CONARACHNE ET PELECINUM: ABOUT SOME GRAECO-ROMAN SUNDIAL TYPES

JÉRÔME BONNIN

This article presents some of the new discoveries I have made on the extensive subject of Graeco-Roman sundials. However, since most of the subject is unpublished and original, I give here a brief account of all the reasoning. More information will be given in a forthcoming publication.[1]

In his well-known book, *De Architectura*, the first-century AD Roman architect and engineer Vitruvius gave names to many types of ancient sundial.[2] Every gnomonicist interested in ancient sundials knows this text and the long debates it created and still creates. Since this list is, with the archaeological remains, one of the rare existing sources for the historian to comprehend ancient gnomonics, the main difficulty is to understand what Vitruvius meant when he wrote *arachne, plinthium sive lacunar, pharetram, conarachne, pelecinum etc*. Indeed, whereas some elementary typologies such as *hemisphærium* or *conus* are not too difficult to grasp, some others are really obscure. To add to the problem, another author quoted, and in addition described, two types of sundial in Antiquity: Cetius Faventinus, in the third century AD, with the *hemicyclium* and the *pelecinum*.[3] The lack of agreement between Cetius Faventinus and Vitruvius has been the subject of numerous articles. Nevertheless, a consensual list seems to have been accepted by most scholars since the publication of Sharon Gibbs' book *Greek and Roman Sundials*, with 236 items.[4] This consensus linked the *conus* with the conical dial, the *hemicyclium* with the roofed spherical dial, and the *hemisphaerium* with the hemispherical dial for example. Other names were still under debate (such as *arachne, conarachne, pelecinum*).

During and after my doctorate in Roman Archaeology on the Graeco-Roman Sundials, I created a new list of typologies, starting with the texts of the two authors but also taking into account two new archaeological discoveries. The goal of this article is to present the two discoveries and a revised classification of Graeco-Roman sundials.

The *Hemicyclium* and *Pelecinum* of Cetius Faventinus

Until a few months ago, I followed the general consensus in thinking that the *hemicyclium* quoted by Vitruvius and described by Cetius Faventinus was the roofed spherical dial. The description of Cetius indeed fits perfectly well with archaeological remains, such as the dial of Carthage displayed in the Louvre (Fig. 1), or that of Tenos, in the Sanctuary of Poseidon, designed by Andronikos of Kyrrhos himself, the Greek architect and astronomer, creator of the Tower of the Winds in Athens. Therefore, no doubts were expressed about this interpretation. Similarly, no doubts were expressed about his description of the *pelecinum*, also quoted by Vitruvius. Once again, he perfectly described a real type of sundial, the vertical dihedral dial, made from two slabs of stone joined together at an angle of 90°. This typology was, until recently, known by few exemplars. The most famous is the dial from Delos (Fig. 2). It is also present in many representations made on sarcophagi. As for Cetius Faventinus and the name he gave us, all was ideal. But research does not follow ideal ways...

Fig. 1. Roofed spherical dial of Carthage displayed in the Louvre. Photo: J. Bonnin, © Musée du Louvre.

The *Conarachne* of Vitruvius...

Since many scholars concurred that Cetius Faventinus was describing the *hemicyclium* as a roofed spherical dial, it was difficult to link the *arachne* of Vitruvius with this type of dial. Therefore, most commentators have seen in the *arachne* a specific dial (either horizontal or spherical) 'with many curves' and thus, in the *conarachne,* a specific conical dial (the name is a contraction between the *conus* and the *arachne*), once again with more than three curves, in order to look like a spider's web.

However, the hypothesis of dials with many lines is not appropriate. First, there is no real difference between a spherical dial with three calendar lines and one with seven, for example. If one manages to create the first, one can easily create the second. It is the same for a conical dial. Moreover, the name *arachne* should have given those commentators something to think about. Indeed, a spherical

Fig. 2. Vertical dihedral dial of Delos stored in the Archaeological Museum of Delos. Photo: J. Bonnin, © Archeological Museum of Delos.

dial with seven calendar lines does not look like a spider's web, or only a very strange one. And the names of those two dials are very important. If the *arachne* was a specific type of dial, as Vitruvius seems to indicate, the *conarachne* should be a conical dial with the specificities of the *arachne*. So, if we look at archaeological remains, we should find some strange conical dials amongst 'common' ones.

Indeed, in Sharon Gibbs' catalogue, one dial meets the specific requirement, listed as 'Conical, Variant'. It is 3109G, from Izmir, stored in the Archaeological Museum and illustrated with a poor photograph (Fig. 3). But Gibbs did not classify this dial as a 'roofed conical dial':

"White marble – The unique shape of this dial is shown in the adjoining meridian section. The surface is conical, possibly a complete right circular cone. The vertex of the conical surface is carved out of the stone. Its position is marked by a shallow, square, depression which contains no metal. The generator of the conical surface is horizontal at the meridian. Seven preserved hour lines cross three day curves but do not extend beyond either solstice."

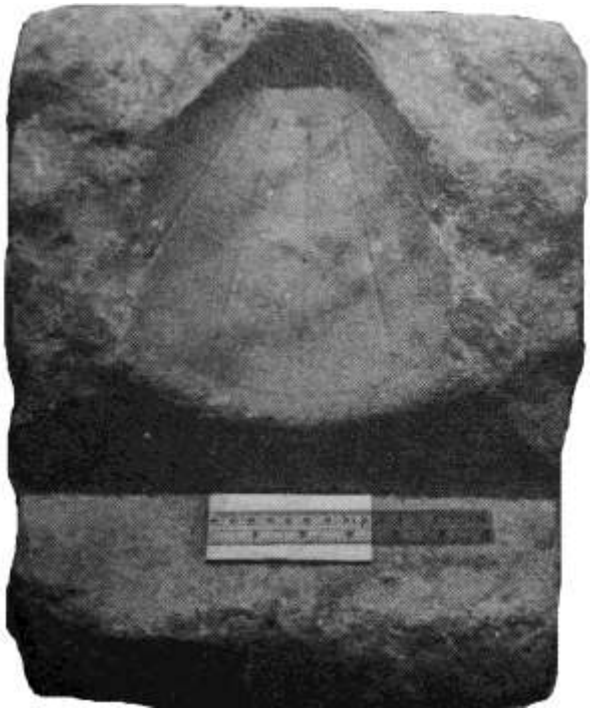


Fig. 3. Dial from Izmir. From Gibbs,[4] p. 325.

And, as a note, she adds: "All roofed spherical sundials have catalogue numbers beginning with 2."

Therefore, it was not a roofed spherical dial, just a strange conical one. Nobody cared about this dial then. Since Gibbs' photo was not good enough to see what kind of dial it was, I sent a request to the Archaeological Museum of Izmir in January 2014. The museum answered me quickly, and sent me many pictures. It was definitely a very beautiful roofed conical dial (Fig. 4). The pierced metallic sheet that admitted a beam of light into the dial is missing but evidence of it is still very obvious. But a unique proof is not

Fig. 4. Roofed conical dial from Izmir. © Archaeological Museum, Izmir.

Fig. 5. Roofed conical dial from Agrigento. From E. De Miro, G. Fiorentini, Agrigento Romana VI, pl. XVI, fig. 3.[5]

a proof in archaeology, and I decided to have a look at my own database (575 dials, against 236 for Gibbs).

Another dial stands out from the rest, a 'spherical' dial found at Agrigento in 2009 or 2010 and published in 2011 with a picture (Fig. 5). The Soprintendenza Agrigento sent me better photos and this too appeared to be a roofed conical dial, with straight hour lines, a conical vertex, and part of the metal sheet on the upper surface. Those discoveries are of importance, for they demonstrate that, in Antiquity, roofed conical dials were known and built. We have identified only two but, since you discover only what you search for, many others may exist in museum stores. Of course, those dials could have been rare in Antiquity and the example of roofed spherical dials can be quoted by way of comparison. We know of 33 roofed spherical dials, against more than 169 spherical dials. If roofed conical dials were more difficult to construct than roofed spherical dials (but this point has yet to be established), the proportion might be smaller.

... and the Reality of the *Arachne*

Let us now return to the names given by Vitruvius. Only two names can be applied to conical dials: the *conus*, and the *conarachne*. If the *conus* refers to the simple conical dial, which seems to be plausible, *conarachne* must refer to the roofed conical dial. And, as a result, the *arachne* can only be the roofed spherical dial of Vitruvius. The network of the receiving surface indeed looks like a spider's web with the spider not far from the centre.

What about the *hemicyclium* then? The Latin term comes from the Greek and signifies 'amphitheatre' or 'semicircle'. Vitruvius used it elsewhere to describe the semicircle of a theatre or basilica. And it can be applied to spherical dials without difficulty: the quarter of the sphere of the receiving surface looks like a semicircular theatre. Cetius Faventinus, in the third century AD, might have made an error and linked the name of the roofed spherical dial with the name of the spherical dial. He was far from being an expert, unlike Vitruvius, and copied many texts without always perfectly understanding them.

There is also another possibility. At the time of Cetius, when the production of sundials was declining, the names used by Vitruvius, themselves taken from Greek books, were no longer understood or even used for most of them. Cetius Faventinus would prefer more readily understood names (and also the most 'Latin' ones), without worrying about truthfulness: who would contradict him?

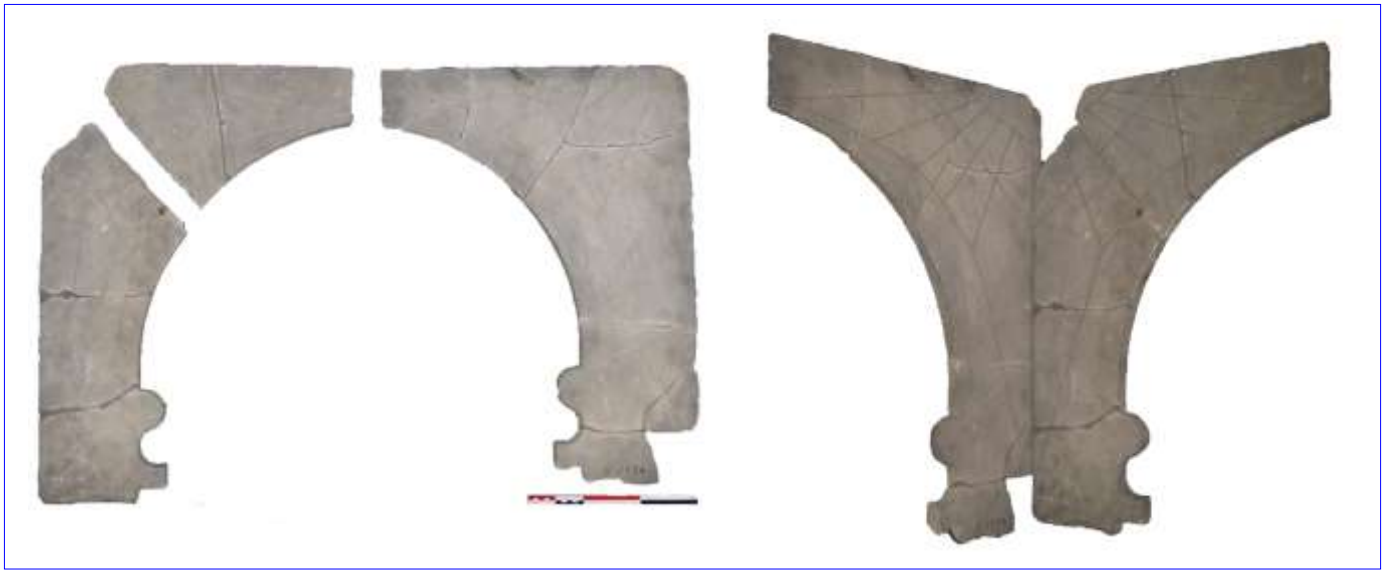
As a final consequence: if we cannot have faith in Cetius' names, is the concordance between the vertical dihedral dial and the *pelecinum* valid?

The Vertical Dihedral Dial

Once again, Vitruvius gave us only a name and the possible inventor, Patrocle, while the description that Cetius Faventinus gave of the *pelecinum* is very detailed. He describes a sundial he knew and saw in his everyday life. But what sundial was it?

Cetius explains that the instrument is made from two slabs of stone joined together with an included angle of 90°. The left part is used in the morning, the join indicates the sixth hour (midday), and the right part is used in the afternoon. The hour lines radiate from the smaller date curve to the bigger and, in summer, the shadow is the longest and reaches the lower curve. Until recently, we knew only a few vertical dihedral dials that could correspond to Cetius Faventinus' description: the one from Delos for example, or the one from Athens, stored in the British Museum, with multiple faces. Sarcophagi and intaglios were the only other places where an historian could find a representation of the sundial that Cetius described. And it was not a convincing proof since they were only iconographical representations.

Such sundials were, however, quite common in Antiquity. That is the conclusion I reached after I found and studied a dial stored in the Museo delle Terme of Rome, in the Magazzino Garibaldi. Gibbs had described this sundial (n° 5016) purely on the basis of an eighteenth-century drawing that depicted only the left part. She was not aware that it was actually stored in the Museo delle Terme. Now, I found not only one fragment, as described by Gibbs, but many more, that correspond to a single instrument (Figs 6 and 7). This exceptionally well preserved large sundial (more than 70 cm high) is very similar not only to the description of Cetius Faventinus, but also to the sundials depicted on some sarcophagi from the third century AD, such as the one displayed in Rome, in the Sala della Colombe of the Musei Capitolini (Fig. 8). A final component can now be put forward to complete this description (Fig. 9). It is the inscribed base of a sundial found in 1972 in Bulgaria at Kjustendil (Pautalia) and described by P. Vălev.[6] As often happens, the instrument



Figs 6 & 7. Fragments and reconstruction of the vertical dihedral dial from the Museo delle Terme. Photos: J. Bonnin, © Museo delle Terme.

Fig. 8. Vertical dihedral dial from a sarcophagus. Photo: J. Bonnin, © Musei Capitolini.

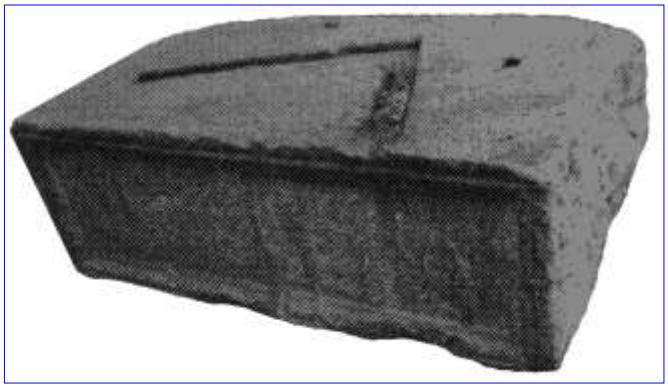


Fig. 9. Base of the sundial from Pautalia. From P. Vălev (2001). [6]

has disappeared but its properties are confirmed by the inscription engraved on the base and which declares it to be the gift of the "architects Laomedon and Glaukias, son of Straton, who set up the sundial (*horoskopion*) in honour of the town and of the sacred temple". Dating from the end of the second or the beginning of the third century AD, the base still includes, at the top, the attachment fittings for the sundial. This example is the unique witness to a long-vanished support arrangement. There is a V-notch, asymmetric with regard to the axis of the base, completed behind by two small holes with traces of lead inside them. The vertical dihedral dial was therefore embedded in the notch and had a support which is now missing, the only vestiges of which are both holes placed behind the dial. These openings can be connected to the marks in crosses present on some dials. They would indicate the place of supports connected behind the dial and set in the base.

All this information is of huge importance, since many fragments of sundials, usually described as vertical declining dials North or South, are in fact part of complete vertical dihedral dials. On some, part of the midday line at the join is still visible, such as on the one from Carthage (Gibbs 5021); on others, there is an angle of 45° at the join. This is the case on two dials from Oropos. There are in reality a least 24 vertical dihedral dials, and not just the three that were identified previously.

The *Pelecinum*: who is right?

Nevertheless, if we identify the sundial Cetius Faventinus described in the third century with the name *pelecinum*, it does not mean that this dial is the one Vitruvius called *pelecinum* in the first century. The case of the *hemicyclium* and the *arachne* prompts us indeed to remain cautious. The term *pelecinum* used by Vitruvius comes originally from the Greek pelekinoj and describes a double-bladed axe (*bipennis* in Latin). With this origin and the shape of a double-bladed axe, most scholars saw in the *pelecinum* a

Fig. 10. Horizontal dial from Delos. Photo: J. Bonnin, © Archaeological Museum of Delos.

horizontal sundial with a vertical gnomon. We have indeed many horizontal dials and they do exhibit the form of a double-bladed axe (Fig. 10). Thus it is not impossible that the *pelecinum* describes the horizontal dial for Vitruvius and the vertical dihedral dial for Cetius Faventinus. In such a case, why did Cetius use this name since the vertical dihedral dial does not look like a double-bladed axe? A first possibility is that he has been misled by the Latin *bipennis*, meaning 'which has two wings'. He insists, moreover, on these two wings: "*pelecinum enim horologium dicitur quod ex* ***duabus tabulis***". On the other hand, Vitruvius still thinks in Greek. He can thus make a reference to an instrument looking like the pelekinoj, the double axe.

Another hypothesis is possible, even if it remains less convincing. The focus on the term pelekinoj could be the origin of our own error, Graeco-Romans granting maybe less importance for the meaning of the word. A passage by Pliny about a plant is interesting in this respect:[7]

"There is a grass which kills the chickpea and the lentil, by winding all around (...). The rye grass does the same in the wheat, (...) The securidaca, a plant in the shape of hatchet which the Greeks, metaphorically, call pelecinum, does the same in the lentil."

He speaks about the *Coronilla securidaca.* Yet, no part of this plant really looks like an axe. Its leaves can evoke two wings, as those of the chickpea (Pliny also makes this link) or of numerous plants. The comparison stops there: nobody has ever questioned the use of the term by Pliny. It could thus be the same for the *pelecinum* of Vitruvius, which would have no real link with a double axe. The name could then describe without difficulty the vertical dihedral dial. In this case, the name of the horizontal dial remains unknown to Vitruvius.

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For a portrait and CV of the author, see *BSS Bulletin* 24(ii), June 2012, p. 44. He can be contacted at *jeromebonnin@laposte.net*