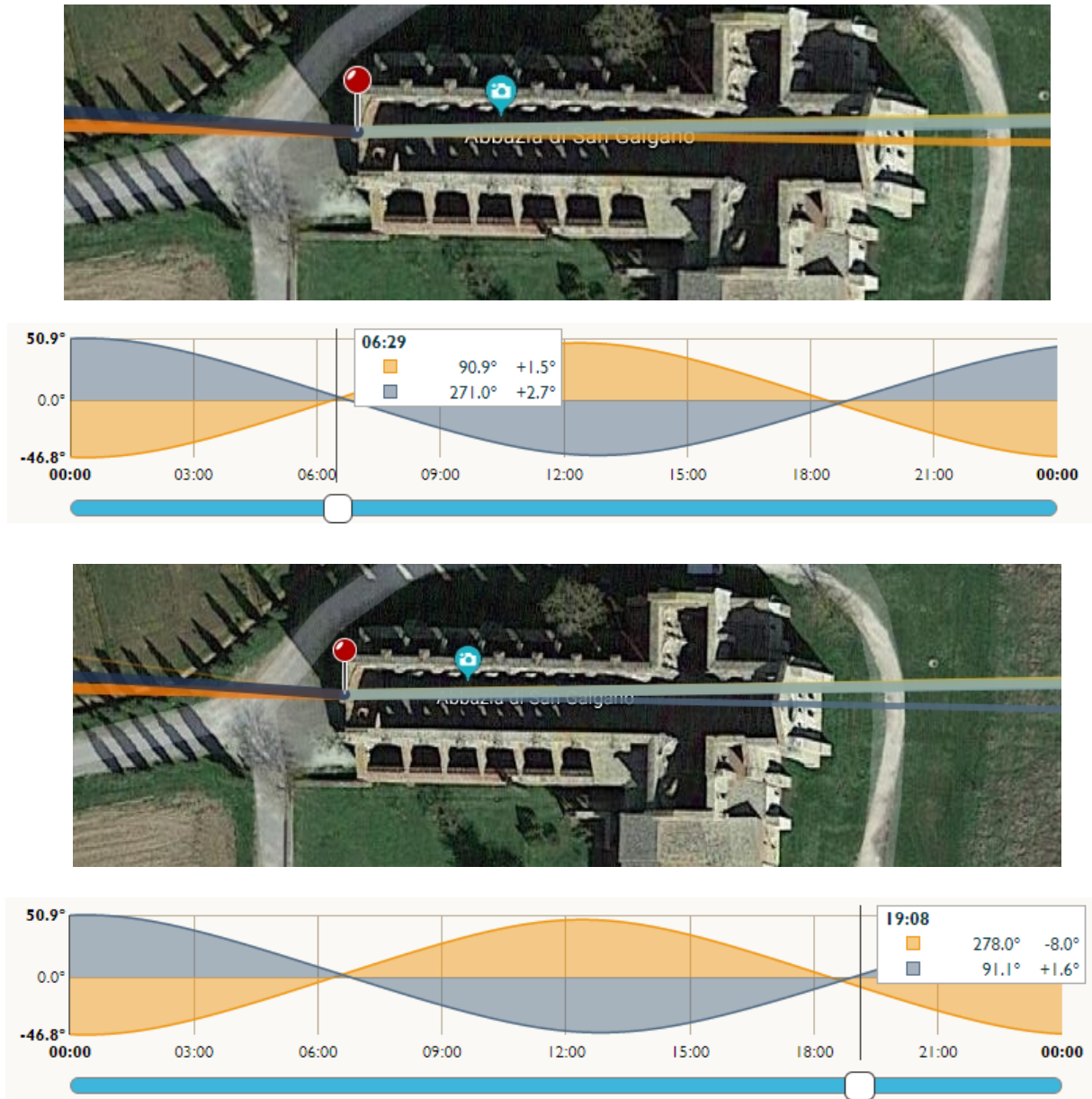


Figure 1 – Courtesy The Photographer's Ephemeris. Let us stress that the simulation is here used for scientific studies. On satellite images, the moonrise on astronomical horizon is given by the thick pale blue line (the line is coincident to the yellow line representing the sunrise). The moonrise on the natural horizon is given by the thin pale blue line (the thin yellow line is representing the sunrise). Curves are giving the altitudes of sun and moon as a function of time. When the sun was setting, the moon (full moon) was rising, and viceversa.

As shown by the simulation in the Figure 1, on 14 March 1218, the direction of the nave of San Galgano was coincident to the direction of the sunrise and of the rising of the full moon too. Therefore, on that day, a specific and rare astronomical event was observed. May be, this event determined the orientation of the future church.

As a conclusion, we can tell that Casamari and San Galgano are both showing orientations according to peculiar astronomical events. This is reinforcing the possibility that the same architect had planned them. In general, we can add these Cistercian abbeys to the cases discussed in [7-9], as examples of orientation according to the moonrise.

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