Mediterranean Archaeology and Archaeometry, Vol. 16, No 4,(2016), pp. 249-255

10.5281/zenodo.220943

THE URBAN SET OF THE PANTHEON AND THE MAUSOLEUM OF AUGUSTUS IN ROME, BETWEEN ARCHITECTURAL AND ASTRONOMICAL SYMBOLISM

Lanciano Nicoletta[1], Paola Virgili[2]

[1]University of Rome "La Sapienza", mathematician and member of the Executive Council SIA
[2] University "Romatre", already Monumenti e Scavi della Sovrintendenza Capitolina di Roma, archaeologist

Received: 03/03/2016
Accepted: 16/04/2016

Corresponding author: Nicoletta Lanciano (nicoletta.lanciano@uniroma1.it)

ABSTRACT

Until 1995, it was thought that the Pantheon of Augustus had the entrance on the south side in contrast to that of the next scheduled time of Hadrian, which has placed it in the north. The archaeological excavation executed by the Sovrintendenza Capitolina di Roma, under the supervision of P. Virgili, during 1995-97, have shown that the Pantheon of Augustus had almost the same plan that Hadrian had rebuilt later and that we can see today.

Even the surveys, conducted during 2007-2009 on the Mausoleum of Augustus, inside and on the forecourt, allowed to advance new hypotheses about the ground plan of the monument and its rearrangement made by a successor of Augustus. In 1990, N. Lanciano published a reading of the Hadrian's Pantheon as a solar calendar that use the light entering from the oculus and scans the interior space, at solar noon, on Equinoxes and Solstices days, in addition to the April 21 birthday of Rome. These researches show the two buildings, Pantheon and Augustus' Mausoleum, have more formal and symbolic links than was supposed. With attention to contemporary written sources, issues arise: the orientation of the axes of the buildings and their distance; the organization of the squares on which they open; the geometry of the inner dome and hall of the Pantheon.

The urban complex of Augustus includes also the monumental sundial, mentioned by Plinius and partially excavated by Buchner in 1979, and the Ara Pacis location and its function: the most recent researches lead to exclude some hypotheses still present in articles and in the web. In the modern reuse (1990) this obelisk is a gnomon in the above horizontal sundial.

KEYWORDS: Pantheon, Augustus' Mausoleum, Augustus, Hadrian, orientation, solar noon, Campus Martius.

1. ARCHAEOLOGICAL INVESTIGATION OF THE PANTHEON[1].

In 1995, P. Virgili has directed an archaeological investigation extended for more than 200 square meters, on the front of Hadrian's Pantheon, on behalf of the Sovritendenza Capitolina of Rome, among which she was supervisor of the Ufficio Monumenti Antichi e Scavi.

During this excavation the structures of the first Pantheon have been brought to light, at altitude 9,10 Mt asl, more than 5 Mt below the square's foot traffic. It was built by the will of the emperor Augustus, by Marco Agrippa in 26 b. C., in his third consul, as written in the following's Pantheon inscription. Especially two sets of stairs of eleven steps each, built in the pedestal which gave access to the Augustan temple's porch have been recorded and that are situated under the square's actual level, made up by just of seven steps each, being the latest Pantheon's podium, of Hadrian's age, shorter than the old one.

The plan of the Augustan Pantheon was almost identical to that of Hadrian: the base of the colonnade, made by wet tufa blocks has been also reused during the reconstruction, naturally elevating it by a new stonework. The differences are in the porch's width: Augustus' Pantheon has a wider colonnade of ten pillars (*decastylus*), and Hadrian's Pantheon with a 8 columns colonnade (*octastylus*), and the Augustus' podium was tall 2,10 Mt and the Hadrian's podium was tall 1,40 Mt (as shown in Figure 1).

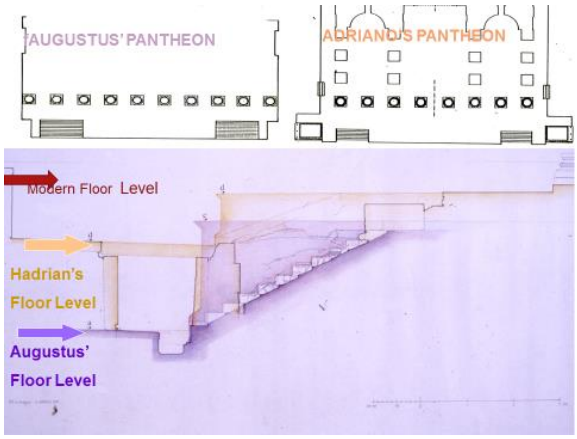

Figure 1. Augustus' Pantheon with ten pillars and two stairs of eleven steps. Hadrian's Pantheon with eight pillars and two stairs of seven steps. The Augustus' and the Hadrian's floor level.

A survey, during the Claudian/Neronian age (41/68 a. C.), rediscovered in Rome, and now preserved in Vatican's Museums, represents a decastylus temple: since there was not any temple with such number of columns (before the construction, in 135 a. C. of the temple of Venus and Roma), that one may represent the Pantheon. On the pediment, Romulus and Remo are represented as breastfed by a she-wolf and Rea Silvia sleeping and about to be raped by Mars (*ierogamia*), an explicit hint about the foundation of Rome. In the great Pantheon's excavations of the Augustan structures made by Beltrami and Armanini in 1892-93, and amazingly drawn by Georges Chedanne, a pensionaire of the Accademie de France, the finding of porch colonnade was interpreted as a temple with a rectangular cell.

Rodolfo Lanciani (denying what previously said), determined and published that the building was structured with a rectangular cell, pointing towards the South of the erected city.

He said that in front of the temple's rectangular structure, there was a circular opening without a cover, fenced in an *opus reticulatus* wall, with a floor made by antique yellow and pavonazzetto sheets, fine coloured marbles that the romans would've never used somewhere outside. However, today we still find on the internet, on Wikipedia for instance, this same description of the Augustus' Pantheon.

R. Lanciani, and the following studies, denied the existence of a homogenous town-planning scheme, the correlation between Augustans monuments from Campus Martius, Pantheon, Horologium, Ara Pacis and Augustus' Mausoleum, specifically between Pantheon and Mausoleum. Would be pointless to look for a correlation between two monuments not facing each other and both oriented toward the southern part of the city!

The Pantheon was built in a swampy depression, the Campus Martius, near the *Palus Caprae* where, traditionally, took place the ascension and the apotheosis of Romulus and his following transformation in the god Quirinus. This choice was not random. Augustus used the Pantheon to build a symbol for the cult of the living emperor, the same place of Romulus divinization, the legendary founder of Rome. Cassio Dio (46,2) wrote that Proculus saw Romulus's ascension and that the same wonder happened when Augustus died; senator Numerius Atticus earned one million of sestertii by swearing to have seen the emperor ascending to the sky. The "indigenous" models from the origin of the city inspired Augustus' propaganda: Augustus wanted to look like the founder of Rome and tried to replicate, even manipulating the truth, events that took place in Romulus' times. *Suetonius* described that Octavianus "while he was being greeted for his first consul twelve buzzards flew towards him" similar circumstances occurred during Romulus's first ceremony: the flight of these animals linked him to Romulus and the crowd had it easier to believe in his authority. Romulus was called "the most august of the well

[1] *This section is edited by P. Virgili.*

wishers", and the Senate would confer the name "Augustus" to Octavianus on the 16th of January 27 b. C., three days later the constitutional reform that would form the empire (was in fact a tradition to reward anyone that acted good toward the republic with a new name). Octavianus would have preferred Romulus but, being the name of a past king; people could have misunderstood the choice.

Even the house that Octavianus bought in 36 b. C., after the win against Sextus Pompeius, and where he lived for more than 40 years, was on Palatino's hill near the *Scalae Caci*, around the *Casa Romuli*.

The date of birth too, might be true or not though, was on 23 of September for both, Romulus and Augustus. Ronald Syme, the historian from New Zealand, defines as "obsessive" his tendency to relate himself with Romulus. Augustus, a clever, cultured and sly man, as confirmed by his lucky rise to power, understood that the way to reassure the people was by using few, repeated symbolic messages. The Pantheon building represents the clearest of all these symbols to Romulus.

2. THE PANTHEON AXIS IS NOT EXACTLY NORTH SOUTH [2].

Today the sunlight, going through Pantheon's *omphalos* create a blinding spot of light that, depending on the season, moves from the dome to the floor but always near the Pantheon's doorway. This phenomenon occurs, more or less, twenty minutes before noon as the building is oriented about 5° west compared to the north-south axis.

The centre of the Pantheon, his doorway and the centre of the Augustus' Mausoleum, are perfectly aligned The real connection between the two monuments is realized by the two squares in front of them, built parallel to the line from the centre of the Mausoleum to Pantheon's. The square before the Pantheon was exceptionally large and plated with travertine's sheets. Large paved spots have been founded during 1995 excavations but even previously, parts of the paved floor have been founded in Rotonda and Madddalena's square (documented by archive data G. Gatti).

R. Lanciani, in his *Forma Urbis Romae* Tav.8, reconstructs a 60 Mt wide, 120 Mt long square, even bigger than the current one, which later will be delimited by the *Basilica Alexandrina* on the eastern side and side by the *Thermae Neronianae Alexandrinae* on the opposite. The northern side has always left open to be seen for the Pantheon. The square extended to the place, where today we find Coppelle's road/Acqua Santa's road, had the same 5° inclination to Pantheon's front side.

From 2007 to 2010 P. Virgili directed another excavation by the Sovrintendenza in Augustus Emperor place, in the Mausoleum and in the surrounding area. In the excavation was founded the bases of the two obelisks that were placed side by side with the Mausoleum, locating the *Res Gestae Divi Augusti*, and bringing to light the paved square in front of the grave's opening. The paved floor, along the line from the Pantheon to the Mausoleum, is built to hide the misalignment between the two monuments with few tricks, such as cutting the blocks not perfectly square. The Mausoleum was erected at an approximate distance of 739 Mt from the Pantheon, a symbolic measurement, almost equivalent to half of a roman mile, a *miliarum* (1478.5 Mt), equal to 5000 roman feet, measurement for the *deambulationes*, the walks narrated by Svetonio (*Aug*. 100) (as shown in Figure 2).

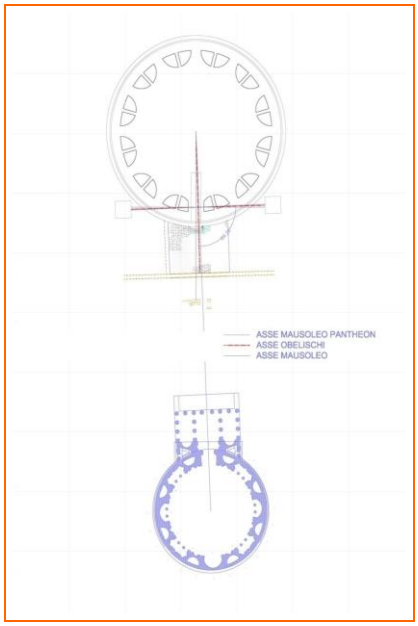

Figure 2. The connection between the two monuments is realized by the two squares in front of them, built parallel to the line from the centre of the Mausoleum to Pantheon's.

The paved floors of these two squares, perfectly oriented towards one another, as on the symbolic as on the physic way, connected the two buildings. From the Pantheon in about 20 minutes, after half roman mile, it was possible to arrive to the Mausoleum, exactly north-south oriented.

On the Mausoleum, there was Augustus tomb with his golden-bronze statue (as shown in Figure 4).

The relationship of astronomy with Augustean architecture is also supported by discoveries occurred in the cities of Augustus' foundation, as shown by Bertarione and Magli (2015).

[2] *This section is edited by P. Virgili.*

3. ASTRONOMY AND GEOMETRY IN THE INNER PANTHEON[3].

In 1990, N. Lanciano published «L'occhio di luce» reading of the actual Pantheon as a solar calendar through the light entering from the oculus, at the solar noon.

She founded

1. The Pantheon has a northward orientation but the axis of the actual monument, of Hadrian's age, is not exactly on the South-Nord line, which means that the solar spot of sunlight is not on the axis of the monument at the solar local noon.

2. The spot of sunlight marks a calendar, in the days of the Equinoxes and Solstices, in addition to the April 21 birthday of Rome, at noon the spot of light is in special architectural points.

3.1. Geometry of the inner of the Pantheon

About the interior shape of the Pantheon, M. Yourcenar, in Memoirs of Hadrian, wrote: «My intention had been that this sanctuary of All Gods should reproduce the likeness of the terrestrial globe and of the stellar sphere. … This temple, both open and mysteriously enclosed, was conceived as a solar quadrant». The interior shape of the monument is the cylinder with the base's radius equal to the high, with a semi sphere, superimposed to a cylinder with the same radius. It remembers the form of the roman and greek roofed spherical sundial with a hole on the top (Gibbs 1976), from which enters the sunbeam. In those sundials the spherical surface is divided in 12 temporary or ancient hours: there are 12 hours from the Sunrise to the Sunset, and 12 from the Sunset to the Sunrise. The hours of the day are longer in Spring and Summer, while the night hours are longer in Autumn and Winter, and vice versa. The sundial analogy for the Pantheon is discussed in Hannah (2009). The position of the sunbeam in the Pantheon, changes with the hours during the day. In the morning, it moves from the edge of the so-called oculus on the west, at the left of the entrance doorway, it touches the axis of the temple; it reaches the minimum height at mid-day, on the north. Then it arrives up to the dome on the right of the entrance, in eastern part, when the Sun rises and the spot reaches again the oculus. If the Sun is on the east side of the sky, the sunbeam inside is visible on the western part, if the Sun is south, the sunbeam is north (as shown in Figure 3).

However, this is different every day, and almost the same every year, in the same days: during the year, we have a minimum route in Winter, round the oculus, and a maximum in Summer when the sunbeam reaches the floor. More precisely, the highest squares receives the noon light on Winter Solstice, near 23 December; the separation between the upper semi sphere and the cylinder receives the big spot of light at the Equinoxes, near 21 March or 22 September, and the ground of the hall, is illuminated on Summer Solstice near the 21 June. Like the difference of the inclination of the sunbeam between the Summer Solstice and the Winter Solstice is 47°, in the Pantheon, that difference is evident, as in a monumental sundial, and architecture creates a memory support. On 21 April, Dies Natalis Romae, the light goes out from the monument, through the large doorway and the grille over the door, and illuminates the pronaos like a symbol: the light arrives on the city of Rome and on the Empire.

We agree with Hannah and Magli when they wrote, "We stress that all the astronomical analysis does not aim to show that the Pantheon was designed to make precise measurements of the Sun's cycle, but rather to substantiate the symbolic connection of the building with the path of the Sun in the course of the year".

In addition to this, within the half south of the hall never receives direct sunlight, but the Hadrian emperor was in the south part of the Pantheon to administer justice; he was the only one who could see the spot of light moving on the walls. People looking at the emperor saw the only one who represent the light for the people: The Emperor-Elio.

3.2. The number that characterise the Temple of all Goods

Pantheon, in Greek, means "all the gods": but which are the gods of the Augustus' and Hadrian's Pantheon?

The historian Cassius Dio, writes: "Perhaps it has this name [Pantheon] because, among the statues which embellished it, there were those of many gods, including Mars and Venus; but my own opinion on the origin of the name is that, because of its vaulted roof, it actually resembles the heavens." (Cassius Dio 53.27.2) (Translation from Latin in Hannah, Magli, 2009). There were statues of Romulus-Quirinus, Divus Julius Caesar, Mars and Venus, two of planetary gods and protectors Julia gens, and of the main Olympic gods.

On the dome, there are 5 concentric circles of squares. Five like the five visible planet by naked eyes: Mercurius, Venus, Mars, Iupiter and Saturnus. In addition, we consider also that 5 is the number that the Pythagoreans attribute to Venus (Lanciano 1988), because of 5 conjunctions every 8 years.

Every circle has 28 squares like the 28 days of the Moon's month. However, the number 28 has also more special numerical characteristics: it is the sum

[3] *This section is edited by N. Lanciano.*

of the numbers up to 7. In fact, 28 = 1+2+3+4+5+6+7; it is the sum of its proper divisors, so that 28 is a perfect number: 28 = 1+2+4+7+14. The perfect numbers are integers numbers and they are very rare; the first are 6 – 28 - 496 – 8128 - 33 550 336 (a number to 8 digits). In addition, it is impossible, only by ruler and compass, to divide a circle in 28 equal parts because of the number 7 like Gauss demonstrate in 1801, and 28 = 4x7.

There is 1 so-called oculus, for the light of the Sun that is 30 roman foots of diameter, about 9 meters.
The hall is 150 roman foots wide, like the Teatro Marittimo in the Adrian's Villa in Tivoli. Also the Big Mosque, in Anna Magnani road, in Rome, made from P. Portoghesi, V. Gigliotti and S. Mousawi, inaugurated June 21, the day of Summer Solstice, 1995, actual headquarters of the Islamic Cultural Centre of Italy, has the same interior shape and the same dimension on the Pantheon.

In the Hadrian's Pantheon, there are 16 niches like the number of the directions in the Etruscan organization of the space; in fact, Hadrian's architecture is very influenced by Etruscan ideas: The Etruscans divided the sky into 16 parts in a clockwise direction: north, east, south and west. They called lefts ones towards the eastern part of the horizon and rights those on the western part, because they placed their deities on the south, so that east is to the left. For them, left is positive like the rise, the birth and right is negative, sinister, like the set and the death. In contrast, the Greeks, which placed their gods on Mount Olympus through the north (from the island of Crete), they have the east part on the right, linked to the positive, and the west on the left that is sinister, like for Romans, and for us. (Plinius N.H. II, 143-144).

"In this way, the space, with its geometric and cosmological properties refers to universe mechanism of the Stoics, to the numbers of the Pythagoreans and the harmony of the spheres of Platonic. The building, expression of the cosmic order, affirms the supremacy of the Sun that illuminates and that is embodied by the central oculus, which holds all the space, as well as the sovereign rules over his empire. This allusion to the imperial cult through architecture that materializes the Sun god Zeus-Helios, master of all the gods, of which the sovereign assumes the splendour, is still comforted by the presence of the chariot with four horses, which once surmounted the porch, evoking the course of the star of the day." (Stierlin, 1986)

Figure 3. Local noon in the Pantheon, on October

3.3. *About the axes*

In fact, the centre of the big spot of light from the oculus is on the axis of the monument about 15-20 minutes before local noon. If we observe the light on the dome at the local solar noon, it is on the right of the centre of the door. The exact instants depend on daily value of the Time Equation, and the longitude of Rome gives a delay, of the real Sun, of +10 minutes. To have a better idea, we can consider that there are 28 squares in every circle of the dome, and between a square and another there are 360°: 28 = 12,8°. As if 1° correspond to 4 minutes near noon, the difference between the two positions of the spot, on the axis and at noon, is about 4°-5°, which means more than 1/3 of square. Instead, the axis of the Augustean Mausoleum is exactly north south.

The room floor has square frames, containing a smaller one, alternated with square frames containing a circle: the inner square and the inner circles are not all the same size. The measurements of frames and internal figures are 10, 2, 1 ½ in Roman feet.

From inside the Pantheon it is possible to watch some stars which depends from the latitude of Rome (near 42° Nord) and from the dimension and height of the oculus. The angle of the cone, from the centre of the hall to the ring of the oculus, around the zenith direction, is about 11° 25′, and from the border of the hall, there is a cone with 9° opening. With these data, is possible to calculate the declination of the visible stars, and the condition of visibility from the hall of the planets and Moon, (Del Monti, Lanciano 1990; Hannah 2005).

Figure 4. Mausoleum's reconstruction (by Virgili- Mancini)

4. THE HOROLOGIUM AND THE ARA PACIS[4].

The urban complex of Augustus includes also the monumental sundial or Horologium mentioned by Plinius in the Naturalis Historiae (N.H., XXXVI, 72 ss). In Egypt, obelisk is the same word for of sunbeam: in Rome, this obelisk, brought from Heliopolis in 10 b. C., is dedicated to the Sun and therefore to the god Apollo, the Augustus' protector.

On the the Equinox, 23 September, Augustus' birthday, the shadow of the Campus Matius's obelisk, reached the Ara Pacis, at sunset, like has shown in the model in the Ara Pacis Museum.

Buchner in 1979 partially excavated the Augustan meridian line, in Campus Martius: recent researches lead us to exclude some hypotheses still present, with the relative figures, in many articles and in the web. The line of meridian was certainly marked on the ground but the others lines of hours, as we can see in the first Buckner reconstruction in 1982, and the declination lines, there were probably not. It means that the occupied space by the meridian monumental line, with an obelisk of 100 roman feet, about 29 meters, was a long strip, of about 70 meters, width of about 2 meters and not a full lines grid.

The same obelisk is, from 1990, the gnomon of a new sundial line in Montecitorio Place. The obelisk is not in the same position than before. Because of the dimension of the Place and the position of the obelisk, relative to the building façade on the north, not all the calendar, from one solstice to the other, is marked on the ground. We found dates from Summer Solstice to November and, on the other side of the meridian line, from February to Summer Solstice: it left the part of the year near the Winter Solstice.

The Ara Pacis Museum, in its twentieth-century accommodation, is located near the Augustus' Mausoleum, between Ripetta Road and Cavour Bridge in a great Teca of the architect Richard Meier. Inside the Teca there are the Ara Pacis and a model of the Campus Martius during the time of Augustus. In this model, toward the northern edge of the area there is the Mausoleum, in the centre there is the Augustus' Ustrinum, on the east side the Flaminia Road, and the Saepta Iulia and the Pantheon (27-25 B. C.) are located further south. In the model, there is the Ara Pacis in its original position and the Horologium, or meridian line, indicating the midday in the seasons, with the obelisk. The Pantheon is close in shape as in size to the building of Hadrian, but with a wooden roof, and 10 columns in the front as in the Augustean building.

Furthermore, like Hannah and Magli (2009) wrote "Hadrian's Mausoleum (Castel S. Angelo) was located on the opposite bank of the Tiber, to the northwest of the Pantheon, and the centre of the monument is located at an azimuth of approximately 300°, with respect to the facade of the Pantheon". This angle is very close to the real azimuth of the setting Sun at the Summer Solstice in 120 a. C. in Rome, taking into account the hill of Monte Mario immediately behind the Castel S. Angelo. With this monument, also Hadrian's Mausoleum take its place in the symbolic and physical organization of the neighbouring urban spaces to the Pantheon.

[4] *This section is edited by N.Lanciano.*

REFERENCES

Bertarione S., Magli G. (2015), Augustus' Power from the Stars and the Foundation of Augusta Praetoria Salassorum. *Cambridge Archaeological Journal*, Vol. 25, pp 1-15.

Buchner, E. (1982) *Die Sonnenuhr des Augustus*. Mainz am Rhein, von Zabern

Buchner, E. (1993-94) Neues zur Sonnenuhr des Augustus. *Nürnberger Blätter zur Archäologie* 10, 77–84.

Del Monti, C., Lanciano, N. (1990) L'occhio di luce. *Il Manifesto*, 22 July, 24-27

Gibbs, S. L. (1976) *Greek and Roman Sundials*. New Haven and London: Yale University Press

Hannah, R. (2005), The Pantheon as Sundial and Observatory, ASCS XXVI Conference, Dunedin (Otago-NZ)

Hannah, R. (2009), The Pantheon as a Timekeeper, *British Sundial Society Bulletin* Vol 21(4) pp.2–5

Hannah, R., Magli, G. (2011), The role of the sun in the Pantheon's design and meaning, Numen 58, n° 4, 486-513

Yourcenar, M. (1990), *Memoirs of Hadrian*, Farrar, Translation by G. Frick, New York, Strauss and Giroux

Lanciano, N. (1988) Due numeri tra cielo e terra. *L'educazione matematica*, vol 3(1), pp. 43-59

Lanciano, N. (2005) *Hadrian's Villa between heaven and earth*, Apeiron editori, Sant'Oreste (Roma)

Lanciano, N. et al (2010) *Astronomia a Roma-Percorsi*, Sant'Oreste (Roma), Apeiron editori

Plinius *Naturalis Historiae* (N.H.)

Rodriguez Almeida, E., (1978- 1980) Il campo Marzio settentrionale: solarium e pomerium, *RPAA*, 51-52, 195-212

Stierlin, H. (1988) *L'astrologia e il potere*, Roma, Armando Editore, (Translation of *L'astrologie et le pouvoir*, Payot, Paris 1986)

Virgili, P., Carnabuci E. (2012) Mausoleo di Augusto: nuovi dati per la lettura della pianta, degli elevati e delle tecniche costruttive. *Le indagini archeologiche,* in S. Camporeale, H. Dessales, A. Pizzo (eds.) *Arqueología de la construcción III, Los procesos constructivos en el mundo romano: la economía de las obras;*,pp.181-192, Madrid-Mérida,

Virgili, P. (2009) Scavi in piazza della Rotonda e sulla fronte del Pantheon, *The Pantheon in Rome*, pp.201-215, Bern

Virgili, P., Mancini A. (2012), Regio IX, tav. 17, Mausoleum Augusti , *L'Atlante di Roma,* A. Carandini (eds), Milano

Virgili, P. (2015) Mausoleo di Augusto, in A. Carandini (ed.), *La Roma di Augusto in 100 monumenti*, pp.392-401, Roma