A possible dating of the Roman Colonia Ulpia Traiana in Xanten to the years 104 or 105 AD

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A possible use of archaeoastronomy is that of dating architectures, in the case that their orientation was determined by some alignments according to sun, moon, or planets and stars. Assuming the Colonia Ulpia Traiana in Xanten, which was built as a new town by Trajan, having the decumanus oriented along a northernmost moonrise direction, we can propose a possible foundation in 104 or 105 AD. To obtain the years we use software CalSKY.

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Xanten is a town in the North Rhine-Westphalia, Germany. The town is known for the Archaeological Park, built at the site of the Roman settlement Colonia Ulpia Traiana. To the town of Xanten it belongs the locality of Birten, where the Roman general Drusus, stepson of Augustus, ordered the construction of the Castra Vetera. The Vetera were one of the military bases for Drusus' campaigns on the east bank of the Rhine, and the main base of the Classis Germanica. The Roman military base was destroyed during the Revolt of Batavi in 70 AD.
After the destruction of Vetera, a second camp was established, named Castra Vetera II. As told by Wikipedia [1], a nearby created settlement, which was inhabited by former legionaries and civilians, was given the rights of a Colonia in 110 AD by the Roman emperor Marcus Ulpius Traianus (Trajan), who renamed it as Ulpia Traiana. The colonia was a new town, with a wall, temples and public buildings. To create this town the old settlement was completely destroyed. The Colonia had a layout which was based on the typical Roman grid made by parallel and perpendicular streets, named decumani and cardines (Fig.1).
According to [2], the town received the status of Colonia between 98 and 107 AD. In [3], the foundation is given about 100 AD. We have therefore references giving, for the foundation of the Colonia a date between 98, the year when Trajan became emperor, and year 110 AD. It means that we have not any historical date concerning the foundation. Therefore, it would be interesting to find an alternative method to determine it. Here we discuss a possibility based on archaeoastronomy.
If it is supposed that architectures of the past had some astronomical alignments, towards sun, moon, or planets and stars, it is reasonable to imagine methods to fit the historical dates of foundations of buildings or even settlements, to possible astronomical events. In the case of the Roman colonies and castra, it is told that they had an orientation of their layout according to the local environment, that is “secundum naturam”, but also according to the rising or setting of the sun and moon, “secundum coelum”. For instance, in the case of Roman Colonia Marciana Ulpia Traiana Thamugadi (Timgad in Algeria) [4], founded in 100 AD, it is told that it was oriented to the sunrise on the day of Trajan’s birthday [5,6]. It was the decumanus, the main axis or road of the settlement, that had been oriented to the rising sun. And shown in [4], the possibility exists that the date of the foundation was coincident to Trajan’s birthday. Let us stress also that we have several Roman towns and castra oriented towards the sunrise on solstices (see for instance the discussion in [7]).

Before discussing the case of Xanten, let us remember the difference in the motion, seen from the earth, of sun and moon. The moon has an apparent behaviour, which is more complex than that of the sun. We have that the sunrise direction oscillates between the two solstice positions during a year, whereas the moon does the same during a nodal period (about 27 days). Moreover, the moon has a period – the lunar standstill period (18.613 years) – on which the values of the extreme directions (standstills, lunistices) are changing. In this manner there are major and minor standstills, of which we can calculate the directions that are depending on latitude. For a latitude of about 45°, like that of Torino for instance, we have that the major and minor northernmost moonrise azimuths (directions) are 47.40° and 65.65° (angles are given from true north). The minor and major southern moonrise azimuths are 116.35° and 132.58°. The azimuths of sunrise on summer and winter solstices are between these lunar azimuths.
After this short discussion, let us consider the case of Xanten, that is of the Colonia Ulpia Traiana, and propose a possible date for the foundation. The method is based on the above mentioned motion of the moon. We have already used this approach for matching the historical dates of the foundation of Augusta Emerita and Placentia (Piacenza) to the moonrise azimuths, according to the direction of the decumani [8,9].
Actually, in [10], an archaeoastronomical study of Xanten has been proposed. Authors of [10] assume the colonia founded in 98 AD.
In [10], it is noted that the orientation of the Colonia cannot be given according to the sunrise, because its decumanus has an azimuth of 44°, therefore smaller than that of the sunrise on summer solstice. It means that only the moon (or Venus) can be involved, and the authors of [10] are considering moon and Venus – however, with question marks - in their Table 1. They noted also that the Temple of the Matronae, the Matronentempel in the Colonia Ulpia Traiana, is facing the Northern Major Lunistice (lunar standstill).
Let us stress that only this temple is aligned along the absolute northernmost moonrise azimuth on a major lunar standstill. The decumani have the different azimuth of 44° (Figure 1).
We can use, as in [8] and [9], software CalSKY to study the northernmost moonrise direction of the years from 98 AD to 112 AD. Let us show, for the sake of simplicity, just the data concerning the month of December (the phase of the moon is also given).

98 AD az 59° December (98.7% waxing)
99 az 58° December (full moon)
100 az 56° December (97.9% waning)
101 az 53° December (full moon)
102 az 50° December (99.6% waning)
103 az 47° December (full moon)
104 az 44° December (99.6% waning)
105 az 43° December (full moon)
106 az 41° December (full moon)
107 az 40° December (full moon)
108 az 40° December (99.2% waning)
109 az 42° December (98.5% waxing)
110 az 44° December (full moon)
111 az 47° December (full moon)
112 az 50° December (98.8% waxing)

First, we see that the major lunar standstill was on 107 and 108 AD (in absolute, as given by CalSKY, the northernmost azimuth of the moonrise was of 40 degrees from true north). Since the direction of the decumani of Colonia Ulpia

Traiana is of 44°, the year pointed out by Calsky, in the historical interval given in [2], is 104 AD. Let us also consider the moon at the beginning of 105 AD. In January 105 AD, we have a moonrise azimuth of 44° too, with a phase of 98.4% waxing. The azimuth of 44° is also found in 110 AD. However, year 110 AD is not considered because it is after the major lunar standstill of 106 - 107, which was probably the time period when the temple of the Matronae was built.
CalSKY data are quite interesting, because we have a very good agreement - for the end of 104 AD and the beginning of 105 AD - of the direction of the decumani to the northernmost values of the moonrise azimuth. Moreover, we see also that the phase of the moon was peculiar, that of the full moon, which was corresponding in Roman tradition to the Ides, the days consecrated to Jupiter.
After the results given by CalSKY, in the case that the direction of the decumani of Ulpia Traiana at Xanten was determined by the moon, the foundation of the colony could have been at the end of 104 AD or at the beginning of 105 AD. A possibility exists that Trajan aimed to encode the year of the foundation by choosing the northernmost direction of the moonrise. Let me stress that this is just a proposal in the framework of archaeoastronomy. Of course, other historical and archaeological results are necessary to corroborate this dating.

A conclusion: In my opinion, in the case of historical periods, it is necessary to ask archaeoastronomy of giving more specific results, and not only general conclusions. In fact, we have astronomical software, such as CalSKY and Stellarium and many others, which are suitable for obtaining proper quantitative data for any possible comparison. Let me also stress that the orientation of buildings and settlements “secundum naturam” must always be considered, and that an orientation “secundum coelum” has not to be considered, “a priori”, the most relevant one.

References

[1] Wikipedia (26 May 2019). en.wikipedia.org/wiki/Xanten
[2] Livius.org (26 May 2019). www.livius.org/articles/place/xanten/xanten-cut/
[3] Nico Roymans and Ton Derks (2011). Villa Landscapes in the Roman North: Economy, Culture and Lifestyles. Amsterdam University Press, 2011
[4] Sparavigna, Amelia Carolina, Archaeoastronomical Analysis of the Roman Colonia Marciana Ulpia Traiana Thamugadi (Timgad), Founded at the Sunrise of Trajan’s Birthday (May 1, 2019). Available at SSRN: https://ssrn.com/abstract=3327833 or http://dx.doi.org/10.2139/ssrn.3327833
[5] Haverfield, F. (1913). Ancient town-planning. The Clarendon Press.
[6] Barthel, W. (1911). Römische Limitation in der Provinz Africa, 1911, CXX, pp. 39-126. Carl Georgi Verlag, Bonn
[7] Sparavigna, A. C. (2014). Solstices at the Hardknott Roman Fort. PHILICA Article number 442. Available at SSRN: https://ssrn.com/abstract=2745184
[8] Sparavigna, A. C. (2016). Augusta Emerita and the Major Lunar Standstill of 24 BC. PHILICA Article Number 635. Available at SSRN: https://ssrn.com/abstract=2807544
[9] Sparavigna, Amelia Carolina. (2019, April 24). Piacenza e la Luna. Zenodo. http://doi.org/10.5281/zenodo.2650467
[10] D. Espinosa-Espinosa, A.C. González-García and M.V. García-Quintela. Urban planning and ritual action in Colonia Ulpia Traiana (Xanten, Germany): Understanding a non-solar orientation pattern. Mediterranean Archaeology and Archaeometry, Vol. 18, No 4, (2018), pp. 25-32. DOI: 10.5281/zenodo.1472255

Figure 1: Colonia Ulpia Traiana, Tricensimae, Archäologischer Park Xanten. Courtesy Thomas Römer / OpenStreetMap data. Map of the Archaeological Park Xanten.
en.wikipedia.org/wiki/Xanten#/media/File:Archäologischer_Park_Xanten_DE.png