# THE SCAPHE SUNDIAL AT HEVER CASTLE, KENT

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This sundial continues to be enigmatical. I offer this account of my involvement with it, with some observations, and have included measurements that might be of use to BSS members and others who may thereby be able to shed more light on it. The questions still remain – is it a genuine Graeco-Roman sundial, and the only known one to show equal hours, or is it a failed attempt of a much more recent age to produce a sundial that looks like an ancient one?

## Historical Background

Hever Castle, near Edenbridge in Kent, dates back to 1270 when the massive Gatehouse, the outer walls and the moat were first constructed.[1] Two hundred years later, the Boleyn family added a comfortable Tudor dwelling-house inside the walls. Hever Castle was the childhood home of Anne Boleyn, second wife of Henry VIII and mother of Queen Elizabeth I. In 1903 William Waldorf Astor acquired the estate and invested time, money and imagination in restoring the Castle, building the 'Tudor Village' and creating the gardens and lake. He had been USA's Minister to Italy from 1882 to 1885 and while in Rome developed a life-long passion for art and sculpture.[2] He emigrated to Britain in 1892[3] and was created 1st Viscount Astor in 1917. He brought sculptures and statuary dating from Roman to Renaissance times to Hever. He was succeeded by his son, John Jacob Astor V who became 1st Baron of Hever in 1956.

*Fig. 1. Noel Ta'Bois examining the dial in the1980s.*

It is not known exactly when the several sundials[4] in the Gardens at Hever were first taken there, or where they had originated. John Jacob Astor's son Gavin, later 2nd Baron, speculated in 1969 that the scaphe dial, often referred to as the 'Roman' sundial, together with many of the other pieces in the Rose Garden were brought to Hever in 1920 or 1922 when his grandfather's villa in Sorrento was sold.[5]

In March 1969, Hon Gavin Astor read an article in *Country Life* in which it had been recorded that the polyhedral sundial[6] had been restored by Dr Frank Ward of the Science Museum, South Kensington, London. Hon Gavin wondered if Dr Ward would consider visiting Hever and giving his advice on the polyhedral dial there (No. 37). The visit was duly made, followed by several others over the following months, during which period Ward became particularly fascinated, as others were, with the scaphe dial (Fig.1). Astor arranged for a glass-fibre cast to be made of it and it was subsequently delivered to the Science Museum in January 1970.[7] Ward came to the conclusion by 1979, after he had retired, that the scaphe dial is "… a rare example of a Roman sundial (indicating) equal or 'modern' hours, whereas classical Greek and Roman sundials usually show the 'unequal' hours which were in general use during this era…. It appears therefore that Hever no. 38 is not merely unusual but unique and deserves further study, and I should be glad if I may pursue this in collaboration with my successor at the Science Museum, Dr. D. Vaughan".[8] He went on to ask: "Is it possible that this sundial dates, not from the classical period but from the 15th, 16th, or 17th century? I should be glad to know if your records shed any light on this". The answer was that there was no further information.

Ward and Vaughan went on to revisit Hever and together wrote an article in the autumn 1980 edition of the *Journal of Antiquarian Horology*.[9] They described all of the dials at Hever in some detail, and re-iterated their conclusion with regard to the scaphe dial that: "its special feature is that it shows 'equal' hours, the present-day type, whereas all other surviving Greek and Roman sundials, numbering over 250 in all, indicate the 'unequal' hours".

Ward & Vaughan had been able to refer to the then recently published book by Gibbs[10] which contains details of all the

256 stone sundials known to her which are thought to date from Greek and Roman antiquity to the fourth century AD. All show only seasonal (unequal) hours. Only about 85 of the preserved Greek and Roman dials are spherical. Bonnin reports that in his database of 563 dials, nothing else like the Hever scaphe exists.[11]

## The Dial at First Hand

My own involvement with the Hever 'Roman' dial came about because I was asked in June 2009 by Graham Aldred (BSS Restoration Advisor) if I would be interested in advising Hever Castle on what restoration work might be done on it, Hever having approached BSS earlier about possible restoration grants. Although I knew of the dial I was not intimately acquainted with it. I made arrangements through the Head Steward, Jane Apps, for a site visit on 4 July – a day when I was also doing some sundial work at nearby Penshurst Place. Hever's Chief Executive, Mr Duncan Leslie, took me to where the dial was stored in an outbuilding amongst other statuary. It had been put there in its deteriorating condition for better protection. I was told that the funerary altar on which the dial had stood, but is in no way related to the dial, was still in its original position in the Rose Garden, but was also in need of restoration.

Having carried the dial between us to a nearby grassy area, I was left to make whatever measurements and photographs I could that would enable me to write a report and make the necessary recommendations. Meanwhile I was able, by correspondence, to enlighten Jane Apps on various aspects of sundials, and in particular on the difference between equal and unequal hour divisions.

*Fig. 2. The dial taken from store in 2009.*

On first appearance, the dial has a very attractive classical appearance (Fig. 2) – the scaphe, the lions claws, the stepped support, the rosettes in the upper corners all tie in with known, authenticated dials. The weathering of the stone surface and consequent loss of detail, such as in the rosettes and lion's claws, suggest a considerable age for the dial, but without personal knowledge of the way in which

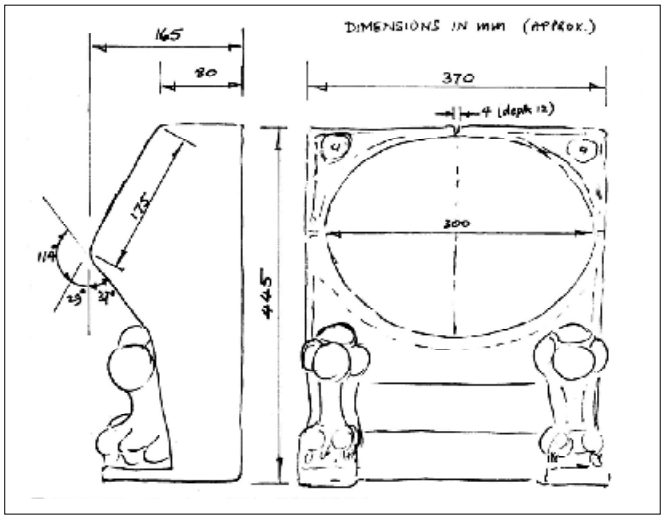



*Fig. 3. Dimensions of the dial.*

marble ages, I cannot speculate as to the age that this weathering implies. It certainly looks ancient.

The upper sloping surface is different from any other known dial, as reported later by Bonnin (see Ref. 11). The dimensions of the dial are given in Fig. 3. The radius of the dial surface is 153 mm between the cusps, but varies slightly from 160 mm at the upper point on the meridian line and 155 mm at the lowest.

I completed the report in Sept 2009 and sent copies to Graham Aldred and to Hever. Further copies were later sent, on request, to Jérôme Bonnin and Nicola Severino. My principal recommendations were:

(a) The surface should be cleaned[12] by professional restorers, amongst whom are Cliveden Conservation,[13] being particularly aware of there being what seems to be a repaired crack running from top to bottom of the dial, as well as other impact damages.

(b) Consult further with the sundial fraternity as to the supposed uniqueness of this sundial and compare it with the Science Museum glass-fibre casting to see what deterioration has taken place over the last 40 years.

(c) There would be little advantage in trying to attach a gnomon to the dial in order that it could be made to 'work' because the dial was not made for the latitude of Hever. Even if the divisions were for equal hours, as suggested by Ward and Vaughan, the dial would have to be tilted forward some 16° to compensate for the difference in latitude between Hever and its designed latitude. It would be much better to keep the dial as it is, cleaned up, and if it was thought that a working sundial would be appropriate, and also for educational purposes, have another dial made of similar design but made for Hever's latitude. I would be interested in undertaking this work.

I realised during the writing of the report that there were other measurements that I needed to take in order to obtain a full picture of the arrangement of markings on the dial surface. There is no record, as far as I have been able to establish, of the detailed measurements made by Ward and Vaughan, so I arranged a further visit on 25 September

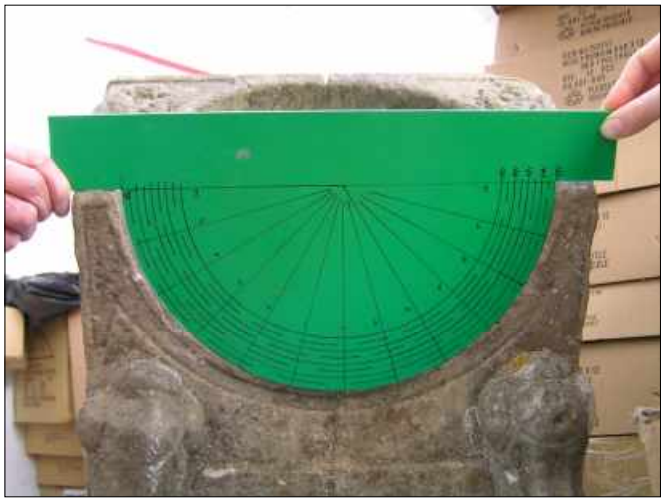
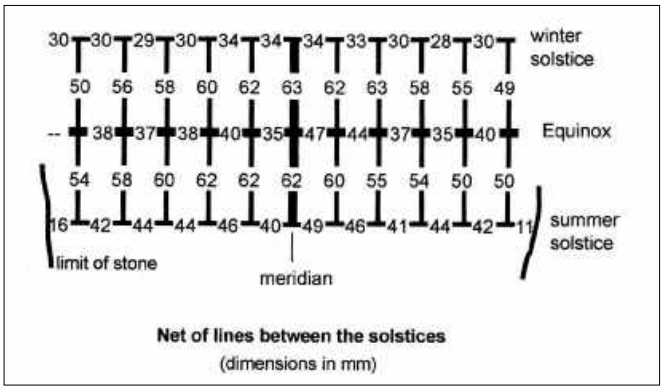


*Fig. 4. Testing the sphericity of the surface.*
*Fig. 5. Testing separation of the seasonal lines.*

2009 to do this and to test the sphericity of the dial surface. A sheet plastic semicircular gauge of diameter 30 cm has two protruding arms coincident with a diameter (Fig. 4). The arms form an axis and are rested on the east-west cusps of the dial and the gauge rotated about that axis. It was found that with some small irregularities, the dial surface is indeed close to being spherical, as noted above. A second quadrant was also used to test the positions of the seasonal curves on the meridian line (Fig. 5). This confirmed that the separations of the seasonal curves were consistent with the geometric centre of the dial. This seemed to be the likely position of the absent gnomon/nodus.

Further close inspection of the dial surface showed that there is a cross marked on the winter solstice on the fourth hour line to east and west on each side of the meridian, just visible in Figs. 2 and 11. Ward and Vaughan state that these represent the approximate times of sunrise (8am) and sunset (4pm) at the winter solstice.[14] That is true for a latitude close to 51°, but for a latitude of 37°, the times are nearer to 7am and 5pm respectively.

Separations of the seasonal curves and of the hour lines were measured and these are presented in Fig. 6. In addition, the distances of the seasonal hour curves measured down the meridian from the top of the dial rim are 170, 256



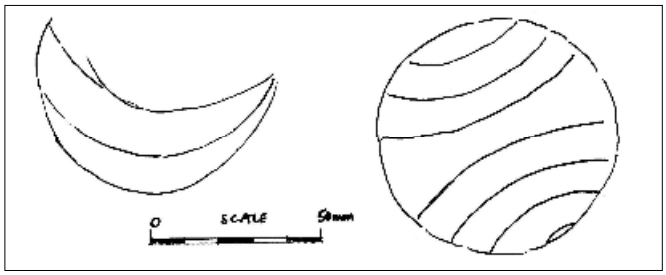




*Fig. 6. Measurements of the delineations.*
*Fig. 7. Markings on the upper surface.*

and 299 mm respectively for the points W, E and S shown later in Fig. 9.

There are two further markings on the uppermost horizontal surface of the dial, each of diameter about 7 cm, which may be nothing more than decorative (Fig. 7).

## Comments on the Delineations

The seasonal curves should be parallel. They are reasonably so near to the meridian, but definitely not at their extremities (Fig. 6).

The separation of the seasonal curves is consistent with a concave surface of these dimensions. For a radius 155 mm, the distance $s$ between equinoctial and each solsticial line is given by $s/\varepsilon = 2\pi r/360$ from which $s = \pi r\varepsilon/180$. For $r = 154$ mm, $s = 63.2$ mm compared to a measured value of 62 for SE and 63 for WE. The separation of the hour lines on the equinoctial should be $\pi r/12$, giving 40.3 mm compared to an average of 39.1 mm (range from 35 to 47).

The equinoctial curve should coincide with the 6am and 6pm hour lines in a horizontal line through the nodus. The nodus is not present and if it were, it would have to be well displaced from the geometric centre of the dial to satisfy this requirement. The 6am hour line is not well marked, and the 6pm line cannot be seen.

If the dial had been delineated for unequal hours, the hour lines for 6 am and 6pm would be horizontal. From what little can be seen of them, they are not.

The hour lines marked between the seasonal curves have been extended towards the northern rim of the dial (Figs. 2 & 11). The shadow of the time-indicating nodus (wherever it may be) would never fall outside these curves, so the hour line extensions are meaningless. However, it is postulated later that there might be some use for these lines – if they had been correctly marked.

There is no evidence for there ever having been a gnomon on the dial, although there is a slot in the uppermost surface which suggests that the maker had intended to use it for holding the gnomon.

The usual form of Graeco-Roman scaphe sundial shows the lower face of the block structure below the scaphe as being parallel to the equinoctial plane (Fig. 8). Gibbs discusses this in more detail and shows how it provides a means of determining the latitude for which an ancient dial has been made. This is how Ward and Vaughan could have determined the supposed latitude of the Hever scaphe, because the lower face is inclined at 37° to the vertical. If we apply Gibbs' reasoning, then the position of the nodus for the Hever dial cannot be at the geometric centre of the recessed surface. Ward and Vaughan place it at P (Fig. 9), but this has the consequence that the meridian distances ES and EW become unequal (EW < ES) whereas measurement on the dial shows that they are very nearly equal (Fig. 6).

If the nodus was intended to be at the geometric centre of the scaphe, in line with the majority of these ancient dials,[15] then various dilemmas arise:

(i) It would mean that the equinoctial would make an angle of 37 + 23.4 to the vertical, taking the dial to 60.4° N – a most unlikely outcome – although it would also mean that the upper sloping face of the dial would be parallel with the polar axis; a rod slotted into the groove on the top of the dial and bent down so as to give a nodus at the geometrical centre of the dial would in effect form a polar gnomon. Could the hour lines be compatible with such a gnomon?

(ii) On a correctly delineated scaphe dial, the 6am and 6pm hour points on the equinoctial and the nodus should all form a straight horizontal line. This is true whether the delineations are for equal or for unequal hours.[16] On the Hever dial, the 6am and 6pm points on the equinoctial are well displaced horizontally and vertically from the line joining the two cusps so the nodus could not have been at the centre of the dial surface.

From the end elevation of the dial (Fig. 3) the angle between the upper and lower sloping faces is 114°. Could there be some significance in this? The upper face could be at any angle, after all. Could a gnomon, bent down to be parallel with the upper sloping face to carry a nodus at its lower end also act as a polar gnomon to cast a long shadow on the dial surface, and give a reason for having the extended hour lines? To be useful, the position of the nodus would have to be such as to form a horizontal line with the 6am and 6pm points of intersection with the equinoctial curve.

It is unlikely that this is what was intended, because that would require the dial to have been made for a latitude of around 61° (Fig. 10). Furthermore, a nodus at Q would place points W and E at very different positions from those on the dial. The extended hour lines would need to be great circles of the dial surface, and look like lines of longitude on a globe. Fig. 11 shows that they do not. So a polar gnomon is ruled out.

## Conclusions

Gibbs reports that the evidence is that Greek and Roman diallists preferred conical to spherical dial surfaces,[17] always marked the twelve seasonal hours of daylight between sunrise and sunset, used the shadow of the tip of the gnomon, not its edge, and fixed the gnomon, shaped like an elongated pyramid, in a lead-filled hole on the dial face somewhere along the meridian line.

Bonnin says: "The lion's feet are of roman style, no doubt. The two rosettes are also Roman, but the base is unique, for it is a mix between what I call a 'scaled type base' and a 'lion's feet base'. This is the only dial of that sort."[18] He goes on to explain that the way in which the upper part of the dial is cut is unique and doesn't fit with a roman spherical sundial where the upper part is horizontal, not sloping. He goes on to explain that judging by the cut recess, the gnomon would have been flat, in iron or bronze, not a prismatic one, which would have been expected on a Roman dial. In addition, a sloping gnomon would be unknown for antique dials.

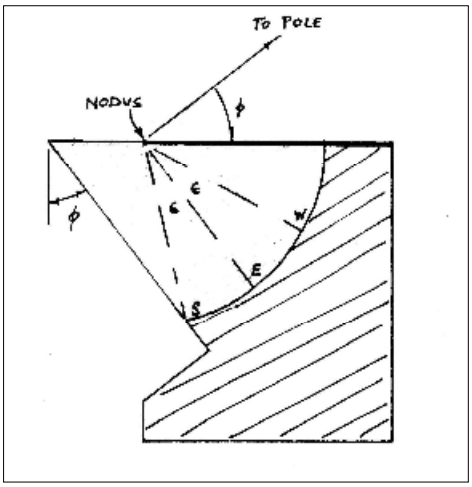



*Fig. 8. Diagrammatic analysis of scaphe dials (after Gibbs[10]).*

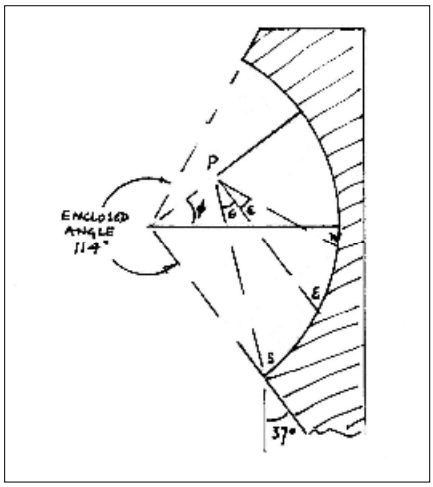



*Fig. 9. Ward's position for the nodus.*

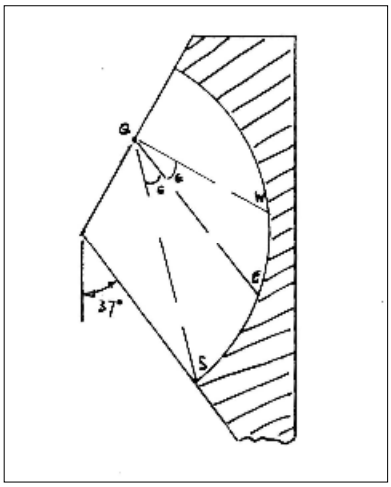



*Fig. 10. Nodus on the polar axis.*

*Fig. 11. Markings on the western side.*

Severino notices the similarity of the lion's claw feet to several shown in Gibbs and to dials he has seen in Pompeii, Ercolano and Rome.

Gibbs describes how it is possible to work out the designed latitude for a dial from the lines on it.[19] Ward and Vaughan provide a simplified version,[20] reproduced in Fig. 9. The conclusion by Ward in 1970[21] had been that the dial was designed for "a latitude of 35°, which corresponds to Tunisia. It could have been used to the north without serious error in Sicily or in the area of Alexandria to the south". Ward and Vaughan state more emphatically in 1980 that it was made for a latitude of 37°, that of Sicily.[22] Ward conjectured that the dial might date not from the classical period but from the 15th, 16th or 17th centuries. "I have never seen an illustration of a Roman sundial of this type from the late medieval or renaissance periods."[23] This is echoed by Bonnin: "if it were an 18th century creation, it maybe would not be the first time we face a 'false sundial' ". Gibbs states that "It is difficult to determine the exact date of origin for most examples of Greek and Roman dials. Few were found in their original location… Most lack datable inscriptions or ornamentation."[24] The Hever scaphe is no exception.

Sadly, I come down on the side of the Hever dial being an unworkable dial, in spite of its visual appeal. Whether it is Roman or from some much later period is still open to question. It is my intention to make a dial of this kind, with all the classical 'trimmings' to produce a dial that would work. Watch this space!

## Tailpiece

The dial and funerary urn base were restored by Cliveden Conservation and now stand back in their original place in the Rose Garden at Hever Castle (Fig. 12).


## ACKNOWLEDGEMENTS

I am grateful to many people who have been generous with their time and expertise during the course of my work on this sundial, *viz.* (*inter al.*): Jane Apps, Head Steward, Hever Castle; Tony Wood, BSS; Jérôme Bonnin, Lille; Nicola Severino, Roccasecca, Italy.


*Fig. 12. The restored dial in 2011.*

## REFERENCES & NOTES


1. I am obliged to Hever Castle's publicity flyer and web site for this concise summary. TN8 7NG. Map ref: TQ 478452 Lat: 51.18691° N; Long: 0.11351° E.
2. From Wickipedia.
3. Cambridge Biographical Encyclopedia 1998.
4. Some of these are recorded in the BSS Register as SRNs 2906 (Mult. facet head, stone), 1961 (scaphe, marble), 2178 (equatorial, metal). These are recorded in Hever's (1969) Catalogue of Statuary and Sculpture as numbers 38, 37 & 25 respectively. There are in fact other sundials at Hever – an octagonal horizontal dial (32) in the rose garden near to numbers 37 and 38, and a scratch dial on the right-hand side of the moat bridge entrance to the Castle. There are further references in the correspondence of Ref. 5 below to a further dial, possibly a cross dial, now lost. A small version of the well-known 'bow-string' dial (28), a copy of which is now outside the Adler Planetarium, Chicago, by Henry Moore used to be in the Castle courtyard, but is assumed to have been sold off in the early 1980s. There is no reference in Eden & Lloyd 'Book of Sun-dials' (Mrs Gatty) of course, whose publication pre-dates the likely arrival date of these sundials to Hever.
5. Correspondence between Hon Gavin Astor and Dr F.A.B Ward – held by The Science Museum (Nominal File 4119) and by Hever Castle Archives.
6. There are in fact two polyhedrals at Penshurst (SRNO 0669 and 0628). The originals have been removed recently for safe-keeping and replaced with identical cast stone versions of one of them.
7. I understand from Rory Cook of The Documentation Centre, Science Museum, London SW7 2DD, that the dial (Inventory number 1970-101) is now stored in the Museum's Small to Medium Object Store, Blythe House, 23 Blythe Road, West Kensington, London. Contact: *graham.wheeldon@nmsi.ac.uk*
8. See Ref. 5.
9. F.A.B. Ward & D. Vaughan: 'Sundials at Hever Castle', *J. Antiq. Horol.,* 12/3, 307-12 (1980).
10. Sharon L Gibbs: *Greek and Roman Sundials*, Yale University Press, New Haven & London (1976).

11. Jérôme Bonnin; private correspondence dated 1 Aug 2011.
12. It was related to me by Mr Leslie that Lord Astor had in the past enlisted the help of local WI ladies to clean the garden statuary from time to time with caustic soda to maintain its pristine whiteness!
13. Cliveden Conservation, by appointment sculpture conservators to the National Trust, The Tennis Courts, Cliveden Estate, Taplow, Nr. Maidenhead, Berks, SL6 0JA.
14. See Ref. 9 p.308.
15. See Ref. 10 and Nicola Severino's CD *De Monumentis Gnomonicis apud Graecos et Romanos* (2005) from *www.nicolaseverino.it*
16. P. Drinkwater: *Oronce Finé's First Book of Solar Horology*, Shipston-on-Stour, p.22 (1990).
17. See Ref. 10, p.4
18. See Ref. 11.
19. See Ref. 10, p.12 *et seq*.
20. See Ref. 9 p.309.
21. See Ref. 5, 28 Jan.
22. See Ref. 9, p.307
23. See Ref. 5, May 1979.
24. See Ref. 10 p.5.

**David Brown,** formerly a physics teacher, has been making sundials for about 20 years. He specialises in particular in multi-faceted polyhedral sundials depicting the recipient's interests and family events. Recently he has been responsible for the design and supply of a 6-metre diameter 'silver' stainless steel analemmatic sundial in the Olympic Park, London. He juggles the joys of hands-on days in the workshop with his responsibilities as Master of the Somerset Guild of Craftsmen and occasionally finds time to enjoy the company of family and friends and do a spot of gardening. He can be contacted at *david@davidbrownsundials.com*