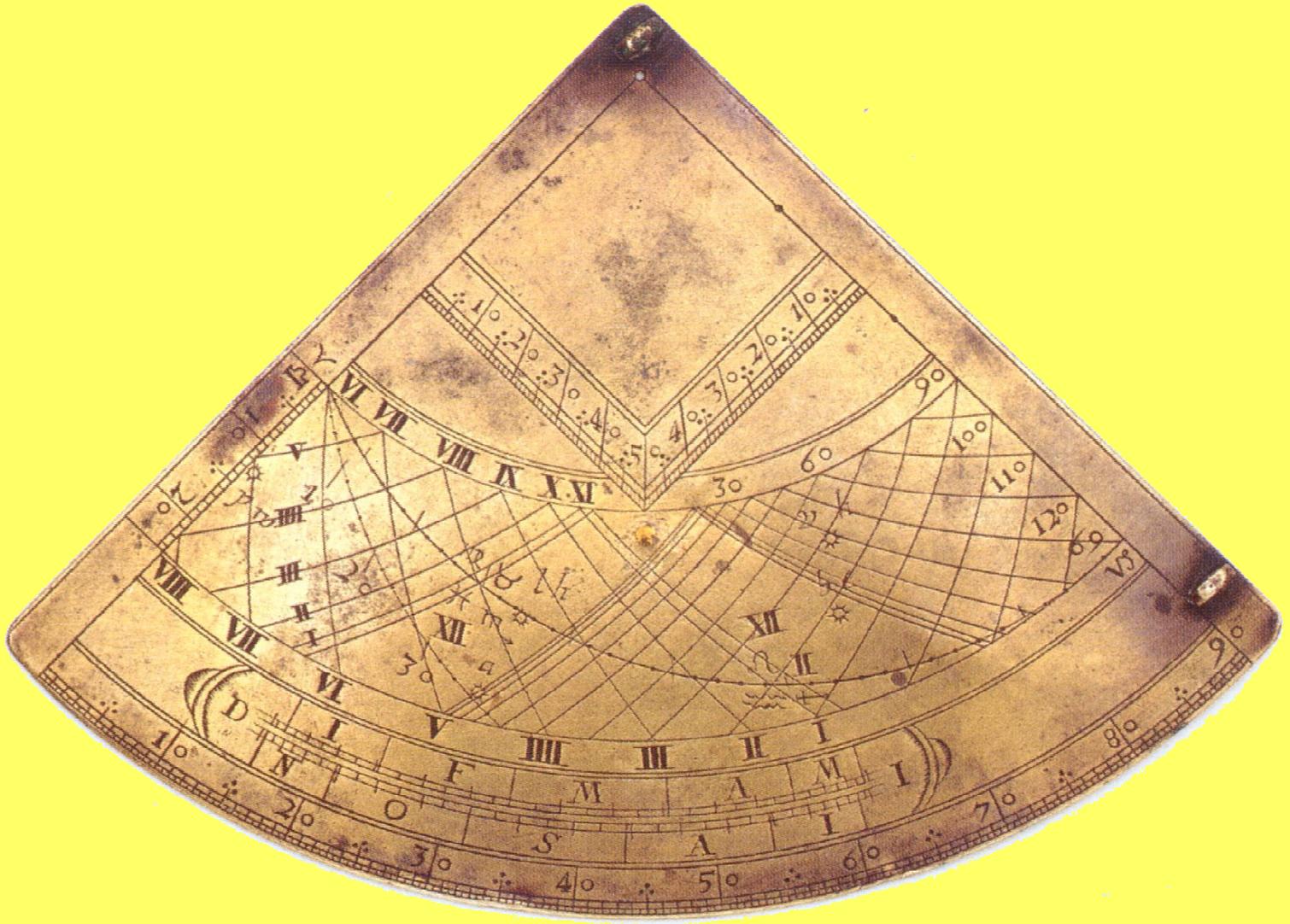


The British Sundial Society

BULLETIN



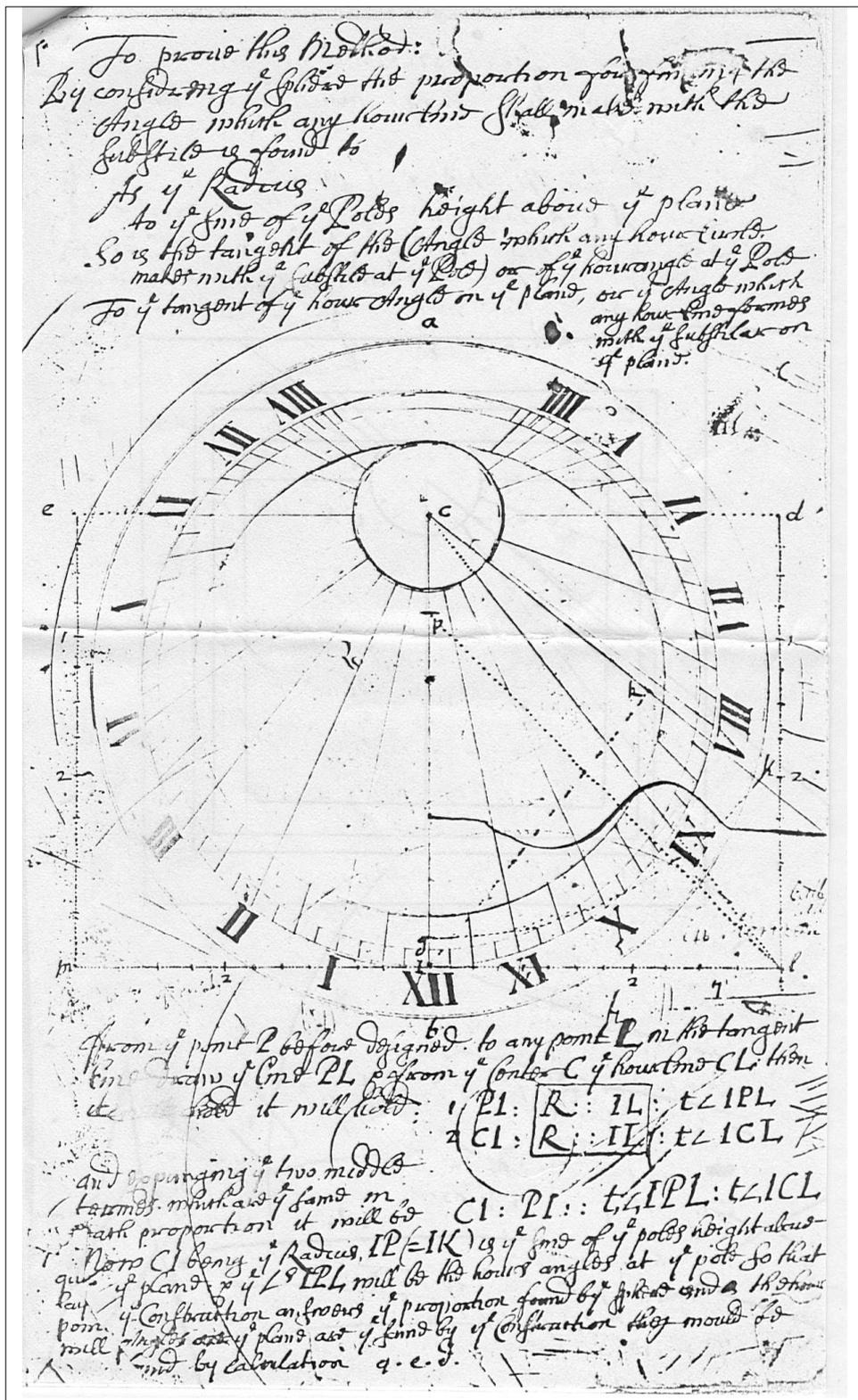
BSS Bulletin 25(i)

March 2013



VOLUME 25(i)

March 2013



This rather scruffy drawing of the construction method for a horizontal sundial might easily be dismissed as being commonplace. What makes it important is that it is from the personal notebooks of John Flamsteed, the first Astronomer Royal. Flamsteed's importance to dialling has long been recognised, not least through his accurate calculations of the Equation of Time in 1672, but his direct involvement in dialling has not been widely proclaimed. This page follows several others on dial design, all in his own hand. We wonder if the designs resulted in any real dials. Note the outward-facing hour numerals: this may be the earliest occurrence of this feature.

RGO Records Vol. 24, f.67v., supplied courtesy of Chris Daniel.

Front cover: The Gunter's quadrant sold at auction by Bonham's, Knightsbridge, in May 2012. See page 43 for more details. Photo: Bonham's.

Back cover: The unusual 'geographical' dial described by Ian Butson on page 37. Note the rather fine gnomon.

BULLETIN

OF THE BRITISH SUNDIAL SOCIETY

ISSN 0958-4315

VOLUME 25(i) - March 2013

CONTENTS

1. Editorial
2. Astronomy and Solar Symbolism in the Basilica of San Miniato al Monte in Florence – *Simone Bartolini & Marco Pierozzi*
8. A West Indies Dial by Thomas Wright – *Maciej Lose*
14. Phil Rogers—Obituary – *Christopher Daniel*
15. The Lesser-known Dials at Barrington Court – *Peter Ransom*
16. In the Footsteps of Thomas Ross. Part 4: The hidden sundials of South Queensferry – *Dennis Cowan*
18. Postcard Potpourri 25—Floral Dials – *Peter Ransom*
19. The Science Fair at Preston—June 2012 – *Graham Aldred*
20. Report on the Greek Dial From Delos Stored in The Louvre (Ma 4823) – *Jérôme Bonnin and Denis Savoie*
23. The Singleton Dial – *Tony Wood*
24. The First International Conference on Sun-dials – *Anthony Turner*
25. *Horologia et Solaria*. Instrumentation of Time in the Roman Empire: Lille 3 University, 29 March 2013 – *Jérôme Bonnin*
26. Dickensian Dials – *John Wall*
28. A Palimpsest Gnomon – *John Davis*
29. A 12th-century Manuscript Indian Circle Diagram – *John Davis*
30. The Duncraggan Stone – *Alastair Hunter*
33. Frank King wins the Sawyer Dialing Prize
34. The Dials of Middle Verdon – *Mike Cowham*
37. An Unusual Geographical Sundial – *Ian Butson*
39. An Interesting Scottish Slate Dial
40. Book Review—*De Cursu Solis* by Mario Arnaldi – *Andrew James*
41. Dial Dealings 2012 – *Mike Cowham*
44. Readers' Letters – *Orders et al, Drinkwater*
45. Thomas Boleyn's Slate Sundial – *John Davis*
46. A Short Trip to Canada for Sundials – *Valery Dmitriev*
48. A Holographic Sundial – *John Davis*

EDITORIAL

We present a selection of articles on various aspects of dialling in this first issue of 2013. Most of the authors will be well known to our readers and I am very grateful to them all for continuing to provide material on a regular basis. Looking at the topics covered, I notice that quite a high percentage of the articles describe historical dials of one form or another. This is quite natural when we consider the long history of dialling but it would be good to have some discussion of modern dials too – new dial types are still being invented (despite the ‘nothing new under the sun’ syndrome) and new versions of old types often make use of engineering techniques or materials which simply weren’t available to the mathe-

tical instrument makers of earlier times. So, how about some of the previously-silent members contributing to the journal in future issues? Let us know of new dials that you have seen or made, or even plans that you might have for a new style of dial.

So far, I have had relatively few inputs to my request for votes for the ‘Most enjoyed’ article from the four issues of 2012. Assuming that you did enjoy at least some of the articles which we printed, it surely is not too much to ask for you to reward the authors for their time and effort by telling us so. Contact me by any method you like with your votes.



ASTRONOMY AND SOLAR SYMBOLISM IN THE BASILICA OF SAN MINIATO AL MONTE IN FLORENCE

SIMONE BARTOLINI and MARCO PIEROZZI

ABSTRACT

After careful measurement and study of many particulars of the Basilica of San Miniato Al Monte in Florence, it turns out that the designers have arranged the building according to precise constructive orientation rules, conditioned by the astronomy and the solar symbolism of the early Middle Ages. As we shall see, many architectural and decorative components of the Basilica are hit by light beams, which are functional for the celebration and the glorification of the most important events of Christianity: Easter, Christmas and the Annunciation, in addition to the celebrations in honour of the Patron Saints of Florence, San Miniato and San Giovanni.

At certain occasions, such as the Solstices and the Equinoxes, the light beams also take astronomical meanings in addition to the mystical and solar ones. From this point of view, the zodiacal marble is surely the pre-eminent element which is not just a simple decorative motive but also plays the role of a Solstice sundial and also turns out to be the oldest functional monumental Solstice Quadrant in Europe!



Fig. 1. The facade of San Miniato al Monte Firenze. 13th-century, Florentine art, polychrome marbles and mosaics.

The construction of the Basilica goes back to the first decades of the year 1000: in reality, its story is far older, going back to the period of the martyrdom of San Miniato (250 AD). The diffusion of Christianity in Florence, a Roman colony, was in the 2nd century

under the Emperor Hadrian, probably through rich merchants coming from Asia Minor. Indeed, the name Miniato has a Syrian origin (Minias).

For some centuries, San Miniato was considered the Patron Saint of Florence; subsequently, the patronage of the town was given to San Miniato and San Giovanni together. As is reported in a declaration of King Berengario on 25th of April in the year 899, the Church of Florence is defined as being entitled to both the Saints, to San Giovanni and San Miniato.¹

As a proof of the veneration for San Miniato, there is a sacred building on the *Mons Florentinus* – the name of the hill on which the Basilica was raised – namely, a church built by the Bishop Zanobi around the end of the 4th century. The idea of building a great Basilica dedicated to San Miniato, in place of the little church existing on the hill in front of Florence, is due to Bishop Ildebrando who noted the situation of decay and ruin of the little church dedicated to the Patron Saint of Florence. Upon approval of the project by Benedetto III and the Emperor Enrico II, in the year 1018, on 27 April, Ildebrando released the *charta ordinationis*² which established the birthday of the Basilica of San Miniato and the subsequent beginning of the relevant works. The works necessary for the completion, the embellishment and the final touches of the main building went on during the whole subsequent century. The official date of the end of all the works is engraved on the marble pavement near to the main entrance of the Basilica: it is the year 1027. This date also indicates the end of the works relevant to the beautiful inlaid marble floor which from the main entrance extends to the base of the presbytery.

The Basilica of San Miniato al Monte is, due to the harmonic beauty which it features (Fig. 1), considered as a model and a symbol of the *Florentine Romanics*. But another feature distinguishes it from the other Florentine monuments. Indeed, solar-religious symbolisms and important astronomical meanings, correlated to architectural and decorative particulars, make it a unique monument in this respect: the existing marble Zodiac represents its pre-eminent element.

The Zodiac, which has always been the symbolic reference of cyclical time, is one of the most important Sun and sky-related symbols, indeed the whole Western World astronomy was founded on measurements referred to the zodiacal constellations.

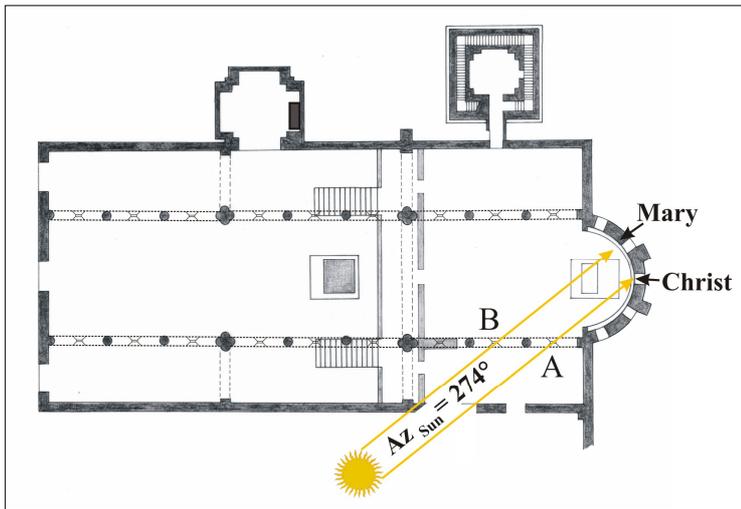


Fig. 2. Plan of the Basilica of San Miniato. Sun position and azimuth for around 15 April and at the end of August.

The recent accurate instrumental measurements have proved that the marble Zodiac on the nave pavement is not just a decorative and symbolical thing but has a specific astronomical function. Moreover, we will see that many architectural and decorative components of the Basilica are hit by light beams which function for the celebration and the glorification of the most important events of Christianity, such as:

- Easter (strictly related to the Spring Equinox);
- The Annunciation (25th of March, formerly the Spring Equinox)
- Christmas (near to the Winter Solstice), and
- the celebrations in honour of the Patron Saints of Florence, San Miniato (25 October) and San Giovanni (24 June, formerly coincident with the Summer Solstice).

The Apse Mosaic

One of the artistic works which mostly features San Miniato al Monte surely is the splendid mosaic realized in the semicircular cap of the apse, where the Christ Pantocra-



Fig. 3. The apse of the Basilica. 13th-century, Florentine art. Sunlight coming from the first window illuminates the foot of Christ on April 16 near sunset.

tor is sitting on His throne, with the Virgin Mary on His right side and San Miniato on the left.

Symbolic solar aspects are present on the mosaic, *i.e.*, particular light beams, coming from the last two windows on the right side of the nave (A and B in Fig. 2), illuminate Mary and Christ at some specific times. Because the transparent glass of the windows has been replaced, in the past years, by opaque glass which prevents the solar light from entering through beams, this event is visible only when the windows are open (Fig. 3).

In the late afternoons of some months, from about one hour before the Sunset until Sunset itself, it can be noted that the solar light illuminates the apse mosaic. In particular, in the days around the Equinoxes two light beams coming from two windows – if they are open – just hit the figures of Christ and Mary who seem to brighten by themselves: in such a way the resurrected Christ was celebrated, *i.e.*, at Easter, as the main Christian celebration.

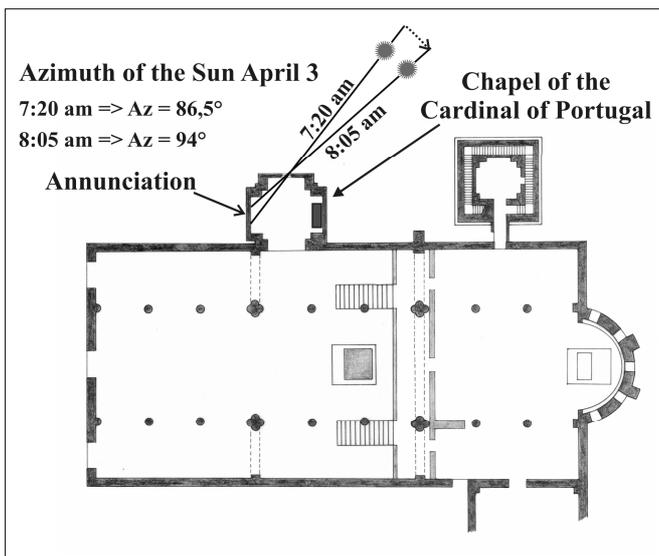


Fig. 4. Plan of the Basilica of San Miniato al Monte, the illuminating times on the Annunciation painting after the Sunrise of 3 April.



Fig. 5. The Annunciation in the Chapel of the Cardinal of Portugal. Second half of the 15th century, Alessio Baldovinetti, painting on wooden panel, a light beam illuminates the painting.

The Chapel of the Cardinal of Portugal

The chapel of the Cardinal of Portugal was built in 1460 by Alfonso V, the king of Portugal, to host the grave of the Portuguese prince Giacomo of Lusitania, cardinal of the church of Saint Eustace in Rome, who during his return journey fell ill and died in Florence in the year 1459 on 27 August. In front of the grave there is a painting showing the Annunciation. The Annunciation, another important Christian celebration, has always been celebrated on 25 March; in the classical iconography the annunciation event is represented by an angel who brings Mary the news of the incarnation of God, accompanied by a light beam, the Holy Spirit, illuminating the Virgin from the Highest. And so happens in the painting of the Annunciation, a light beam coming from the window at 7:20am (Civil time) illuminates the painting area in front of the angel; then, at 8:05am it slowly moves to illuminate the golden lily, and standing just in front of the Virgin (Figs 4 and 5), ends by reaching the northern edge of the Chapel.

Such an event is visible in the days around 3 April, which corresponds to 25 March in 1460 (the period of the painting) due to the incorrectness of the Julian calendar which, at that epoch, was in error by 9 days from the exact date. Thus the position and the elevation of the Sun of 25 March 1460 corresponds to 3 April nowadays.

The Crypt

Another important solar aspect can be noted with reference to the crypt altar, where some of the relics of San Miniato, together with the relics of other contemporary Christian martyrs, are conserved. Performing some simple measurements (and relevant computations) of the altar with reference to the central window of the crypt, the time when the

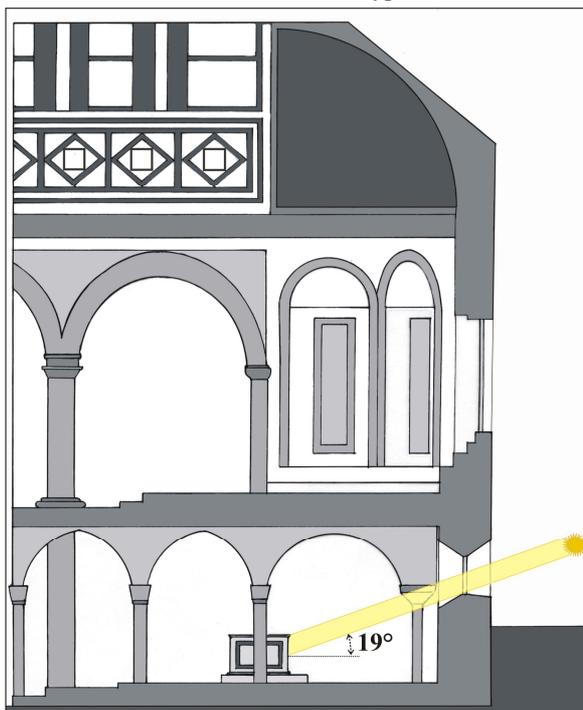


Fig. 6. Longitudinal cross-section of the apse and of the crypt of the Basilica of San Miniato al Monte. The illuminated altar in the centre.

sunlight hits the altar centre to illuminate the relics of San Miniato can be determined. This happens at 8:55, near to 1 November, when the Sun's elevation is about 19° and its azimuth is 131.5° , *i.e.*, aligned with the Basilica axis (Fig. 6). Again, due to the incorrectness of the Julian calendar, the Sun's position on 1 November (nowadays) corresponds to that of 25 October (in the 11th century, when the construction of the Basilica was initiated). The crypt windows are closed by alabaster slates and thus no light beams can be seen hitting the centre of the altar. Instead, an aura of light is visible wrapping the altar, which is made of white marble, exalting it inside the crypt, recalling the holiness of the martyrs buried here.

Thus, it can be claimed with a reasonable certainty that this particular orientation of the Basilica was realized in honour of San Miniato: his mortal remains are being illuminated by Sun beams predominantly on the day of his death and his passage to eternal holiness.

The Zodiacal Marble

Returning to the main nave, everyone is fascinated by the splendid Zodiac, inlaid in the marble, and by its symbolism and by the mystery emanating from it.

Is it just a decorative and ornamental feature or did its inventor design it to transmit a cosmic symbolism? But another question also drives one to investigate this Zodiac: was it used to carry out astronomical measurements?

Until today, no ancient document is known that, in some way, relates the Zodiac to some astronomical events, such as Equinoxes or Solstices. Instead, we know from old remembrances that the Zodiac of the Baptistery of San Giovanni was realized "for astronomy".³ Also, Leonardo Ximenes (1716-1786), meticulous with scrupulous attention to all the milestones of the astronomical culture in Tuscany,⁴ does not mention at all the Zodiac of the Basilica of San Miniato al Monte, while dwelling upon the astronomical aspects related to the Zodiac of the Baptistery. Thus it appears to be just a decorative marble, with a plenty of cosmic symbolism: the Zodiac was one of the deepest symbols used to represent the relationship between the Sky and the Earth.

The zodiacal signs are enclosed in a circle which, in turn, is inscribed in a square: in the symbolism of the Middle Ages the circle represented the Universe and the celestial vault, while the square was the symbolic representation of the Earth because of the four elements composing all matter (earth, air, water and fire) and the four cardinal points. Only recently has an hypothesis of a symbolic-astronomic kind been formulated; according to Renzo Manetti,⁵ originally a light beam would have passed through the central window of the apse cap and hit the inlaid sign of Capricorn, exactly on 21 December, the Winter Solstice.

Originally, when the Basilica was built, the aedicule (shrine) of Michelozzo (Florence, 1396-1472) at the centre of the nave and in front of the crypt staircase, did not exist.

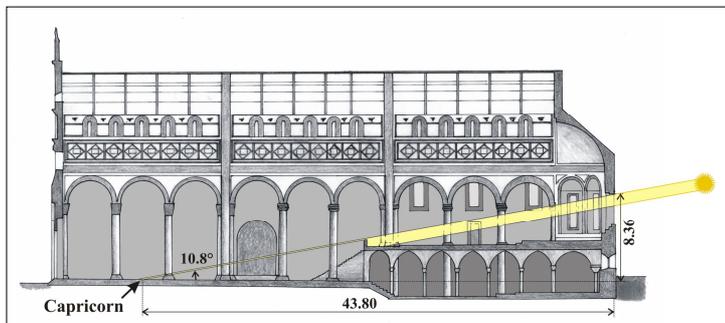


Fig. 7 (left). Longitudinal cross-section of the Basilica of San Miniato al Monte. The illumination of the sign for Capricorn in late January and the end of November.

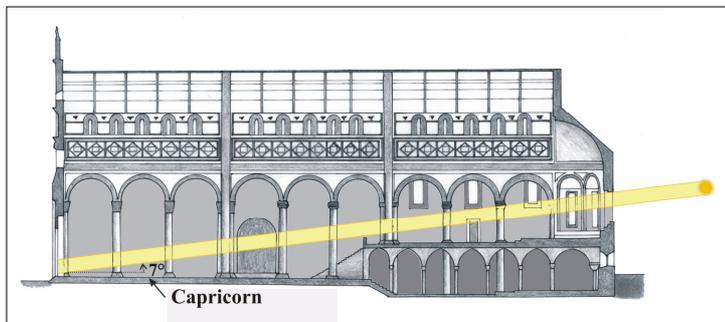


Fig. 8 (left, lower). Longitudinal cross-section of the Basilica of San Miniato al Monte. The illumination of the main entrance door of the Basilica at the winter solstice.

So, without this structure, the sunbeams could reach the sign of Capricorn in the Zodiacal marble.

From the measurements and relevant computations which have been performed, it turns out that, with the azimuth of 131.5° (the orientation of the Basilica axis), the Capricorn sign could be illuminated during a few days around 22 November and 21 January if Michelozzo's aedicule was not present (Fig. 7). Thus, it can be claimed that the marble Zodiac does not have a close astronomical connection with the Winter Solstice. Other computations show that, at the Winter Solstice, a light beam could hit the central entrance door to the nave early in the morning, when the Sun's azimuth is 131.5° and so is on the prolongation of the Basilica axis (Fig. 8).

Assuming that in the 13th century a glass slab existed closing the central window of the apse, anyone who entered the church early in the morning on the Winter Solstice would be invested by the light and, walking towards the presbytery, would meet the Capricorn sign of the Zodiacal marble.

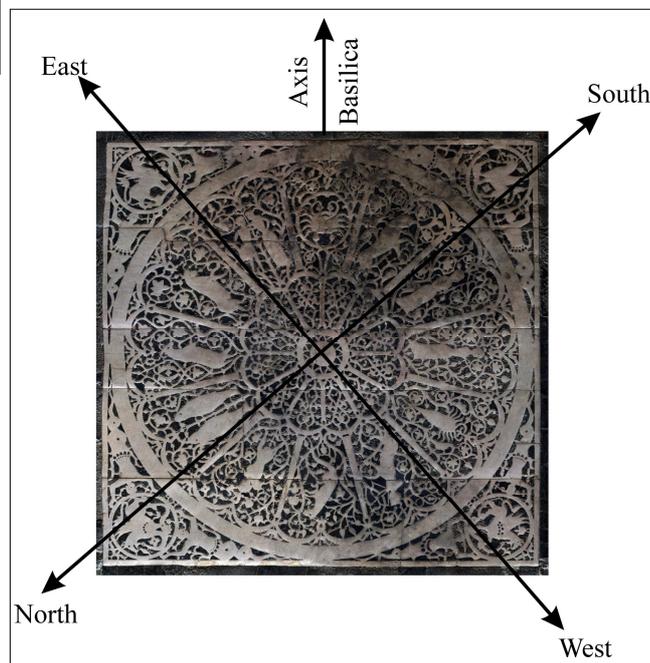


Fig. 10. Orientation of the marble Zodiac. 1207, Florentine art, inlaid polychrome marble.

Surely it was a powerful solar and cosmic symbolism and indeed the Capricorn sign is just connected to the birth of Christ, established on 25 December.

Due to the anomalous orientation of the Basilica – not in the eastern direction, as for most Roman basilicas – this Zodiac is not oriented normally (Figs 9 and 10), with the Aries sign towards the East (the East direction is actually between the Taurus and Gemini signs), *i.e.*, towards the Sun rise at the Spring Equinox. In the ancient times, the entrance of the Sun into Aries indicated the beginning of the year and the beginning of the Zodiacal cycle.

The accurate field survey carried out by the first author, and the numerous computations on the position of the Sun during the year with reference to the windows of the nave, lead to the identification of the third southern window of the nave as a possible opening for the illumination of the Cancer sign at the Summer Solstice (Fig. 11).

And exactly as it was computed, near to solar midday (precisely at 12:36 solar hour, corresponding to 13:53 Summer civil hour) of 21 June, the first sunbeam entering the church, just through that window, hits the Cancer sign producing a small illuminated disk. It is exciting to wait in the half-light of the Basilica: the brightness increases with the approach of the Sun's entrance into the nave and then, suddenly, like the switching on of a little beacon, an impalpable touch of the light brush appears to highlight the Cancer

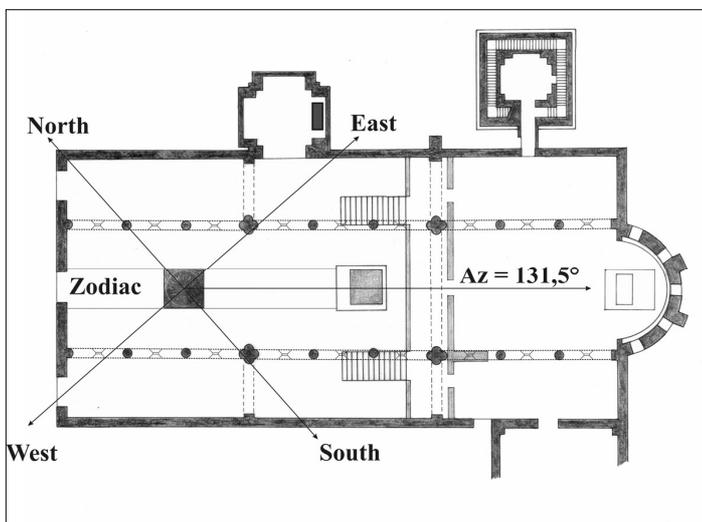


Fig. 9. Plan of the Basilica of San Miniato al Monte. Position of the Zodiac and orientation of the Basilica.

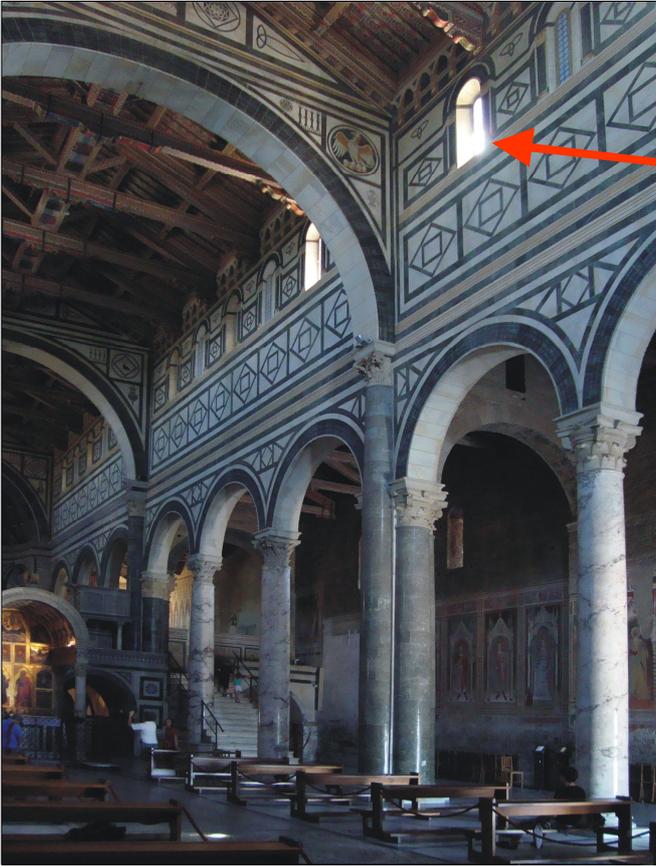


Fig. 11. South-western wall of the main nave, the third window of the nave, with the Sun entering the Basilica di San Miniato al Monte at circa 2 pm on 21 June.

sign. For some minutes the light disk, initially of few centimeters, enlarges progressively and concentrically becoming as large as the Cancer figure (Fig. 12).

The punctuality of the phenomenon and the precision of the hitting of the Cancer sign seem to leave no doubt: the Zodiac has been accurately positioned in order to accomplish the same astronomical task as its reference model does in the Baptistery of San Giovanni. Afterwards, the Sun spot enlarges like a window and slowly moves on the marble floor until finally disappearing into the nave darkness. This phenomenon repeats itself daily during a very limited period, about six days near to the Summer Solstice. Observing this event, two peculiarities can be considered:



the Sun disk hits the Cancer sign and stands exactly on the Basilica axis.

Considering this second peculiarity, we can say that the height of the windows has been precisely computed with respect to the pavement, with reference to the Sun's elevation at the midday of 21 June: only in that way can the sun's rays hit the pavement along the church axis.

Subsequently, when the layout of the marble floor was designed, it was accurately computed to position the Zodiac frame in order to make possible the coincidence of the light beam with the Cancer sign. Only adopting this kind of project it is possible to realize this astronomical instrument. With the rediscovered astronomical function of the Zodiac of San Miniato a Solstice Solar quadrant (the oldest one still working!) adds to the list of the eight ancient monumental sundials built in Florence:

- The Solstice Zodiac of the Baptistery of San Giovanni (XI Century);
- The sundial of Santa Maria del Fiore (1475);
- The sundials and the astronomical instruments of Santa Maria Novella (1572-75);
- The Uffizi sundial (1590);
- The Palazzo Pitti sundial (1694);
- The sundial of the Ximenesian Observatory (1755);
- The sundial of the Specola (1784);
- The sundial of the Certosa in Galluzzo (1863).

Moreover, it can be asserted that the Zodiacal marble also has a religious function, in fact the Cancer sign, when illuminated at the Summer Solstice, is announcing the feast of the Patron of Florence, San Giovanni, on 24 June.

In order to complete the study of the astronomical features of the Zodiacal marble, a computation of the apparent Sun position at the beginning of the 13th century has been made, when the marble floor was realized. As a matter of fact, due to the precession movement of the Earth's axis, in past times the Sun appeared at a greater elevation in the sky, namely, at midday on the Summer Solstice it was higher by about 6 arcminutes.

In order to perform the computation of the Sun elevation at midday of the Summer Solstice in the year 1207, first the obliquity of the Ecliptic relevant to that year has been determined.

The secular value of the obliquity given nowadays by modern astronomy is

$$\varepsilon = 23^{\circ} 26' 21.26'' - 46.84'' \cdot T$$



Fig. 12. The Zodiac, 1207, polychrome marble, the sign for Cancer illuminated by sunlight at the summer solstice.

where T indicates the time (in centuries) from 1900.

Using the previous formula we get for the year 1207, $T = -6.93$ from which we have

$$\varepsilon = 23^{\circ}31'45''.$$

At Summer Solstice of 1207 the Sun elevation at 12:36 was:

$$\sin(\hat{H}_{Sun}) = \sin(\Phi) \cdot \sin(\delta) + \cos(\Phi) \cdot \cos(\delta) \cdot \cos(t)$$

giving $\hat{H}_{Sun} = 68^{\circ}27'$

where:

$\Phi = 43^{\circ}45'32''$ (latitude of San Miniato)

$\delta = 23^{\circ}31'45''$ (Sun's declination at Summer Solstice in 1207)

$t = 9^{\circ}02'$ (Sun's hour angle, corresponding to 12^h36^m)

In this computation the influence of atmospheric refraction has been neglected because its contribution is negligible as far as the Sun elevation variation is concerned.

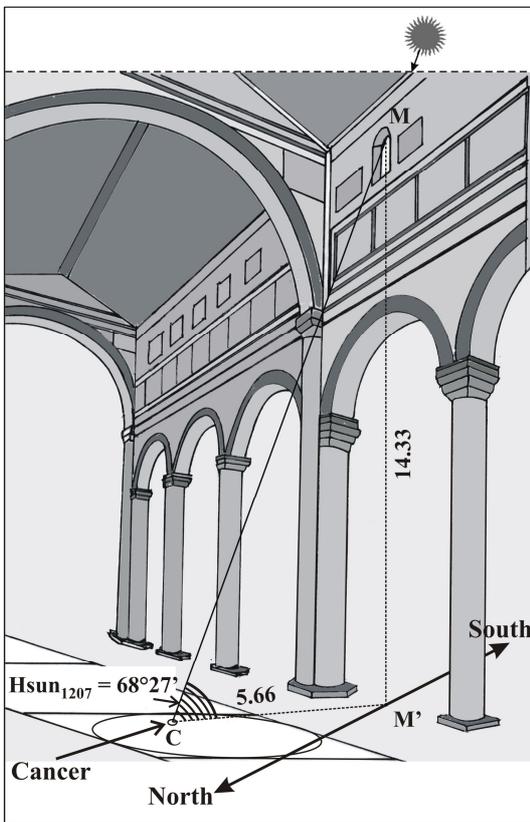


Fig. 13. The Sun's elevation at the 1207 Solstice. The position of the light beam on the pavement.

With this angular value and a window height h equal to 14.33 m (Fig. 13), we compute the distance $M'C$ from the foot of the window:

$$M'C = \frac{h}{\tan(H_{Sun})} = 5.66 \text{ m}$$

Therefore, in 1207 the light disk would be at a distance of 5.66 m from the foot of the window. The distance between the centre of the Cancer sign and the window foot is 5.68 m, hence the light disk in 1207 would be displaced of about

2 cm towards the window, a displacement hardly perceptible by eye.

Such a situation does not invalidate the Solstice astronomical measurements – not so extremely precise by themselves – the precision of the position of the illuminated area cannot be so high indeed, because a window is used as a 'gnomonic hole'. In any case, it was an acceptable precision if one considers the purpose of the Zodiacal marble, *i.e.*, to indicate the beginning of Summer and the subsequent arrival of the feast of San Giovanni, who was at that time the Patron of Florence together with San Miniato.

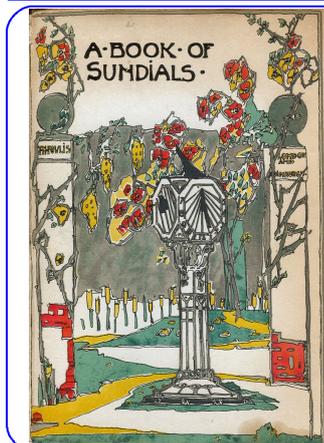
REFERENCES

1. R. Manetti: *Le Porte Celesti. Segreti dell'Architettura Sacra*, Firenze, Polistampa, p.7 (1999).
2. F. Pratesi: *La splendida basilica di San Miniato a Firenze*, Firenze, Octavo, p.335 (1995).
3. G. Villani: *Croniche di Giovanni, Matteo e Filippo Villani*, note di G. Aquilecchia, Torino, Einaudi 1979, I, LX
4. L. Ximenes: *Del vecchio e nuovo gnomone fiorentino...*, Firenze, Stamperia Imperiale (1757).
5. R. Manetti: *La lingua degli angeli*, Firenze, Polistampa, p.71 (2009).

Simone Bartolini has, in the last decade, designed and realized several artistic gnomonic works, including the gnomonic area in the public park of the Nan Lian Garden Buddhist Monastery in Hong Kong (being the winner at the tenth edition of the international competition 'Shadow of Time'). He collaborates with the Galileo Museum team in Florence on the reproduction of ancient scientific instruments.

He can be contacted at simo.bartolini@tiscali.it.

Marco Pierozzi was formerly a geographical engineer at the Italian Military Geographic Institute in Florence. Since 2008 he has been an Associate Professor of Geodesy at the Italian Navy Hydrographic Institute in Genova. Among his current interests are the figure of the Earth from a physico-mathematical viewpoint and geodetic astronomy. He can be contacted at pierozzi@teletu.it.



The front cover of *The Book of Old Sundials and Their Mottoes*, with paintings by Alfred Rawlings and drawings by Warrington Hogg. First published in 1914, it shares illustrations with some other sundial books of the time. There is no credited author though the section on old sundials is by Launcelot Cross. Note the use of 'sundials'; Mrs Gatty, two decades earlier, had 'sun-dials'.

A WEST INDIES DIAL BY THOMAS WRIGHT

MACIEJ LOSE

Recent editions of the *Bulletin* have brought to light examples of London-made, 18th- and 19th-century West Indies horizontal sundials.¹⁻³ These rare dials, made for distant colonies of the British Empire, together with other dials made for Turkish, Russian or other markets, exotic at that time, are evidence of the flourishing period of the craft of sundial making in London.



Fig. 1. West Indies sundial by Thomas Wright London, before cleaning and restoration.

Interestingly, some of those dials were recorded on the old continent and most likely had never made their way across the Atlantic Ocean.¹ The same can be said of a horizontal sundial recently acquired by the author on French eBay (Fig. 1). The seller stated that it was found in the ruins of an old *château*, destroyed during the Second World War and never restored. Considering the poor state of the dial – its deformed plate, bent and loose gnomon in addition to a heavily corroded surface – this could well be the truth.

Since in French latitudes the sundial could only indicate correct solar time at noon and, for half the year, at 6am and 6pm, it would have functioned merely as a garden feature or a collector's curiosity – similar to the two Gloucestershire West Indies dials described by Tony Wood and Jill Wilson in the March 2010 *Bulletin*.¹

Description of the Sundial

The dial (Figs 1 & 2) is a thin (varying between 1.4 and 2.3 mm) brass square measuring 30.1 × 30.1 cm (a nominal 12 inches). The surface is heavily weathered with the erosion quite uneven; its northern half is preserved in much

better condition. Before restoration, the dial plate was severely bent, with deformation up to around 10mm out of the reference plane. There are also few fractures along its perimeter and in the gnomon mounting area. A small trapezoidal part of the dial, between numerals I and XII, has been inexplicably cut out (Fig. 2).

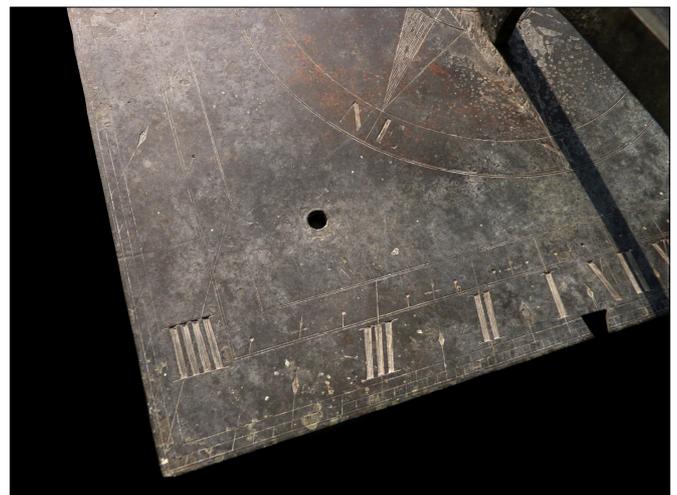


Fig. 2. Detail of the finely preserved NE corner of the dial. Notice the diamond-shaped time markers for half hour intervals in the outer time ring and two different marker types used in the inner ring. Photographed before cleaning and restoration.

The dial is simply but elegantly engraved with the sequence of Roman hour numerals from VI to VI, oriented to be read from the north side of the dial.

The external time chapter ring is divided into 5-minute intervals, with each half-hour marked with a diamond shape. The internal time ring is divided into quarter- and half-hours, the former terminated with a dot and the latter with three inward-oriented arrows.

The central part of the dial is decorated with an eight point floral compass rose engraved with initials of corresponding directions.

The instrument maker's signature, *Tho. Wright LONDON* (Fig. 3), is located along the southern edge, and the tip of the gnomon is marked with two holes at the origins of the delineation.

The solid gnomon with a curved northern edge follows typical mid-18th century pattern. Before restoration, its 'tail' was also bent downward by a few degrees. It was originally attached to the dial by hammering-over the two short



Fig. 3. View of the maker's signature (top) and of the hammered gnomon tenons (bottom). The apparent gap between two origin holes and the gnomon tip results from the deformation of the dial plate. Photographed before cleaning and restoration.

tenons on the gnomon onto the back of the dial. When the dial arrived, the gnomon was in place but wobbled terribly – it is fortunate it had not been lost during the dial's recent history.

Pattern for the Low Latitude Horizontal Sundial

The overall design – rectangular shape, simplicity limited to essentials, gnomon setting and the orientation of Roman numerals – are all reminiscent of a simple vertical dial. Actually, if not for the clockwise sequence of the hours, one could mistake it for an 18th century vertical south dial, taken off a church wall or an old public building from a northern latitude.

After a study of the common features, it does not seem unlikely that a vertical dial could have been used to form a pattern for this and probably other early West Indies horizontal dials.¹ Typical south facing vertical dials are topped with the 6–6 hour line; the gnomon starts at the centreline; and, in British latitudes where the gnomons of vertical dials are angled between 40° and 32° to the vertical, the tilt is small enough to notice similarity to angles of gnomons of tropical horizontal dials.

The similarity of the numeral placement for northern latitude vertical dials and for horizontal dials for tropical latitudes results from the fact that 6am and 6pm are the earliest/latest full hours for the sunrise/sunset at tropical latitudes, making them the best choice to start the time delineation on the horizontal dial (Fig. 4).

One could speculate that the pattern for first batch of London-made horizontal dials intended for tropical regions had probably originated on the wall of one of the townhouses of London. Later horizontal dials for tropical locations have hour numerals aligned with the hourlines and arranged to be read from the outside – a pattern adapted from contemporary horizontal dials and resulting in dramatically elongated and skewed morning and evening hour numerals.^{2,3}

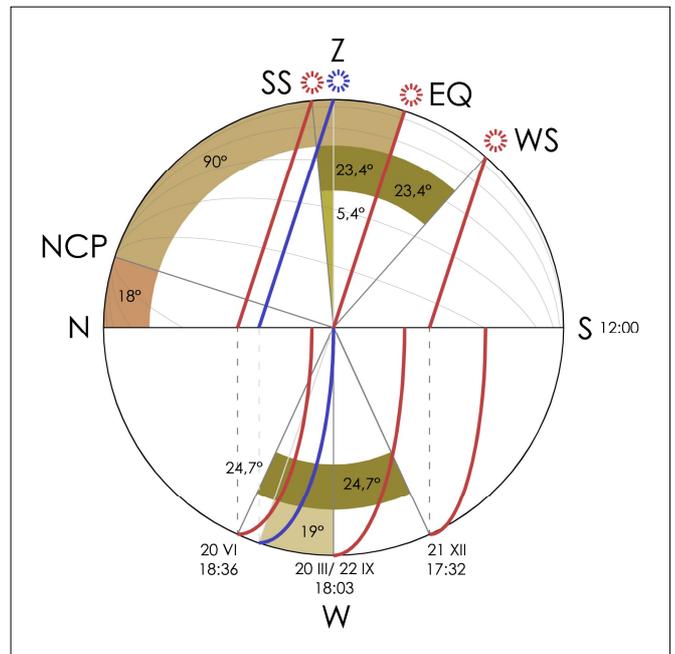


Fig. 4. Side and top projection of the celestial sphere and Sun paths at the equinoxes (EQ) and the summer and winter solstices (SS, WS), drawn for the 18°N latitude of the West Indies dial. An interesting fact about the Sun's apparent movement across the tropical skies is that it is highest in the sky (at the zenith – Z, blue line), not at the solstice as most northern latitude inhabitants are used to. The rising and setting Sun at latitude 18°, alternates to both sides of E-W line maximum ca. 24.7°, which corresponds in time scale to ca. 31 minutes at the winter solstice and ca. 33 minutes at the summer solstice. The apparent instants of the sunset on the drawing are given in relation to the local solar noon. 3 minutes are added to these times as a result of atmospheric refraction, while the remaining 2 minute difference of times between extreme and equinox sunsets is partly a coupled effect of refraction and the different rate of change of the solar angular height at opposite solstices. The summer sun, when just below the astronomical horizon, but apparently on the skyline due to refraction, moves less steeply than in the winter and apparently sets or rises a little further north than could be expected from the refraction itself. This combined effect grows with latitude – besides refraction not appearing on the equator at all, contributing to a difference of ca. 11 minutes at 45°N, 22 minutes at 60°N and some 2-days at the poles. Times were calculated using the NOAA Sunrise/Sunset calculator.

Planned Location

The average from the measurements of the hour and half-hour angles of the dial correspond to a latitude of around 18°, while the gnomon angle gives a result of around 18.3°. John Davis, in his more accurate 'reverse analysis' of the dial plate with the gnomon removed, confirmed that for the optimum latitude of 17.8°, the hour and half-hour angles have the smallest standard deviation error (Fig. 5).

Angles for the gnomon and dial match quite well, given its deformation and measurement errors, and indicate with a good likelihood that Jamaica in the West Indies is the planned location of the dial. Jamaica was an important

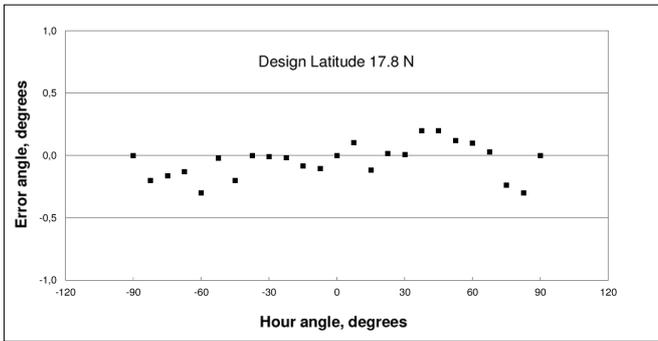


Fig. 5 Error analysis (by John Davis) of the dial's hour lines using a theoretical latitude. A value of 17.8° gives the smallest errors for delineated hour and half-hour angles on the dial, making this the most probable design latitude for the dial.

English colony in the 18th and 19th centuries, being one of the largest sugar production centres with strong trade links with London. The latitude of Jamaica ranges from 17°54' N to 18°24' N, with Kingston, its most populated town since the 1720s, at exactly 18° N.

An alternative location of the dial comes from a clue given by the French eBay seller. The dial could well have been an order from a French nobleman who had a sugarcane plantation in neighboring Haiti, at that time the French colony of Saint-Domingue, which is located at the same latitude. Today, we find many English 18th-century horizontal dials in different parts of continental Europe, so this speculation has some support in 18th-century trade routes.

The Question of Time and a Maker

The first glimpse of the dial (Fig. 1) suggests that it was made around mid-18th century, but the use of thin brass and the unpretentious aesthetics of the design, coupled with the signature of *Tho. Wright LONDON*, brings some doubt about dating and the maker.

The apparently obvious attribution of the dial is to one of the most prominent of 18th-century sundial makers, Thomas Wright (c.1695–1767, Fig. 7), who bore the title *Mathe-*

matical Instrument Maker to George II, having served from 1718 to the Prince of Wales and from 1727 to the King (MIM to Geo. II) until his retirement in 1747.⁴ Thomas Wright is known as a maker of a multitude of sophisticated scientific instruments, including portable and fixed sundials. His classical horizontal dials were comprehensively discussed by John Davis in the December 2004 Bulletin,⁴ and an example of such a fine dial from the collection of the British Museum is reproduced in Fig. 6.

Apart from the short-form signature,⁵ which follows the engraving style seen on other Wright instruments, the West Indies dial has a number of features worth closer examination:



Fig. 6. Thomas Wright's horizontal sundial, dated 1726, from the collection of the British Museum. The dial includes the set of features often used by Wright on his other dials: right-angled gnomon, complex signature, abundant furniture (EoT, transversal time scale, geographic places), small truncated pyramids as gnomon side supporters and rich decoration including oak leaf borders between chapter rings. Photo courtesy of the Trustees of the British Museum.



Fig. 7. Two portraits of noticeably different Thomas Wrights, both commonly regarded as being depictions of Thomas Wright of Durham.⁹ The left one, a mezzotint by Thomas Frye dated 1737, represents mature man that is unlikely to be Wright of Durham, then only 26 years old. The image may actually represent Thomas Wright, Instrument Maker to George II,⁹ then in his mid 40s.

The right portrait was engraved in the 1740s by Paul Fourdrinier and the inscription definitively states that it depicts Thomas Wright of Durham.

- the engraving of numerals, cardinal points and time markers is of high quality, typical of the most skilled London makers. The better-preserved northern part of the dial shows that the engraver used a burin with proficiency (Fig. 2); the compass rose seems to be executed with slightly less quality, but this is the area where corrosion most visibly affects the engraved pattern,
- time markers include a diamond-shaped symbol that became very popular from the mid-18th century, but it was used earlier and quite frequently by Wright on his instruments,⁶
- the style (serifs) of the labels of the cardinal points match those on other Wright dials,
- the gnomon shape became standard in mid and late 18th century, but was used earlier by Wright interchangeably with another, right-angled shaped, design,⁷
- the gnomon mounting method – short tenons hammered from underneath the dial – is similar to the one used occasionally by Wright’s master John Rowley⁸ but is unusual for known Thomas Wright dials. Wright mostly used hand-made bronze screws to secure the gnomon from the bottom and additionally stabilized it with small pyramidal supporters on both sides,
- there are no oak leaf borders separating the various rings of the dial (Fig. 6) – unusual for Wright, but again also found on Wright’s master’s dials.

Intriguingly, the dial’s economical use of thin brass, simplicity of the rectangular shape, large unengraved areas and the gnomon mounting method are all early features that co-exist with progressive ones (diamond markers and gnomon shape). This forms a set that certainly is not in line with Wright’s known classical, mature sundials – copious furniture and decoration (Fig. 6) which so visibly corresponds to his position as the royal instrument maker. This all brought me to the conclusion that the sundial could have been made during his early period – possibly around 1720.

Thomas Wright of Durham

I shared my thoughts on the dial with John Davis, who was very surprised to see such an unusual dial with Wright’s signature. John, having knowledge of the BSS *Register* and Wright’s horizontal dials in museum collections, was somewhat skeptical in relation to his authorship, pointing out that such an economic character of the dial does not match other confirmed dials by this maker. He advised further research suggesting that the dial possibly could have been made by another Tho Wright; Thomas Wright of Durham.

Thomas Wright of Durham (1711–1786, Fig. 7)^{9,10} was a philosopher, amateur astronomer, architect and teacher. He is mostly known for his correct understanding of the Milky Way as a celestial projection of our own galaxy observed from within, as well as for explaining the faint nebulae observed through telescopes as distant galaxies similar to ours. His theories were published in *An original theory or new hypothesis of the Universe* (1750), which was read by

Immanuel Kant in 1751 and stimulated him and to some extent influenced his cosmological theory.¹⁰

Thomas Wright of Durham was, in his early years, for some time apprenticed to a local clockmaker but fled from this service, regarding it as slavery. When he was 19 he moved to London, where for a year he worked as a journeyman for Thomas Heath and Jonathan Sisson^{9,10} – both renowned instrument makers, known for many beautiful sundials. Interestingly, in this period he planned, as a result of an unhappy love affair, to move to Barbados (lat. 13° 10') in the West Indies!¹⁰ After this short London episode he returned to Sunderland, his homeland, where he resumed teaching and writing. The success of his first publication resulted in his obtaining patronage which put his career on a new track.

Thomas Wright of Durham was known to be talented in mechanics and it is recorded that he had constructed an orrery¹⁰ for Earl of Pembroke at Wilton, which must have followed the originals—made by Thomas Wright (MIM to Geo. II) and George Graham—possibly seen during his London episode.

With his service to a clockmaker and work for sundial makers Sisson and Heath, he must have achieved a level of experience that made him capable of executing of a fine sundial. Unfortunately, though, there are no other recorded instruments by him allowing for cross comparisons. It is also unlikely that during his service he was allowed by his masters to sign instruments with his own name. This left the attribution of the West Indies dial to Thomas Wright of Durham possible, but uncertain.

The Missing Link

It was obvious that further research was required to establish the actual maker. Research continued and I found, not



Fig. 8. Bonhams’ sundial by Thomas Wright (MIM to Geo.II), dated 1722. The dial includes Wright’s mature workshop features (angled gnomon, complex signature) as well as early or unusual ones (ascetic form, gnomon brackets and three lugs to the dial). The time markers follow the pattern present on the West Indies dial. Photo: Bonhams, London.

previously discussed in the literature, a sundial (Fig. 8) by Thomas Wright (MIM to Geo. II), which looked to be the link between the West Indies dial and his later, mature works. The dial was offered at Bonhams auction house in 2004 and the catalogue description of the dial stated: “*Thos Wright, Instrument maker to his Royal Highness; an 18th century brass sundial with angular gnomon, the dial engraved with Roman numerals and Arabic minutes, also inscribed for latitude 50 40' and dated 1722, diameter 25.5cm*”.¹¹

The Bonhams dial is an intriguing mix of early 18th-century features and elements typical of Wright’s later, mature workshop. Features typical for his later workshop include: circular shape, standard right-angled ‘Wright’s signature’ gnomon and ornamental signature. The early features include: the method of gnomon mounting with side brackets in the style of the late 17th century,¹² the ascetic composition of the dial unusual for later works, no compass rose at all, simple scrolls at the ends of the chapter ring and no additional decoration. Unusual features are three circular lugs to the dial used for its leveling or mounting to the plinth and a small disc at the base of the gnomon.¹³

Another key feature of this dial, linking it with the West Indies dial, are the time markers used: diamond-shaped for half-hour intervals in the main time ring and ‘inward oriented arrows’ for the inner time ring – which exactly follows the pattern used on the West Indies dial.

Thus the Bonhams dial does seem to be a link between Wright’s mature and early works, and shows that he was at

a stage of developing his workshop around 1720, making much different, simpler and less sophisticated dials than in his later period.

Thomas Wright was freed from his apprenticeship to John Rowley in 1715¹⁴ and he obtained the patronage of the Prince of Wales in 1718, being only 23 years old. It seems natural that the young maker had occasionally to accept less attractive commissions than his more experienced and prized comrades of the London guilds.

Coming back to the West Indies dial: its main features – time markers and ascetic composition – correspond with the Bonhams dial, however its thin brass plate and the lack of maker’s title suggest it could have been made by Thomas Wright possibly even before 1718.

Examination of many popular, simple and unsigned English dials of the period shows that some of them have intriguing aesthetic similarities to the style of the fine and signed instruments of selected makers.

It is plausible that, in a manner similar to 16th and 17th century Nuremberg,¹⁵ budget and fine sundials were crafted together in some workshops of the known London makers until at least early 18th century. The West Indies dial can just be regarded as such an example of Wright’s early work and a transient design, focused only on meeting the primary need of time telling.¹⁶

Restoration

When received, the dial’s surface was a little dirty, encouraging its cleaning with agents dedicated for antique brass. This turned out to be an unwise decision, as cleaning removed the light coloured sediment from the engraving, which significantly lowered its contrast against dial plate and affected legibility of the engraving. Furthermore, some of the dark patina was removed from the surface and exposed a patchy corrosion pattern of the underlying metal, with an intriguing reddish colour in some areas (Fig. 9). Fortunately, my cleaning obsession didn’t advance too far, saving the dial from over-cleaning. Let my case be a warning for other sundial owners wishing to clean their dials – they might really look worse after this operation!

After this initial failure, I asked John Davis for his assistance in restoration and we agreed a restoration programme which included:

- detaching, then flattening and straightening dial plate and gnomon,
- enhancing the contrast of the engraving,
- re-attaching of the gnomon,
- applying surface protection

He reports as follows:

“The wobbling gnomon was removed by cutting off the peened-over edges of the tenons with a 1" diameter cut-off disc in a high-speed Dremel, taking care not to scar the underside of the dial plate unnecessarily.

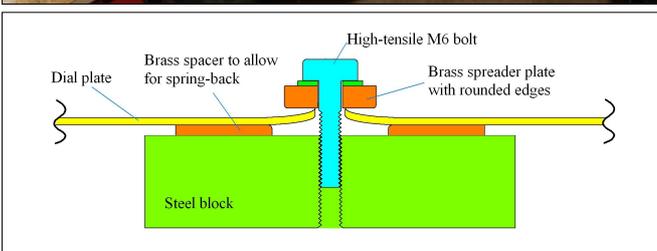


Fig 9. Workshop photograph of the dial plate undergoing restoration. The detached gnomon with its short tenons is seen in the top left corner and one point of the compass rose shows an experimental application of white wax. The schematic shows the principles of flattening the edges of the tenon slots.

J. Davis



Fig 10. The restored sundial.

Two methods of reattaching of the gnomon were considered – the original one of hammering the tenons, and a more robust solution of drilling and tapping holes into the ends of the tenons and then fitting a small brass plate with milled pockets for the tenons, across the underside of the dial. We decided that the latter would be more appropriate, guaranteeing better stability of the gnomon and protecting the cracked thin brass of the dial plate in the gnomon area from further damage. The small brass plate was signed and dated to identify it as a later addition. It was originally planned to complement the restoration of the sundial with putting a coat of protective micro-crystalline wax but in the end we abandoned this idea, worrying that the solvent would remove the white wax so patiently applied.”

With the gnomon removed, it could be seen that the edges of the tenon slots in the dial plate had been bent upwards when someone had attempted to yank the gnomon off. Lacking an hydraulic press with a deep enough throat to reach the centre of the dial and not wanting to hammer it, a different approach to flattening the area was employed. This involved exerting downward pressure, though a series of carefully-placed brass spreader plates, with a high tensile M6 bolt passing through the tenon slot into a tapped hole in a large steel plate behind the dial (see Fig. 9). A similar process was used to flatten the areas around the countersunk holes for the pedestal screws, this time using a number of penny washers to direct the pressure appropriately.

The dial plate was badly out of flatness in several directions and the corners were also distorted. Being relatively thin, this could be cured by manual pressure using vices of various sizes (with soft jaws) and across the edge of a bench, using a straight-edge to check progress at every step.

The gnomon was also straightened using the judicious application of brute force: the brass was sufficiently soft not to require annealing, which would have destroyed the patina.

Two experimental methods of enhancing the contrast of the engraving were considered – a white enamel paint infill or an application of white wax. The benefit of the latter method is its reversibility – it can be easily washed away with a solvent if required. Trials on small portions of the dial with white wax (see Fig. 9) proved this option promising and so it was applied.

The normal application technique is to spread the fill material liberally over the surface and then remove all of it except in the engraved lines. However, the rough surface of the patina made this impractical. Thus, shavings of white Liberon™ wax were dissolved in a solvent (lighter fluid) and painted into the engraved lines with as little overspill as possible. After the solvent had evaporated, the excess wax was polished off with a cloth just barely moistened with solvent.

With the restoration completed (Fig. 10), some further details of the history of English dialling craft have been added by this unusual brass timekeeper by Thomas Wright. Hopefully that will preserve it for at least another three centuries.

ACKNOWLEDGEMENTS

I would like to thank John Davis for his support, remarks and restoration of the dial, as well to Michał Goncerzewicz and Jon Baddeley for their input.

REFERENCES and NOTES

1. T. Wood & J. Wilson: ‘West Indies Dials in Gloucestershire’, *BSS Bull.*, 22(i), p.41 (Mar 2010). The authors describe two 18th C square horizontal sundials from the first half of the century, by John Fowler and by one of his apprentices, Henry Gregory of London from around 1750.
2. J. Davis: ‘West Indies Dials’, *BSS Bull.*, 23(ii), p.51 (Jun 2011). This note covers two late 18th-century circular horizontal sundials, by Gregory & Wright (London) for Antigua and by Henry Pyefinch, London, for Barbados (SRN 3799). As part of our correspondence, John has determined that he mis-attributed the Antigua dial to Thos. Wright and that it was actually made by yet another Wright; Gabriel (w.1782–1803), in partnership with Henry Gregory.
3. P. Ransom: ‘Another West Indies dial?’, *BSS Bull.*, 23(iii), p.36 (Sept 2011). The author describes his circular horizontal dial from the turn of 18th and 19th century by Parnell, London.
4. J. Davis: ‘Thomas Wright’s horizontal sundials’, *BSS Bull.*, 16 (iv), pp. 135-143, (Dec 2004).
5. Examples of Thomas Wright’s short-form signature, that is without his current title in regard to George II that he normally used on most instruments, can be seen on: church horizontal sundial (SRN 2723), mechanical equatorial dial in Adler Planetarium Collection (Inv. No. W-167), inclining analemmatic dial from the Oxford History of Science Museum (Inv. No. 37076), portable telescope (Inv. No. AST0951) NMM, London.
6. Time-markers of the diamond-shape can be seen virtually on all Wright’s portable instruments. On horizontal dials, classical *fleur-de-lys* are regularly used, apart from the Bonhams sundial (Fig. 8) and his supposed West Indies dial.

7. For a full list of Wright's curved and right-angled gnomons see Ref. 4. The oldest gnomon of curved shape (that is solid and with a sinuous (sigmoidal) northern profile), known to the author, was used on horizontal dial by John Worgan, instrument maker to the Queen Anne, dated 1695 (SRN 2687).
8. M. Lose: 'An unrecorded Silesian sundial by John Rowley', *BSS Bull.*, 22(iii), pp. 40-45, (Sep 2010).
9. E. Harris: 'The right Wright vs the wrong Wrights', *Georgian Group Journal*, vol. XIX, pp. 186-189, (2011).
10. R.A. Sampson: 'Thomas Wright's theory of the Universe', *The Observatory*, vol. 26, pp. 313-317, (1903)
11. Bonhams' auction No. 10952 "Works of Art & Clocks", Lot 491 (2004).
12. Another early dial in the BSS Register with a gnomon attached by means of similar brackets is by John Hasselhurst, dated 1691, reported by the Registrar as missing in January 2010. Also, other dials are known with more primitive iron rod supporters to both sides of the gnomon.
13. Three unusual drilled circular lugs integrated with the brass dial interestingly follow the pattern used by Wright's master

- John Rowley to attach the gnomon in one of his two known double horizontal sundials, dated ca. 1700, denoted *DH-25* in BSS Monograph No. 5.
14. M.A. Crawford: 'Instrument makers in the London guilds', *Annals of Science*, 44:4, pp. 319-377, (1987).
15. P. Gouk: 'The Ivory Sundials of Nuremberg 1500-1700', Whipple Museum of the History of Science, Cambridge, (1988).
16. Another example of a similarly economic horizontal sundial, signed by Edmund Culpeper, is aesthetically very different from other recorded dials by this known maker. It is in the collection of Oxford History of Science Museum (Inv. No: 54983). Despite its 10" size, its engraving is limited to a single chapter ring, divided into 5-minute intervals. That instrument is dated ca. 1710.

mlose@interia.pl

For a biography and portrait of the author, see *BSS Bull.*, 24(i), March 2012.

PHIL ROGERS – OBITUARY

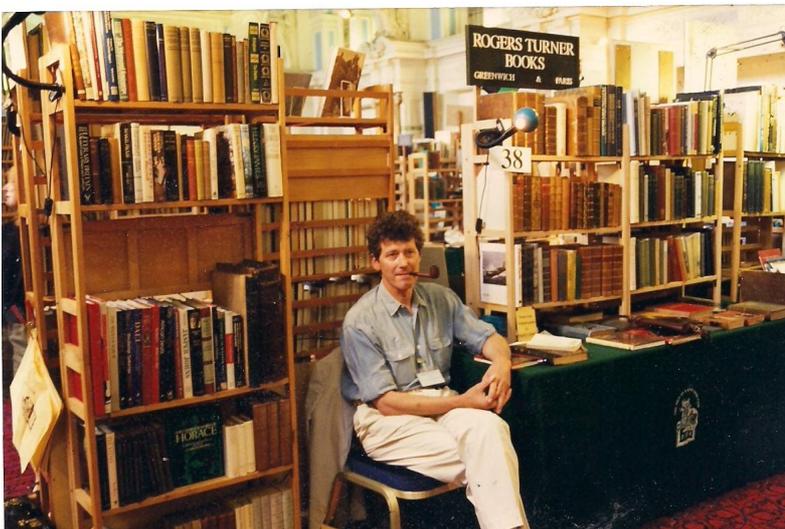
It is with regret that I must inform members of the British Sundial Society of the sad death of Philip J. Rogers, senior partner of Rogers Turner Books, who died on 22 October 2012, at the age of 67, after a long battle with cancer. His funeral was held at the Honor Oak Crematorium, Brockley Way, London SE4 2LW on 31 October at 11:30am.

Few members of the British Sundial Society will have known Philip Rogers personally; but most will have heard of Rogers Turner Books and those who have attended the annual conferences and meetings of the Society will have met Elspeth Hill, his representative, looking after his book stall of both antiquarian and modern sundial works. Phil Rogers was not a member of the Society, since he believed that it was unethical to use membership of an organisation for commercial gain; but he took a keen interest in the Society and he had a remarkable knowledge of gnomonical publications, past and present, whilst stocking a large number of books on the subject.

I cannot recall when I first met Phil Rogers; but I think it was in about the year 1972, some eight years after I had joined the staff of the National Maritime Museum at Greenwich, when I had curatorial responsibility for the Museum's collection of sundials in the then Old Royal Observatory. It was also about the same time that I produced a little pamphlet entitled *Sundials – The Common Vertical in NW Kent*, when I had a growing interest in sundials and when I was collecting gnomonical works. Phil was a member of the Antiquarian Booksellers Association and had established himself as a book dealer in Greenwich, specialising in science and horology, including sundial publications. His business partner, Anthony Turner, had moved to Paris and was much engaged in researching scientific instruments. Consequently, I saw Phil quite frequently over the years, in his bookshop in Nelson Road, often puffing a pipe, whilst meticulously recording the many transactions of his business.

In the late 1990s, Phil Rogers gave up his Greenwich premises and took to working from home, publishing his book sales in regular catalogues – 161 in total to date. These were always well illustrated and nicely produced, and worthy of a place on one's bookshelves! However, it was the personal contact that I appreciated most – he was always kind and helpful – and, in recent years, although I didn't see him nearly as often, I enjoyed having a cup of coffee with him in the large kitchen of his family home. Many may miss the services he provided in his book selling business; but he will be much missed by all those who were privileged to be his friends.

Christopher Daniel



THE LESSER-KNOWN SUNDIALS AT BARRINGTON COURT

PETER RANSOM

If you visit the National Trust site of Barrington Court (Barrington, near Ilminster, TA19 0NQ) you can hardly miss the polyhedral dial on a column outside the house. Based on a dodecahedron, this dial is recorded in the *Register* as number SN0040. Each face is a pentagon with the top row consisting of 5 reclining dials, the bottom row having 5 proclining dials. There is a lion rampant on the top. Although a dodecahedron has 12 faces, there are no dials on the top or bottom faces.

However, if you search the woodwork upstairs in the Long Gallery you will be rewarded with a number of smaller, non-working dials! The Long Gallery runs the whole length of the house and was open to the stars when one of the National Trust founders visited the house. A Colonel Lyle introduced the panelling (which is not dated) in the 1920s

and near the centre of the gallery there are incised marquetry panels dated 1679. Here one can see a number of time-related instruments including a few horizontal dials on pedestals. As well as hour glasses and death's heads there are sundials, crescent moons and scythes.

Barrington Court itself has much to offer with Gertrude Jekyll-inspired gardens and the manor house. Originally it was a Tudor manor house and was restored in the 1920s by the Lyle family who installed a sprung dance floor. There is much for the gardener as well as the diallist, so it is well worth visiting!

pransom@btinternet.com

[Barrington Court also had a large horizontal dial by Cary of London but it was stolen a number of years ago. The NT have made a number of half-hearted attempts since 2004 to have it replaced and have recently commissioned a reproduction. Ed.]



Fig. 1. The polyhedral dial at Barrington Court showing the pentagonal dial faces on the dodecahedron. There are 10 dials present.



Fig. 2. Detail of the North reclining dial and lion's backside at Barrington Court. Note the N on the north face.



Figs 3, 4 & 5. Detail of a horizontal marquetry dial in the Long Gallery at Barrington Court, together with a sand-glass and a second pedestal dial.

IN THE FOOTSTEPS OF THOMAS ROSS

Part 4. The Hidden Sundials of South Queensferry

DENNIS COWAN

South Queensferry, now part of the City of Edinburgh, is a village situated on the banks of the River Forth between the Forth Bridge and the Forth Road Bridge, about seven miles from the centre of Edinburgh.

I was always intrigued by Thomas Ross's mention in *The Castellated and Domestic Architecture of Scotland*¹ of a sundial in South Queensferry (Fig. 1). He states only that it "is built into a chimney-stack on the south side of a house near the east end of the village. It has had rough usage, and the ledge projecting at the base has been broken as indicated. The dial is about level with the road behind the house, and is not visible from the street."

I had looked out for it several times, but I had never seen it and I was beginning to think that the house and sundial no longer existed. But I decided to have one last attempt to find the sundial, this time putting a bit more effort into it. Using Ross's scant information regarding its position, I scoured the Ordnance Survey map and discovered that a narrow lane that I previously was unaware of led from the east end of the village towards the village centre. The clue was in Ross's words and I should have found it earlier, but the lane wasn't easily seen. It ran parallel to and on the south side of the houses that were on the main street

through the village. It appeared to me that if the house and its sundial were not on this lane, then they had definitely gone for ever.

Foolishly I started walking the lane from the centre of the village, and it was only when I had reached the second last house that the sundial suddenly appeared on the roofline to my left. Why did I start walking from the village centre? I should have started from the east end of the village and I would have found it virtually right away!

The roofline had changed since Ross's day, but it was unmistakably the same dial (Fig. 2) and still sat on a chimney stack. Photogenically, it was in a perfect position with the Forth Bridge framed behind it, but as in Ross's day, it still could not be seen from the main street.

It is a two-faced stone dial with a pyramid capping and a flower above with a winged head below. One gnomon is missing whilst a tiny part of the other can just be seen. It has Arabic numerals from 6am to 9am just visible on the south face and 2pm to 7pm just visible on the west face. The other numerals can no longer be seen and the hour lines are only just visible.

To say that I was pleased to have found it at last was an understatement. I was delighted to have discovered that it still existed.

On the eastern edge of South Queensferry, Barnbogle Castle sits within the Dalmeny Estate, owned by the Earl of Rosebery. A footpath that is open to the public runs along

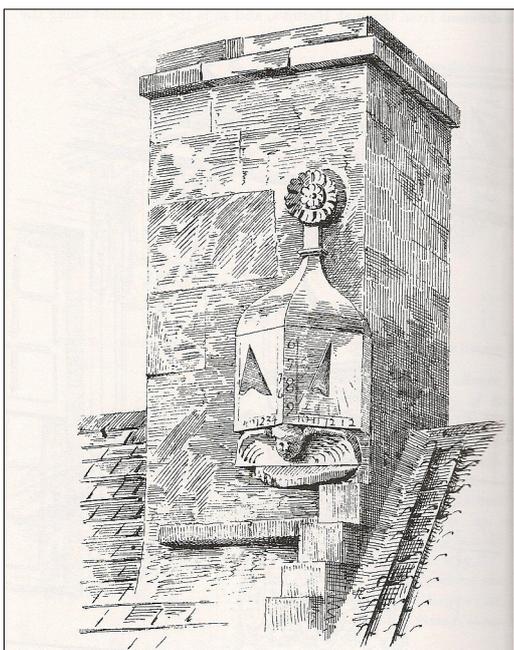


Fig. 1. South Queensferry sundial – Ross's sketch.



Fig. 2. South Queensferry sundial and the Forth Bridge.



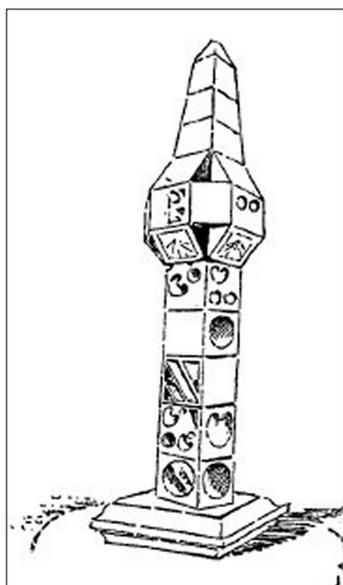
Fig. 3. The beach at South Queensferry.

the coastline from South Queensferry to Cramond, and Barnbougle Castle is about half-way along on the coastal side of the path. This 4½-mile Shore Walk from South Queensferry to Cramond is open all the year round. The walk is full of interest throughout, with beautiful and ever-changing views over the Forth to various islands and the coastline of Fife. The immediate grounds of the castle are private, however, and should not be entered without obtaining the relevant permission beforehand.

It is a delightful walk from South Queensferry to the castle, and who would have thought that such a beautiful beach (Fig. 3) existed not six miles from the centre of Edinburgh? It was virtually empty, even though it was the middle of summer on a warm sunny day.

Although the history of the castle stretches back to the 13th century, the present castle is the result of the extensive rebuilding in 1881 by the 5th Earl of Rosebery who was Britain's Prime Minister from 1894 to 1895. Apparently he practised his speeches here in a gallery especially built for the purpose.

The dial identified by Ross was an obelisk and he writes "when this dial [Fig. 4] was sketched it was standing in a



Far left: Fig. 4. Barnbougle Castle sundial – Ross's sketch.

Left: Fig. 6. Barnbougle obelisk sundial.

Above: Fig. 7. Detail of the Barnbougle obelisk sundial.



Fig. 5. Barnbougle horizontal sundial.

garden in front of the cottages Lang-green, not far distant from Barnbougle Castle, to which place it was removed a few years ago when the castle was rebuilt. It has a base a little deeper than is shown by the sketch, the lower part having been partly concealed. The dial is about 7 feet 2 inches high, and including the base 8 feet 4 inches, with a shaft 10 inches square. On one of the spaces of the shaft, on the north side, are the Cumnyngham arms."

On entering the castle grounds, a sundial (Fig. 5) can be spotted almost right away, but disappointingly this was obviously not the one identified by Ross. It was a simple square horizontal stone dial on a short pedestal with no numbers or hour lines visible. The metal gnomon is still in place.

But where was Ross's sundial? I couldn't see it anywhere. And then I spotted it. It was well hidden, and virtually surrounded by thick bushes (Fig. 6). Only on the north side was there a space where the sundial could just be seen. Even then, you had to be directly in front of it before it was visible.



Fig. 8. Barnboughe obelisk sundial scaphe.

The dimensions are as described by Ross. There are no numerals to be seen on the dial faces now, but some hour

lines remain as well as many gnomon stubs (Fig. 7). It has numerous heart-shaped and other sinkings (Fig. 8) on its many faces and is one of only twenty-six known complete examples of obelisk sundials in Scotland.

Both of these sundials at South Queensferry may be hidden, but at least they still exist. I imagine that Thomas Ross would have been pleased.

ACKNOWLEDGEMENTS

Grateful thanks to Lord and Lady Rosebery for allowing me access to Barnboughe Castle grounds.

REFERENCE

1. D. MacGibbon and T. Ross: *The Castellated and Domestic Architecture of Scotland*, David Douglas, Edinburgh (1892).

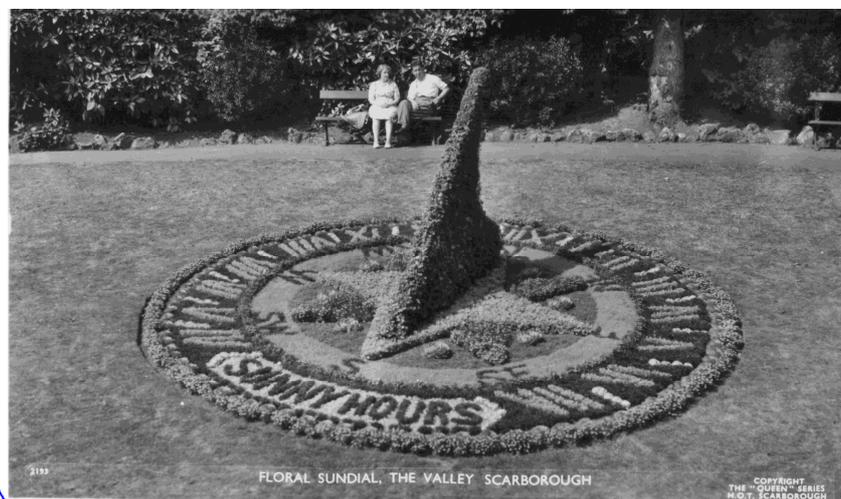
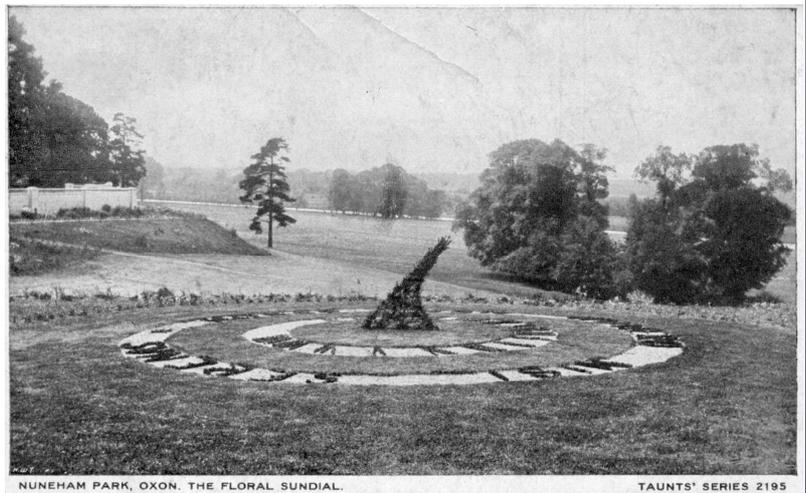
For a portrait and CV of the author, see *Bulletin* 23(iv).

Postcard Potpourri 25 – Floral Dials

Peter Ransom

Floral dials are probably the most transient of all dials because they will need replanting with new flowers each year. Whether the gnomon remains in place each year is unknown – if made out of shrubs such as box, then they probably have a longer life than those where flowers or creepers are grown around a wire framework. This time we have two postcards featuring such dials, the one below in The Valley at Scarborough (postcard posted in August 1951). It appears that this was the work of John Haldane Clark who died on February 14 1972 aged 85. In conjunction with Harry Smith he was responsible for the floral fecundity of gardens in Scarborough for many years. Every year he designed and laid out a new sundial at this location. More can be learnt about him at

<http://www.thescarboroughnews.co.uk/news/features/gardener-with-vision-1-4712644>.



The other postcard (above) is a lot earlier. It features the floral sundial at Nuneham Park, Nuneham Courtenay in Oxfordshire and the picture was taken by Henry W. Taunt in 1907. This lay in the grounds (designed by Capability Brown) of the 18th-century manor house built for Sir Simon Harcourt. Unfortunately, the gardens were damaged by the army who occupied the house in the 1940s.

If any readers have postcards of other floral sundials I would be delighted to hear from them.

pransom@btinternet.com

The Science Fair at Preston – June 2012

Graham Aldred

My first encounter with a Pilkington & Gibbs Helio-Chronometer was in 1983 in a garden in Wales. I guessed that it was a special sundial but, knowing very little about sundials and time, I could not understand why it had moving parts. Thus my curiosity was fired for sundials in general and the P&G Helio-Chronometer in particular. Research led me in 1989 to Preston where I was surprised to find that there was no formal recognition or acknowledged civic pride in the remarkable dialling achievements of the famous pair. What little was known about P&G then had been gleaned outside Preston pre-BSS by a few dialling enthusiasts, notably Chris Daniel and Andrew Somerville. Although it was disappointing that P&G were not on the Preston map I was content to share my findings, and subsequent restoration experience, within the dialling community. It is quite remarkable that 'Proud Preston', normally so conscious of its history, has been quite unaware that over 1000 very accurate mean time equatorial sundials of various types had been designed and manufactured from individual common components in a small workshop in the town. About 100 years ago these fine instruments were sold throughout the British Isles and were exported all over the world where many still survive. What should be celebrated is that P&G not only conceived a practical mean time sundial but that they applied current modern batch production methods to this very unlikely product when hitherto sundials had always been made individually and to a specific order.

But fortunately no secret can remain buried for ever. Jonathan Westaway and Keith Vernon from the University of Central Lancashire conducted a general research project in 2009-10 that included an examination of the life and work of George Gibbs, curator of the Moor Park Observatory in Preston, Lancashire in the early twentieth century. The specific

Jonathan Westaway and Keith Williams of the UCLAN



project had twin aims: to understand the role of Gibbs as a public science educator and to evaluate the business history surrounding the Pilkington & Gibbs Helio-Chronometer.

The right to hold a Civic Celebration in Preston was conferred by King Henry II in 1179. At first it was irregular but by 1328 it was decided to hold it every 20 years, although there have been a few slips due to wars over the intervening 700 years. Thus the next Preston Guild had been planned to be held in 2012. In June, as part of Preston Guild, the University mounted the three-day Lancashire Science Festival to celebrate the scientific and technological achievements of the region, both modern and historical. The festival provided the opportunity to publicise the story of George Gibbs, the observatory and the Helio-Chronometers to a wide Preston audience. Jonathan had made contact with the author in connection with his previous research, and with Geoff Parsons and Mike Shaw subsequently to ask if we could help on the exhibition



stand. Mike and Geoff kindly provided two standard Helio-Chronometers from their collections for demonstration purposes. These were available on display to provide practical demonstrations of the principles of the instrument to many of the thousands of people who attended the event. The rather small stand included excellent charts produced by UCLAN which summarised George Gibbs's contributions to scientific education in Preston and his long curatorship of the local astronomical observatory. There was considerable interest from the general public of all ages and abilities and I think we definitely captured the interest of several young minds. After a rather hectic day we agreed that at least the work of Pilkington and Gibbs would be more widely known in future by Prestonians and it would be recognised more fully in the business history of Preston thanks to the efforts of UCLAN.

However, the day demonstrated that if you were giving even a superficial introduction to the functioning of sundials and concepts of time measurement you would not start with a description of a very strange looking instrument with peculiar moving parts that looks nothing like a sundial. An explanation of an instrument which uses mechanical parts you cannot see, and solving a problem that you did not know you had, is not the best place to start. Nevertheless, we optimistically agreed that on another occasion a somewhat bigger stand and a few simple and familiar sundial models together with an artificial sun would be very useful. The interested visitor could then be gently guided towards the equatorial plane to encounter the Helio-Chronometer where sunshine and shadows conspire with mechanical ingenuity to make Mean Time.

It certainly was a 'Grand Day Out' as well as an exhausting one. It was most encouraging to feel the interest and curiosity of whole families as well as young students who crowded round our little stand; there were many who could not get to it in the cheerful crush. Jonathan and Keith should be congratulated for grasping this opportunity to publicise Pilkington and Gibbs.



REPORT ON THE GREEK DIAL FROM DELOS STORED IN THE LOUVRE (Ma 4823)

JÉRÔME BONNIN and DENIS SAVOIE

In June 2012, John Davis asked if it was possible to identify and find two dials drawn by C.R. Cockerell in 1810. The conclusion of this enquiry was published in the September 2012 *Bulletin*.¹ The aim of this second paper is to provide up-to-date information about the Delos dial which is stored in the Louvre. On 5 September, thanks to the valuable help provided by Ludovic Laugier, we were able to study this very special dial in detail. Jérôme Bonnin carried out the historical research work and Denis Savoie made the mathematical study.

History of a (Re)Discovery

This dial is the only one from Delos not conserved *in situ*. In all likelihood, as C.R. Cockerell drew it in 1810, the time of the discovery of this instrument can undoubtedly be set at this year. The dial remained on the island after Cockerell's departure. In 1811 or 1812, a Capuchin monk called P. Urbain and living in Mykonos gave the instrument he had found "amongst the ruins of Delos" to a French architect, A.-F. Mauduit (1778-1854).² After that, Mauduit brought the sundial to France and asked the astronomer J.-B.-J. Delambre to study it. Delambre produced three similar articles on the object.³ Then, Mauduit gave it to the 'Cabinet des médailles' in Paris⁴ where the dial was dis-

played in the 'salle du zodiaque'. In 1929, the dial was given to the Louvre, where it is still stored to this day, in the storage rooms to be precise, under the inventory number MND 1580 / Ma 4823.

This is not the place to present a complete description of the dial. Delambre gave a very good account two centuries ago in the introductions to his studies. Those studies can be found nowadays on the internet free of charge. Nevertheless, we would like to communicate considerations about the original setting of the dial and additional information about the object itself.

The Temple of Apollo at Delos

The information about the real location of the discovery of the dial is not very precise. Cockerell's drawing shows that the dial was no longer in its original environment when it was discovered. It was reused, probably in late Antiquity, inside a sort of dry-masonry construction. But according to Cockerell and Mauduit, it can be assumed that it was dug up not far away from the 'Temple of Apollo'. Nowadays, this term is used for three temples found inside the sanctuary of Apollo. But in 1810, it could only be the 'Great Temple', the peripteral hexastyle temple built between 475 BC and the 1st century BC. For some unknown reason the



Fig. 2. Close-up of the hour lines and gnomon hole.

Fig. 1. The Delos dial, photographed in The Louvre.

temple was never finished. What the link was between the instrument and the Temple, or even if this link ever existed, are questions which we cannot answer. But we can present an hypothesis based on other cases of sundials found inside sanctuaries, near Temples of Apollo. Indeed, sundials are quite often linked with Apollo (or other Gods) in Antiquity. Here are two examples among many others: (a) the British Museum holds a miniature dial found inside the Temple of Apollo of Naucratis, Egypt (inv. n° 1909 2-16 10); (b) in front of Apollo's Temple of Pompeii, a sundial was displayed on a column. Unfortunately, the reason why sundials were placed inside sanctuaries is not totally understood. Undoubtedly, the link between Apollo and the Sun is of importance. But the question is whether the dial had a defined function for the cult ceremonies or whether its function was solely that of a timepiece for passers-by.

Additional Information on the Sundial

The instrument is in an average state of preservation (Fig. 1). The base of the dial is the only damaged part. The cylindrical gnomon is missing. Traces of red pigment are visible along the hour and calendar lines (Fig. 2). These seem to be rather modern (maybe from the 19th century). The marble disc is 56 cm in diameter. It is nearly circular and has a rectangular foot at its base. The centre of the instrument still has the remains of the hole used by the craftsman to draw the circular shape of the dial. On the upper part of the circular surface of the dial, above the gnomon hole, we have noticed some graffiti. It seems to be inscribed in Greek '(ρ)ολ(ο?)' or 'Pol(o)' in Latin. This inscription is modern (19th century) and does not date back to Antiquity. The word 'polos' in Latin (or in Greek 'πόλος', not 'ρόλος') was indeed used in the 19th century and even the beginning of the 20th century in order to design any type of sundial. Two barely visible small marks on the horizon line could be the remains of a construction guide for the craftsman. The back of the stone is plain, without any inscription or trace of another dial. It just shows three circular holes, one being the end of the gnomon hole of the dial, the other two being the remains of a fixing device to a vertical surface (a wall most probably). To conclude with the shape of the dial, it belongs to a very rare typology with only one other example, from Grottaferrata. It could be the *discus in planitia* mentioned by Vitruvius.

Gnomonic Study (Denis Savoie)

It is a vertical sundial that functions when oriented exactly towards the East. It is thus a vertical oriental sundial, operational in the morning, from sunrise until approximately the sun's passage into the sundial plane, *i.e.*, before solar noon.

The five hour lines are not labelled; the indicated time is in temporal hours [seasonal or temporary]. The sundial possesses two arcs for the solstices (the lower one for the summer solstice, the upper one for the winter solstice) and a line for the equinoxes. The straight stylus, *i.e.*, the horizontal gnomon (perpendicular to the plane of the sundial) that

casts a shadow on the sundial and whose tip alone gives the time (and date), is set at the intersection between the equinoctial line and the horizontal straight line (which corresponds to the moment of sunrise). One can notice a very tiny offset between the setup hole and the equinoctial line.

To determine the latitude for which this sundial is intended, one has to measure the angle between the equinoctial straight line and the horizontal line passing by the base of the gnomon. This angle is equal to $(90^\circ - \phi)$, where ϕ is the latitude. Several measurements⁵ give an angle of 59° with an uncertainty of 0.5° , and thus a latitude of $31^\circ \pm 0.5^\circ$. Note: the true latitude of Delos is $37^\circ 23'$ while Alexandria is at 31° . There is thus a difference in latitude of at least 6° .

On the equinoctial line, one has to measure the distance r between the hour line and the point at which the gnomon is set. This gives the length a of the gnomon through the trigonometric relation: $a = r \tan H$, where H is the equinoctial hour angle ($H = 15^\circ$ for hour line 1, 30° for hour line 2, etc.).

For $H = 15^\circ$, we measure $r = 9.2$ cm and thus $a = 2.5$ cm.

For $H = 30^\circ$, we measure $r = 4.3$ cm and thus $a = 2.5$ cm.

For $H = 45^\circ$, we can measure directly $a = 2.6$ cm.

For $H = 60^\circ$, we measure $r = 1.5$ cm and thus $a = 2.6$ cm.

Note that a 1 millimetre error (due to measurement error, to the thickness of the engraved line and/or to the slight eccentricity of the hole) translates into an error of ± 1 mm in the length of the gnomon. The values seem closer to 2.6 cm when estimating the sundial in a modern way.

Assuming an obliquity of the ecliptic of 24° (in the second century BC, its exact value was $23^\circ 43'$), modern calcula-

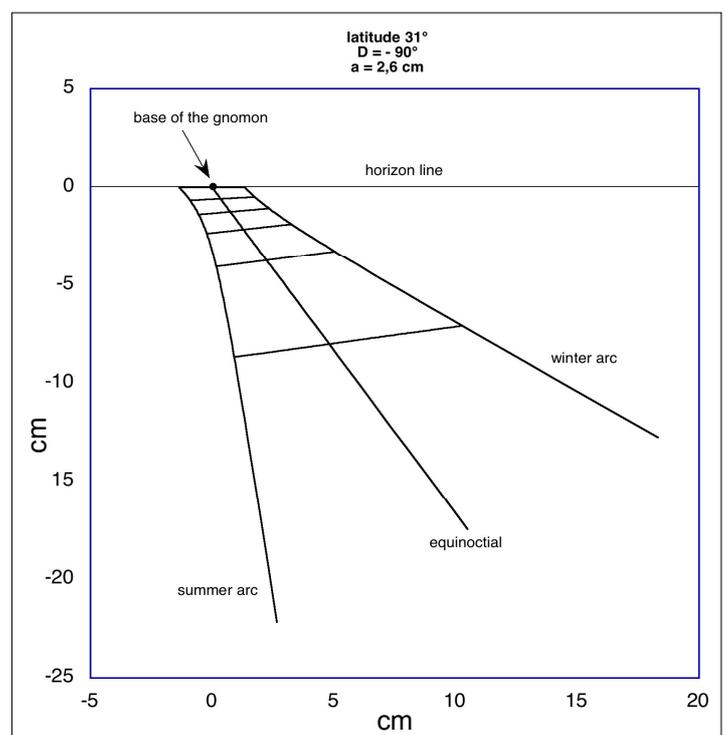


Fig. 3. Sketch of the Delos dial as it would have originally been delineated.

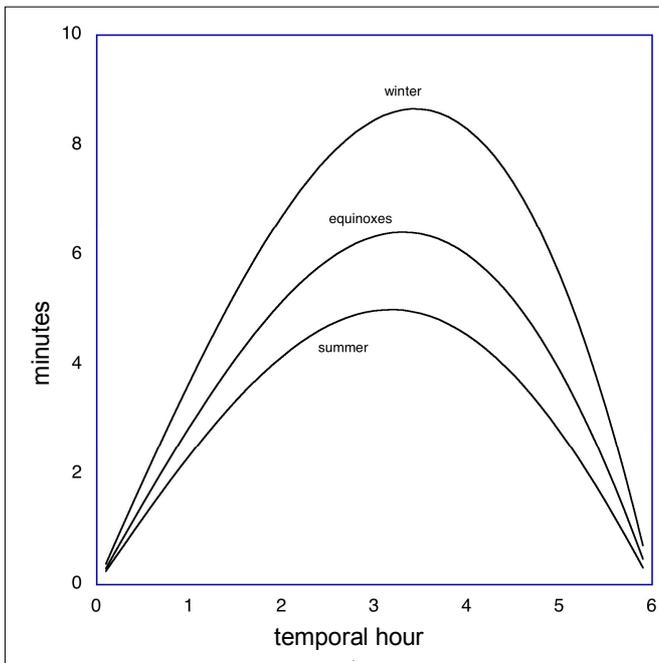


Fig. 4. Error in the hour reading due to the displacement in latitude.

tion⁶ (with parameters $\phi = 31^\circ$, $a = 2.6$ cm) shows that the summer hyperbolic arc is very accurately estimated in its upper part, that is from the horizon line up to temporal line 5. But then it goes down too abruptly, going as far as crossing again the vertical, passing the setup point, which is not normal. The temporal hour lines between the summer arc and the equinoctial line are fully accurate.

By contrast, the hyperbolic winter arc is totally erroneous; its distance to the equinoctial line is much too large. In addition, one can notice a pronounced break in the autumn-winter hour lines on the equinoctial; it is not only the arc that is erroneous, but also the lines are too steeply inclined and should be in the continuation of the spring-summer lines.

We note that the sundial's displacement in latitude (intended for a 31° latitude but set up at a latitude of $37^\circ 23'$) results in a maximum error of 9 minutes in temporal hour (in absolute value) during winter (Figs 3 & 4). As a matter of fact, the most blatant error (which must have been clearly visible) was that the extremity of the gnomon's shadow would not fall on the arcs of the solstices and on the equinoctial straight line at the correct date.

Conclusion

To conclude, we could say that, in many respects, this sundial is exceptional. First of all, the typology, place and circumstance of its discovery are quite uncommon. This sundial, despite its surprising computation, belongs to the very small number of Greek dials from Delos. We are also very lucky to have Cockerell's drawing and a modern mathematical study of it. Sundials with such well-documented and complete study are very rare. There still remain a few puzzling questions about it (in particular, its original location, the reason for its creation and the method of its con-

struction). That is not the case for the other sundial drawn by Cockerell.¹ Searches carried out at the Kia/Ceos Museum were unsuccessful since the curator told us that no dials or fragments of dials were stored in the museum. This work has to be pursued in order to locate it.

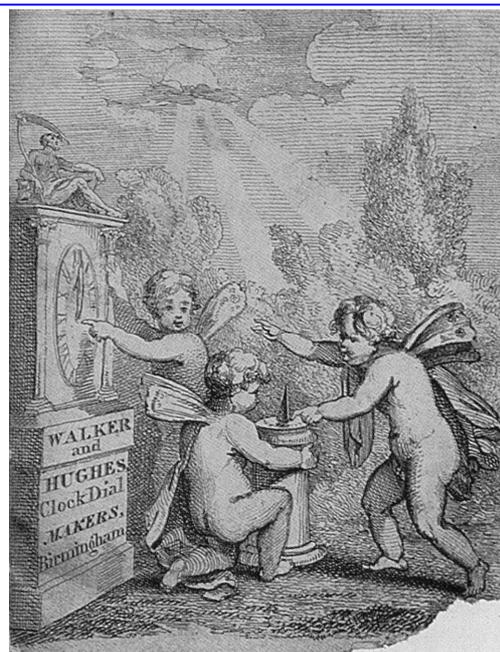
ACKNOWLEDGEMENTS

We are grateful to Ludovic Laugier (Louvre) for his help and permission to study the dial and to Maria Koutsoumpou (Greek 21st Ephorate of Prehistoric and Classical Antiquities) for her research work and assistance in order to find the second sundial drawn by C.R. Cockerell.

REFERENCES

1. J. Davis & J. Bonnin: 'Early 19th century English drawings of Greek dials', *BSS Bull.*, 24(iii), 43–44 (September 2012).
2. A.-F. Mauduit, *Découvertes dans la Troade*, Paris, 1840, p. 242.
3. J.-B.-J. Delambre: 'Mathématiques, cadran antique trouvé dans l'île de Délos, et par occasion de la gnomonique des anciens : Notice lue à la classe des sciences physiques et mathématiques de l'Institut Royal de France, le 10 octobre 1814' in *Magasin encyclopédique : ou Journal des sciences, des lettres et des arts* V, 1814, p. 361–391 / 'D'un cadran trouvé à Délos, et par occasion de la gnomonique des anciens, par M. le chevalier Delambre. Année 1814', *Mémoires de la classe des sciences mathématiques et physiques de l'Institut de France. Années 1813, 1814, 1815*, Paris, 1818, p. XXIX-XXXIX / 'Lettre de M. Delambre, secrétaire perpétuel de l'institut royal de France pour les sciences mathématiques, au sujet d'un cadran antique rapporté de Délos par l'Auteur', *Découvertes dans la Troade*, extrait des mémoires de A.F. Mauduit, Paris, 1840 p. 236–239, figs 3 & 4.
4. *Le Moniteur Universel* 264, 21 September 1814.
5. All the measurements were been made from two rubbings, in addition to direct measurements on the sundial.
6. D. Savoie: 'La Gnomonique', *Les Belles Lettres*, Paris, 2007.

jeromebonnin@laposte.net
Denis.SAVOIE@universcience.fr



The tradecard of Walker and Hughes, 19th-century clock dial makers. Courtesy of the Guildhall Library, London.

THE SINGLETON DIAL

TONY WOOD

Brainchild of the brothers Barrie and John Singleton of Newbury, this helical dial makes a striking alternative to conventional dials, yet is essentially simple in concept.

The everyday equatorial dial is usually an arc strip encircling a polar gnomon (see, for example, the Henry Moore dial in the December 2012 *Bulletin*) with the delineation limited to the hours 6am to 6pm and the arc limited to 180°. By making the arc a helix, the delineation can be carried backwards and forwards, eliminating the problem of the arc scale casting a shadow on itself at the equinoxes. In fact the Singleton helix starts at 4am in the morning and is extended to 10pm in the evening (Figs 1 and 2).



The base is heavy concrete, necessary to retain stability as the gnomon support arc is quite substantial, as is the helical scale itself. The support arc carries pictures of the sun and the planets in order, including Pluto, no longer a planet and now relegated to some mystery astronomical status.

The construction of moulded and formed white and black plastic elements is a result of the brothers' experience in the industrial chemistry. The spiral and frame are in uPVC and made by immersing in a bath of hot water and glycol and bending round a former. The spiral is made from 30mm half-round rod and a 60mm half-round rod was used for the frame.



The dial appeared in 1989 and was exhibited at the first Society Conference in 1990 at Oxford. It is covered by UK Patent No. 2212630; the design was anticipated in 1974 by J. Masuet and a similar dial some 2 metres high is pictured at Léruda in Spain in Ref 1. The hour scale of that dial only extends from 6 am to 6 pm but, like the Singleton dial, it is a left hand spiral.

Some adjustment for latitude is provided, the production version featuring three screw holes in the base of the gnomon support arc (replacing an original slot design). As it was made for the British market the latitude ranges were described as: (a) south of Nottingham, (b) between Nottingham and Edinburgh (53° to 56°N) and (c) north of Edinburgh.

The hour scale helix could be rotated about the gnomon providing adjustment for GMT/BST. The equation of time correction was not part of the design but may have been incorporated into the large version shown in Fig. 3. This is a man-sized example and is perched high up on a house wall in Newbury; it appeared at a Newbury Meeting some years ago – under the name DRUID – whose acronymic origins may be lost in time!

The dial was marketed by Tangible Innovation Ltd and one or two examples appear in the Sundial Register.

Another form of helical dial is also covered in Ref 1 and consists of a uniformly twisted metal strip pointing polarwise and relying on the rather vague shadow edge formed from the helical edges of the strip. The hour marks are thus delineated on the gnomon itself. An example of this design, made by Aylmer Astbury, was in the December *Bulletin* and is looking for a good home.

One other claim to fame for helical dials may be that they can exist in two chiral or enantiomorphic forms, left handed and right handed. As noted above, so far, only left handed versions have appeared.

This article was triggered by the appearance of a Singleton dial in the auction at the 2012 Cheltenham Conference. It had originally belonged to Edward Martin of the Mass Dial Group.

REFERENCE

1. A.A.Mills 'Helical Sundials', *BSS Bulletin*, 92.2, 21–23 (June 1992).

THE FIRST INTERNATIONAL CONFERENCE ON SUN-DIALS

ANTHONY TURNER

It is a measure of the advance in sophistication that the study of the history of sun-dials has made in the last three decades that the historiography of the subject now begins to attract attention. A witness to this is the reproduction of the programme of the 'First International Conference on Sundials' in a recent *Bulletin*.¹ As convenor of that conference, perhaps I may be allowed to add some notes about it. The conference was organised by the Centro Internazionale di Storia dello Spazio e del Tempo, a private research institute, the brainchild of a professor of history at the University of Sardinia, Giampiero Bozzolato, domiciled in Padua, and of one of the leading steel-manufacturers in Italy, Giancarlo Beltrame of Vicenze, a man with a passionate interest in books, time and space. Beltrame had an extensive private library on the subject, with a full-time librarian to look after it, and an interesting collection of clocks, watches and instruments.² Although the centre was housed in Bozzolato's renaissance villa at Brugine, it was largely funded by Beltrame and a vigorous programme of research seminars, public lectures and publications was undertaken. Of these the most extensive was that devoted to Giovanni dei' Dondi and his *astrarium* directed by Emmanuel Poulle.³

The conference on sun-dials was conceived as a research and study seminar and publication of the papers was intended. The programme given differed slightly from that announced as in the event neither J.-P. Verdet nor Francis Maddison were able to attend, but Francesco Azzarita (Union Astrofili di Bari) offered a survey of 'La Ricerca dei quadranti solari in Italia'. Of the two visits announced that to Aquileia did not take place. The exhibition of instruments and books was held in the Palazzo Constantini with the collaboration of the Biblioteca Bertoliana, not in the library itself. Most of the items came from the collections of Beltrame augmented by items from the library. A catalogue accompanied it (see illustration).⁴

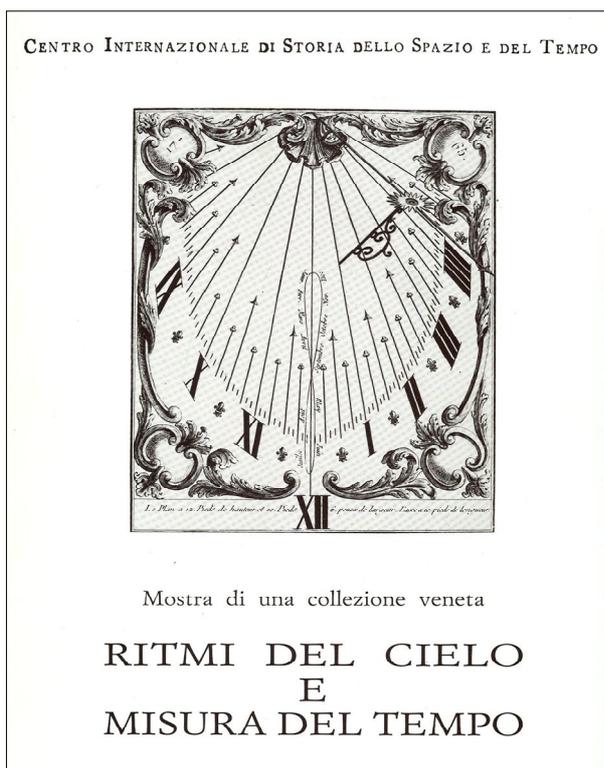
The conference was itinerant and memorable. The first day was held in Vicenze, the second in Padua, the third at Brugine where a remarkable lunch (I shall never forget the black bean pasta) led to considerable difficulty in reconvening for the last session of papers about an hour later than programmed. In the middle of John North's discussion of the length of a human shadow two secretaries arrived with coffee and bottles of the most excellent grappa which the chairman was forced, instantly, to confiscate!

The conference was quite widely reported in the local press, at least nine articles being published about it. The papers given were of a uniformly high standard,⁵ and that they were not published in a single volume was indeed 'a shame'. It was not, however, for want of effort. In the months following the conference most of the authors sent in their texts and editing took place. In mid-1986 the complete volume was delivered to the centre for publication. But by this time internal dissensions and organisational difficulties had surfaced and nothing was done. In January

1989 I was forced, finally, to write to all the authors stating that there was no further hope of publication by the centre and suggesting they publish elsewhere. This many of the authors did and the following is a list, in the same order as that printed in the *Bulletin*, of where papers were published in so far as I am aware of them.

A.J. Turner, 'Sun-dials: history and classification' was published in *History of Science*, xxvii 1989, 303-18; reprinted in *Of Time and Measurement. Studies in the History of Horology and Fine Technology*, Aldershot 1993, ch. II.

J. Field & M. Wright, 'A Byzantine sun-dial and geared calendar recently acquired by the Science Museum, London'. These papers provided the basis for two sub-



The front cover of the exhibition catalogue. The illustration is from Francois Bedos de Celles, 'La gnomonique pratique, ou l'art de tracer les cadrans solaires avec la plus grand précision', Paris 1774.

stantial articles: 'M.T. Wright, 'Rational and Irrational Reconstruction: the London Sundial-calendar and the early history of geared Mechanisms'; J.V. Field, 'Some Roman and Byzantine portable Sundials and the London Sundial-Calendar' both in *History of Technology*, xii 1990, 65–102, 103–35.

B. Goldstein, 'The Sun dial of Ahaz in the Bible and subsequent Interpretations', was largely deployed by him in 'Galileo's Account of astronomical Miracles in the Bible: a Confusion of Sources', *Nuncius. Annali di Storia della Scienza*, v, 1, 1990, 3–16.

J.D. North, 'The human sundial in Chaucer', derived from his work for, and became part of, his study of *Chaucer's Universe*, Oxford 1988. See sections 3, vi 'Nicholas of Lynn and the human shadow' and 3, viii 'Daun John's chilyndre', 106–9 and 111–16.

D. Vaughan, 'Horizontal quadrant Sun-dials of Humphrey Cole' was published in a revised and expanded version as 'A very artificial Workman: the altitude sundials of Humphrey Cole', in R.G.W. Anderson, J.A. Bennett & W. F. Ryan (eds), *Making Instruments Count: Essays on historical scientific Instruments presented to Gerard l'Estrange Turner*, Aldershot 1993, 191–200.

A.R. Somerville, 'Scottish Polyhedral Dials: a problem of origins and diffusion', was part of his ongoing investigations which led to 'The Ancient Sundials of Scotland', *Proceedings of the Society of Antiquaries of Scotland*, cxvii 1987, 233–64, re-issued as a separate publication by Rogers Turner Books Ltd in 1990 with a revised edition in 1993.

M. Archinard, 'Construction géométrique des cadrans solaires de direction', was published in *Scienza e Storia, Bolletino del Centro Internazionale di Storia dello Spazio e del Tempo*, vii 1988, 35–44.

What, if anything became of the other papers on the list I cannot say, except that Bruce Chandler's 'Dialling, perspective and projective geometry', never even got onto paper, let alone into a published version.

Is it time for a rerun? Perhaps, but a rerun in which emphasis is placed on the *longue durée*, the development of sundials over the centuries in different societies and the role they played in them from Ancient Egypt to the present. A rerun in which the techniques of sun-dial making are seen as reflections of social need and the mathematical and sculptural ability available.

REFERENCES and NOTES

1. *BSS Bull.* 24(ii), inner front cover (June 2012).
2. Most of it was recorded in the catalogue by Paolo Brenni, Mara Miniati, Luigi Pippa and Anthony Turner, *Orologi e strumenti della Collezione Beltrame*, Florence (1996).
3. The outcome of this was a full colour reproduction of the author's manuscript with a critical edition and French translation. *Johannis de Dondis, Paduanis, Astrarium, t. I Fac-simile du manuscrit de Padoue et traduction française; t. II Edition critique de la version A.*, par E. Poulle, 3 volumes, Padua & Paris (1987–8).
4. Anthony J. Turner: *Mostra di una Collezione veneta: Ritmi del Cielo e misura del Tempo*, Vicenza (1985).
5. In the programme as reproduced in the *Bulletin* (ref. 1 above), the important question-mark at the end of Anthony Aveni's title has unfortunately dropped off.

anthonyjturner@9online.fr

***Horologia et solaria* – Instrumentation of Time in the Roman Empire** **Lille 3 University, 29 March 2013**

A study day entitled '*Horologia et solaria*. Instrumentaliser le temps à l'époque romaine' ('*Horologia et solaria*. Instrumentation of Time in the Roman Empire') will take place at Lille 3 University on 29 March 2013. This study day will follow an exhibition entitled 'Le temps des Romains, perception, mesure et instruments' (Roman Time, perception, measure and instruments), scheduled at Amiens Museum between the 24 October 2012 and the 24 March 2013.

The aim of this study day is to enlarge our knowledge of time-keeping instruments in Antiquity. The study of all historical data about *horologia* (texts, archaeological information, inscriptions, iconographical representations), together with modern data (astronomical/gnomonic) might allow us to re-evaluate the place of the *horologia* in Greco-Roman society. We would like to concentrate on the object's types, peculiarities, artistic and social resonances, and not upon the question of time as a philosophical, metaphysical or literary notion. We intend it to be a first step toward a more general reflexion on the question of scientific knowledge.

Javier Arce, Professor of Roman Archaeology, Lille 3 University and Jérôme Bonnin, Doctor in Roman archaeology, Lille 3 University are organizing this study day with the help of the laboratory Halma-Ipel, UMR 8164 and the 'Pôle patrimoine mondial' (UNESCO) of the French 'Ministère des affaires étrangères'.

Talks will be given by Hermann J. Kienast, Professor, former Vice-chair of the German Archaeological Institute in Athens, Christine Hoët-Van Cauwenberghe, Associate Professor in Roman History, Lille 3 University; Denis Savoie, Head of Department of Astronomy and Astrophysics of the department of the 'Palais de la Découverte', Paris; Karlheinz Schaldach, Professor of Mathematics and Physics, Independent Researcher; Christophe Schmidt, First Assistant in Ancient History, University of Lausanne; and Anthony Turner, Independent Researcher.

Contact: jeromebonnin@laposte.net



DICKENSIAN DIALS

JOHN WALL

[Our late member John Wall was working on this article when he sadly died in October 2012. We are extremely grateful to his daughter, Ruth Dennis, for retyping the draft article and submitting it to the *Bulletin* for publication. Ed.]

It was the genius of Charles Dickens that he vividly brought to life the Victorian scene, in superlative prose. Indeed, our image of Victorian society, for example, is largely derived from his novels and other works. Throughout his writings he employs a number of recurring themes, of which one of the most emotive and powerful is the passage of time and man's mortality. This theme is given substance through many references to devices for the measurement of time – clocks, watches and of course sundials. They are introduced not only in their own right as interesting artefacts, but also for their significance as metaphors for the passage of time and man's mortality. As we would expect from their comparative numbers as time-tellers in the real world, there are many more references to clocks and watches than to sundials. Nevertheless, and bearing in mind the sheer volume of his written works, descriptions of sundials are by no means infrequent, and when they do occur the impact on our mind and imagination can be quite profound.

I first came across a 'Dickensian dial' near the beginning of *David Copperfield*. There and then I resolved to read or reread all of Dickens' works to discover how many dials are introduced and in what context. At the time I did not realise what an absorbing task I had undertaken. Withal, it has proved to be a most enjoyable exercise, if immensely time-consuming. What follows is the fruit of that search. I do not pretend that it is exhaustive, and if through some mischance I have failed to notice a Dickensian dial as it appeared on the printed page, I would be grateful if the reader, having spotted the omission, would bring it to my attention – 'to make the catalogue complete.'

Little Dorrit

When the hero of this novel returns from abroad he seeks information about the eponymous heroine (with whom, it eventually transpires, he falls in love) from the insensitive and self-regarding uncle Frederick, brother to her father William, the oldest inhabitant of the notorious debtors' prison, the Marshalsea, with whom she lives. "I know very little of the world, sir," he replies, "I am merely passing on, like the shadow over the sun-dial."

Later, Arthur Clenman seeks out Thomas Plornish, an unemployed plasterer, whom Little Dorrit had befriended, in Bleeding Heart Yard. Dickens dwells on the interminable, poverty-stricken condition of the inhabitants of the Yard. He signifies another time-telling device by contrast to signify the passage of time. "And, considering that the hour-glass they turned from year to year was filled with the earthiest and coarsest sand, the Bleeding Hearters had reason enough for objecting to be despoiled of the one little golden grain of poetry that sparkled in it."

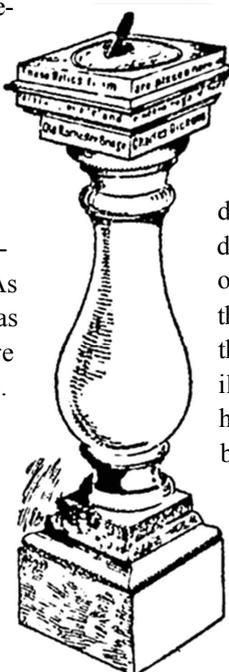
The Old Curiosity Shop

Little Nell and her grandfather, to whom she is devoted, make their painful way on foot out of London in the vain hope that he will be cured of his ruinous gambling fever, and away from the clutches of the malevolent dwarf, Daniel Quilp. On their way they are befriended by an aged cottager and his family. "I should have a son pretty nigh as old as you if he'd lived, but they listed him for a so'jer – he come back home though, for all he had but one poor leg.

He always said he'd be buried near the sun-dial he used to climb upon when he was a baby, did my poor boy, and his words come true – you can see the place with your own eyes: we've kept the turf up ever since." This is an exceptionally clear expression of Dickens' preoccupation with man's mortality, symbolised by the sundial.

Bleak House

At the heart of *Bleak House* is the story of unassuming Esther Summerson, and in particular her unhappy servitude to her godmother, the icy, unfeeling Miss Barbary. Unknown to Esther, Miss Barbary is in fact also her aunt. Shortly after the revelation of her true identity, imparted by her natural mother Lady Dedlock, Esther, sad and distressed, walks in the park surrounding Lord and Lady Dedlock's mansion. There follows a minute description of the gardens and their ornaments that seem so accurately to reflect Esther's emotions. "I passed before the terrace garden, with its fragrant odours, and its broad walks, and its well-kept beds and smooth turf, and I saw how beautiful and grave it was, and how the old stone parapets and balustrades, and wide flights of shallow steps, were seamed by time and weather; and how the trained moss and ivy grew among them, and around the old stone pedestal of the sundial; and I heard the fountain falling." The whole passage,



Charles Dickens' own sundial—see *Postscript*

The sundial at Restoration House, Rochester.

of which this is but a part, is a superlative evocation of a grand but gloomy mansion garden. Once again Dickens introduces a sundial to suggest the infinitely slow but enduring, inescapable effects of the passage of time.

Chesney Wold, the elegant home of Lord and Lady Dedlock, is in the care of an admirable house-keeper in the person of Mrs Rouncewell. She is instrumental in bringing to the Dedlock household Rosa, Lady Dedlocks' 'pet-secretary-messenger'. One evening Mrs Rouncewell's son, an Ironmaster and M.P., calls on the Dedlocks with a proposal concerning Rosa's future. "Sir Leicester is content enough that the ironmaster should feel that there is no hurry there; there, in that ancient house, rooted in that quiet park, where the ivy and the moss have had time to mature and the gnarled and warted elms, and the umbrageous oaks, stand deep in the fern and leaves of a hundred years; and where the sun-dial on the terrace has dumbly recorded for centuries that Time, which was as much the property of every Dedlock – while he lasted – as the house and lands. Sir Leicester sits down in an easy chair, opposing his repose and that of Chesney Wold to the restless flights of ironmasters."

The enduring nature of the Dedlock dynasty, persisting these hundreds of years, is perfectly manifest in the sundial itself which, unchanged, records from day to day the passage of interminable time in the Chesney Wold domain. At the same time, in that last sentence, Dickens skilfully manages to convey the repose of centuries with the daily "restless flights of ironmasters" by means of the one sundial's dual function.

Dr John Wall MA, BD, FRPS, FRHistS (1928–October 2012)



was born in Middlesbrough and remained a true Yorkshireman all his life, eventually retiring to Kirkbymoorside to be near the North Yorks Moors Railway, one of his many interests. Others included sundials (of course), photography, walking, coins and stamps, medieval history and sculpture.

He graduated in divinity and later studied for a part-time MA at Bristol and

then a PhD in Medieval History (London). Initially, he took pastoral charge of churches in Newcastle and Somerset and later became a principal lecturer and head of religious and social studies at Middleton St George College of Education in County Durham. He was a Methodist preacher and a popular speaker on many diverse subjects. In 1954 he married Betty Durkin with whom he had five children and whom he nursed through Parkinson's after his early retirement in 1988.

He published over a dozen articles and letters in the *BSS Bulletin*, with his particular interests being in the fields of mass dials, railway dials, ecclesiastical dials and dials in Yorkshire. Many members will remember him with affection.



POSTSCRIPT

It seems likely that John Wall had not completed his rereading of all Dickens' work when he was admitted to hospital as there are some other references to sundials which are not included in the article above. I have included those that I found in a brief (and probably incomplete) survey below. Can readers add more?

David Copperfield

In chapter 2 ("I Observe") of this work David Copperfield describes his childhood using the real Suffolk village of Blundeston as the location. He says "There is nothing half so green that I know anywhere as the grass of that churchyard; nothing half so shady as its trees; nothing half so quiet as its tombstones. The sheep are feeding there when I kneel up, early in the morning, in my little bed in a closet within my mother's room to look out at it; and I see the red light shining on the sun-dial, and I think within myself, 'Is the sun-dial glad, I wonder, that it can tell the time again?'"

Blundeston church, with its flintwork round tower, still exists and has a sundial (SRN 2032) although the present dial replaced the seventeenth century one David Copperfield would have 'seen', which had become dangerous, within living memory.

The Mystery of Edwin Drood

Chapter 19 is entitled "Shadow on the sun-dial" and describes a meeting between Rosa and Mr Jasper with the words "The moment she sees him from the porch, leaning on the sun-dial, the old horrible feeling of being compelled by him, asserts its hold upon her. She feels that she would even then go back, but that he draws her feet towards him. She cannot resist, and sits down, with her head bent, on the garden-seat beside the sun-dial."

The Haunted Man and the Ghost's Bargain

In this short story, we have, in a sentence of 213 words, "His dwelling was so solitary and vault-like, – an old, retired part of an ancient endowment for students, once a brave edifice, planted in an open place... ..its sun-dial in a little bricked-up corner, where no sun had straggled for a hundred years, but where, in compensation for the sun's neglect, the snow would lie for weeks when it lay nowhere else, and the black east wind would spin like a huge humming-top, when in all other places it was silent and still."

Dickens' Sundial

Dickens had a real sundial of his own which he described to his daughter in a letter of 11 June 1859 from his home at Gadshill, Higham-by-Rochester:

My Dearest Mamie,

One of the balustrades of the destroyed old Rochester bridge has been (very nicely) presented to me by the contractor of the works, and has been duly stone masoned and set up on the lawn beside the house. I

have ordered a sun-dial for the top of it and it will be a very good object indeed.

The combination is illustrated above though we do not know from whom Dickens ordered the actual dial. Mrs Gatty tells us “The sun-dial stood in the garden at Gadshill, and after the death [in 1870] of the novelist was bought by Mr. Crichton, of Rochester.” Further, Alice Morse Earle, in her 1902 book *Sundials and Roses of Yesterday*, says that the dial was later sold in London for the sum of £50. An article in the *Pittsburg Press*, 14 February 1899, gives more details “There is offered for sale by a curiosity dealer in London the old sun-dial and stone column formerly the

property of Charles Dickens. The column is inscribed [probably by Mr Crichton]: ‘These relics, from Gadshill place and old Rochester bridge are placed here in sincere regard for Charles Dickens.’ Dickens considered it one of his most valuable treasures and placed it in the most prominent position in his garden.”

Where is it now?!

At least one recent sundial has been set up to honour Dickens. In the December 2012 *Bulletin*, John Foad showed a cube dial at Restoration House, Rochester, which is known as ‘Miss Havisham’s house’.

John Davis

A PALIMPSEST GNOMON

JOHN DAVIS

Brass has always been a relatively expensive metal so there has long been an incentive to recycle unwanted brass items into other forms. For some artefacts, the best solution is often to melt down the material and to re-cast it into another shape but, for artefacts in the form of engraved brass plates, a cheaper method is simply to turn the plate over and engrave the reverse face with its new function – a palimpsest. Sundials can come under this consideration as either the first or the second use of the plate. For the former case, we can point to the horizontal dial recycled as the lock plate on a church door in Sydenham.¹ For the latter, one example of sections of a monumental brass from a medieval tomb re-used to make a seventeenth-century dial was described in the *Bulletin* by Andrew James.² Now, a second example has come to light.

The fragment seen in Fig. 1 was reported to the Portable Antiquities Scheme in 2003.³ It was found in a field in the parish of Cockfield, Suffolk, by a metal detectorist. It is 3.8mm thick and is pictured with the original edge of the monumental brass at the bottom. The inscription is part of a date, probably the date of death for the owner of the tomb on which it would have been placed. According to the Field Liaison Officer who recorded the find, it can be interpreted as [mccc]cxx vij, *i.e.* 1427. The online description refers to the diagonal cut as being “45 degrees” but a simple measurement shows that it is actually 52°, very close to the latitude of 52° 10' N at which it was found, thus suggesting that the sundial for which the gnomon was made has not travelled far.



Fig. 1. The two sides of the metal detector find SF-71BFE4. Photos courtesy of the British Museum’s Portable Antiquities Scheme.

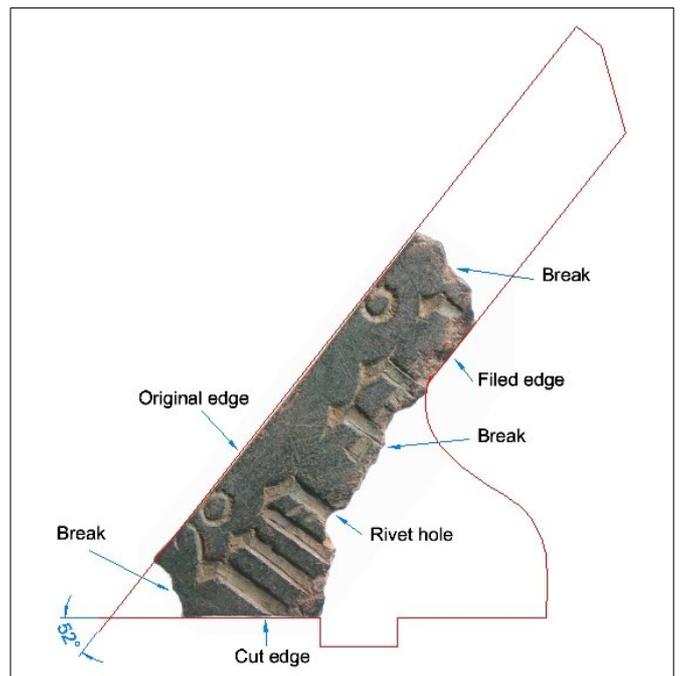


Fig. 2. Conjectured incorporation of the find as part of a gnomon for a horizontal sundial.

The straight bottom edge of the brass would not have allowed for any material to form a fixing of the gnomon to the dial plate so instead it is suggested that it was made as the style edge with a tenon having been cut from the bulk of the material, along the lines depicted in Fig. 2. The other cut and filed edge, running parallel to the style, would then form the underside of the gnomon ‘tail’.

There are two principal periods when material from monumental brasses became available for other uses. One was during the dissolution of the monasteries in the 1530s and '40s. The other was during the Civil War period. A Parliamentary Ordinance of 28 August 1643 stated that “all Monuments of Superstition and Idolatry should be removed and abolished”, specifying: “fixed altars, altar rails, chancel steps, crucifixes, crosses, images of the Virgin Mary and pictures of saints or superstitious inscriptions.” The form of the Latin inscription on brasses was particularly repellent to the iconoclasts, causing them to be defaced or removed. William Dowsing (1596–1668) was a notorious local Puritan, born in Laxfield, Suffolk, who, appointed ‘Commissioner for the destruction of monuments of idolatry and superstition’ visited over 250 churches in East Anglia and

caused much destruction to their artefacts.⁴ It seems quite likely that he was involved in some way with the ‘liberation’ of the brass used for this gnomon.

We do not know the dates when the sundial was made and then subsequently lost, or the circumstances. The former probably occurred in the 17th century, soon after the brass became available, but the latter could have been at almost any time since. The possibility that there are other palimpsest sundials waiting to be found must be quite high and an incentive to keep looking.

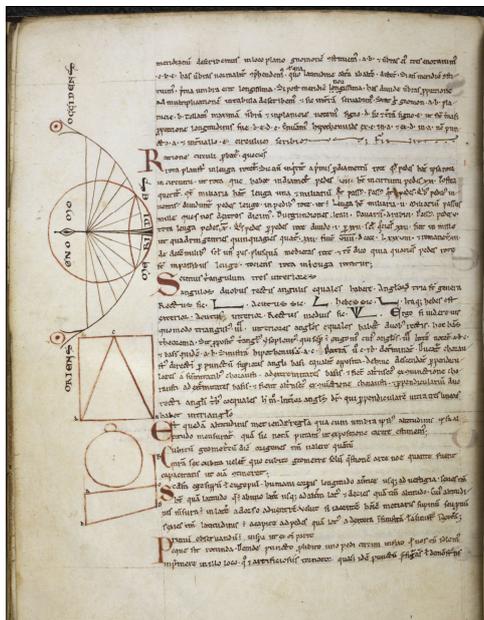
REFERENCES and NOTES

1. C.St.J.H. Daniel: *Sundials*, Shire Books, Princes Risborough (2004). The door-lock sundial at Sydenham church, Oxfordshire, is illustrated on p.4.
2. A. James: ‘A Happy Ending: The Preston Gubbals Sundial’, *BSS Bull.*, 20(ii), 144-147 (Sept. 2008).
3. The Portable Antiquities Scheme (www.finds.org.uk) is run by the British Museum. The fragment described here is on the PAS database as SF-71BFE4, categorised as a fragment of a monumental brass.
4. http://en.wikipedia.org/wiki/William_Dowsing.

john.davis@btinternet.com

A 12th-CENTURY MANUSCRIPT INDIAN CIRCLE DIAGRAM

JOHN DAVIS



While searching an old manuscript in the British Library for an illustration for Mario Arnaldi’s new monograph *De Cursu Solis*, I happened on this marginal drawing in the codex BM Royal 15 B IX, f. 68v. I have not seen it reproduced in any modern dialling treatise. At first sight, it looked to be a very early drawing of a ‘scientific’ horizontal dial but the angles of the lines are not appropriate. Mario quickly recognised it as a diagram for the ‘Indian circles’ method¹ of establishing a meridian line.

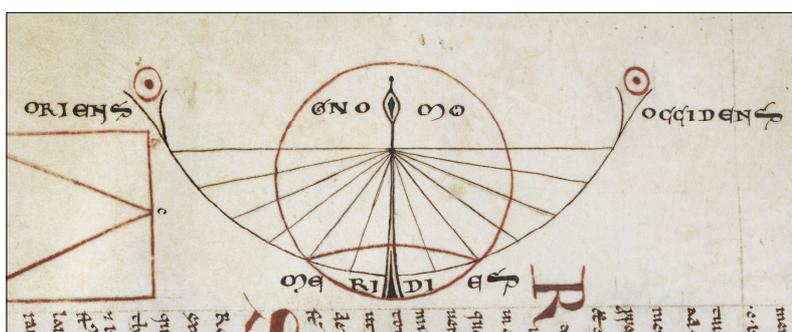
The codex contains a collection of scientific texts, including material from Boethius, Hermannus Contractus and, here, Gerbert of Aurillac (c.946–1003) on geometry and mathematics. The section is mainly on the construction of a celestial globe, though the Latin text has not been transcribed and translated (a challenge!). It is written in very small script on vellum and is dated by the BL to the end of the 12th century. At one time it belonged to John Dee, astrologer/scientist in Queen Elizabeth’s court. The sketch is nicely drawn and labelled. The abbreviation for ‘gnomon’, combining the final ‘N’ with the ‘O’, is especially neat.

The ‘Indian circle’ method of finding South by measuring equal altitudes of the sun before and after noon is very much older than this document, being used by Vitruvius and the Venerable Bede, amongst many others. This version shows its continued practical use through the Middle Ages.

Images courtesy of the British Library.

REFERENCE

1. Hugh McCague: ‘The Method of Equal Altitudes or the Indian Circle’, *BSS Bull.*, 19(iv), 164–172 (Dec 2007).



THE DUNCRAGGAN STONE

ALASTAIR HUNTER

A sundial stone inscribed with the date 1666 was found some twenty years ago at a place called Duncraggan on the southern edge of the Scottish Highlands, lying in a pile of rubble. Its owners were intrigued by its history, if it was genuine, and whether it could be restored. They approached the BSS, and subsequently Macmillan Hunter, on these points. This article completes the story, with grateful acknowledgement at the end to the several contributors.



Fig 1. The Duncraggan stone, showing sundial hour lines and numerals with date 1666.

INVESTIGATION OF THE STONE

Visual Examination

The stone is marked out as a sundial with hour lines, half hour marks, and numerals and it carries the date 1666 (Fig. 1). The gnomon slot was found empty except for remnants of lead packing. The stone is a piece of carved sandstone about 25 cm square and 4 cm deep with a rebate round the underside. The hour lines run clockwise showing that it is a horizontal rather than a vertical sundial.

An immediate question is whether the sundial is genuinely as old as 1666, or is it more recent, or even a modern piece. The form of the numerals with '6's having a tail wrapped to the right is not unlike styles of writing in the 17th century. And the numerals face inwards rather than outwards, unlike today's sundials. The lettering appears irregular in places, primitive even, and suggests amateur work. The '8's have rather a weak form like two 'O's one above the other. Some

letters appear to have been re-cut; the '2' completing the '12' seems squashed into place, the '4's might be modern. Recent scratch marks seem to have been used to pick out parts of the detail.

The top surface of the stone is pitted and worn away in shallow hollows, the surface falls off towards the edges, and all corners and edges are worn or damaged (Fig. 2). The surface wear looks like weathering by wind, rain and the four seasons over long periods; quite reasonably this could have been over three and a half centuries. Although the stone was found in a heap of rubble, all of the carved, worn and damaged surfaces are weathered; none is fresh or very recent.



Fig 2. Indications of wear on the stone.

Original Location

Duncraggan is an unlikely place to find a sundial. At least, it would be very unlikely to find an ancient sundial of the grand Scottish style in such a place because the surrounding land is extremely poor and wet, not the location for a substantial landowner in the seventeenth century building a large mansion house with pleasure gardens. Duncraggan is a croft, at that time offering an eked-out subsistence living from the land supplemented with fishing in the river and lochs. Situated 10 km west of Callander in Stirlingshire, it is quite close to the Trossachs, which did not become famous until two hundred years later when Queen Victoria opened Glasgow's new water supply at Loch Katrine in 1859. The 1666 date of the sundial, however, is not unreasonable when compared with the 1630 date of the earliest and grandest of Scottish sundials at Drummond Castle, 30 km to the east.

The stone is characteristic Scottish sandstone very likely to be from Kingoodie quarry, Invergowrie, next to Dundee, 80 km to the east of Duncraggan. The colour and flakiness of the stone are distinctive from that quarry. Similar sandstone from Alloa, near Stirling, has more pink in its colouring. This does not explain why a small stone sundial came to be found where it was, but it does suggest that at some time in its history it was taken from one place to the other. One clue might come from the hour lines; for example were they made for the latitude of Dundee?

Analysis of Hour Lines

A pencil tracing of the hour lines showed up well enough to be transferred to computer and overlaid with precise lines drawn in at calibrated angles using computer graphics (Fig. 3). In case this method relied too much on judgement by eye, the study was repeated using a photo of the sundial instead of the tracing (Fig. 4). A further cross-check might have been to analyse the half hour marks, but this was not done. The two sets of hour line angles were then compared with calculated hour line angles for several latitudes. If the hour lines matched a particular latitude it would provide additional information on the design location of the sundial.

The latitude of Edinburgh, 56° N, was used as a reference. If the hour lines matched a latitude north of Edinburgh, the

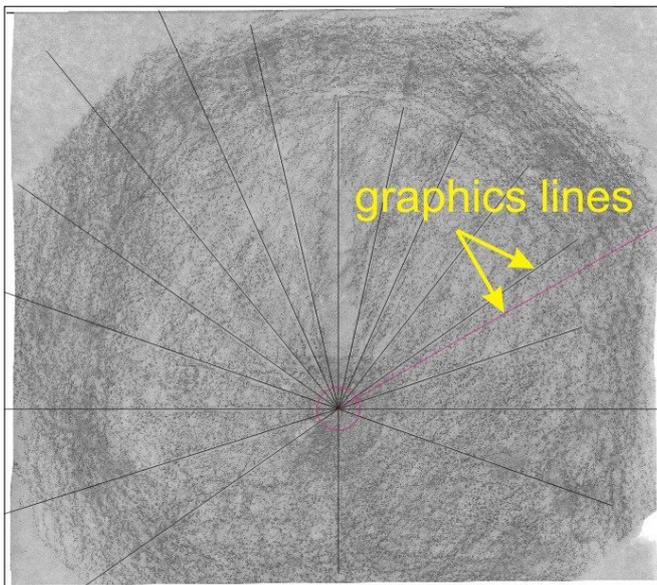


Fig 3. Pencil tracing of the dial surface after transferring to computer graphics and overlaying precise hour lines at known angles.

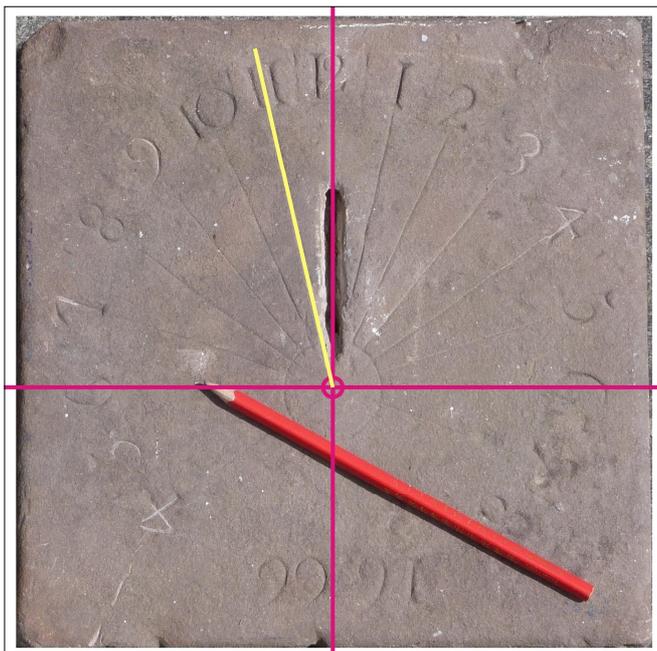


Fig 4. Photo of the dial surface after transferring to computer graphics showing reference hour lines (red) and 11am hour line (yellow).

sundial might be said to be in its home territory, but if they matched a more southerly latitude it might be far from home. To cover the whole of Britain equally, the other latitudes were 51° , 53.5° , and 58.5° , shown in Fig 5. In this graph, the hour line angles obtained from the tracing and from the photo are consistent with each other and, surprisingly, they match latitudes in the broad range 51° to 53.5° . They do not match 56° and they do not indicate that the design was for any latitude higher than 56° . The design appears to be for somewhere from Yorkshire southwards.

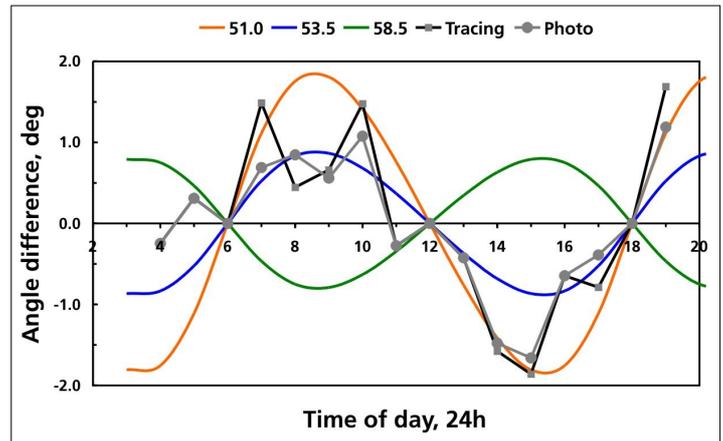


Fig 5. Analysis of hour line angles as a difference from computed angles for latitude 56° —angles derived from tracing and photo of the stone compared with angles for latitudes 51° , 53.5° & 58.5° .

Laboratory Analysis

Another aspect of the sundial that might indicate its history would be the material the gnomon was made from. If it was iron and any fragments remained they could be analysed and might be characteristic of a particular era. But, as mentioned above, the gnomon slot was empty. The residual lead packing at the bottom of the slot did show the imprint of a gnomon plate but did not contain any metal fragments. The gnomon, or the last gnomon fitted, must have disappeared, perhaps broken or knocked out or fallen out.

In order to prepare the stone for fitting a new gnomon, all the residue needed to be cleaned out of the slot, and this was carefully kept. Apart from the pieces of lead, the rest appeared to be dust but this was actually a mixture of iron with sand from the sandstone, which could be separated using a magnet (Fig 6). These fine particles were sub-millimetre in size, as revealed by electron microscope (Fig. 7). The presence of iron was confirmed by its definitive X-ray signature (Fig. 8). The residue material is still available for further examination, if it is of interest.

RESTORATION OF THE SUNDIAL

Design of New Gnomon

Because of the plain design of the sundial stone, a plain design of gnomon seemed suitable. A simple triangular flag was chosen (Fig 9). This needed to fit accurately into the existing slot in the stone and to provide for secure fixing. The design drawn up for manufacture had an oversize



Fig 6. Entire residue recovered from the gnomon slot, separated as iron, sand, and lead particles—the iron was separated by magnet.

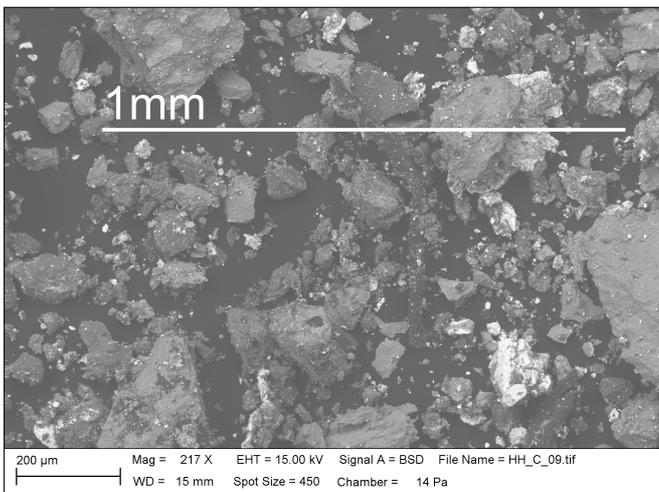


Fig 7. Sample of mixed fine particles of mainly iron and sand displayed as back scattered electron (BSE) image, shown against 1mm size scale.

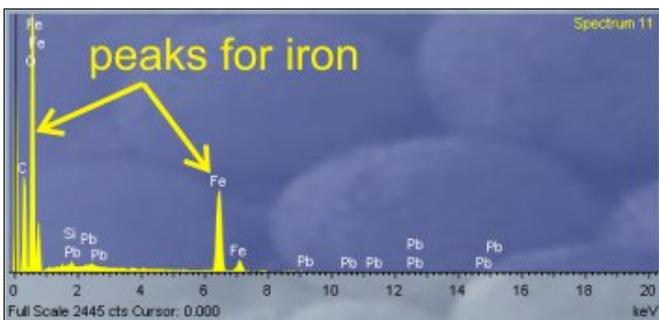


Fig 8. Energy dispersive X-ray (EDX) analysis of a single particle showing a definitive signature for iron.

flange, for final fitting after it was machined. The gnomon angle (style height) was made 53° , consistent with the hour line analysis explained above.

Stainless steel and brass were offered as choices for the gnomon material, in either case to be sandblasted leaving a dull finish rather than a polished one. The material chosen was brass. The gnomon was cut out by CNC machining.

Fitting the Gnomon

The gnomon flange was fitted by hand to go exactly into the slot, which had an irregular shape. Because the sundial

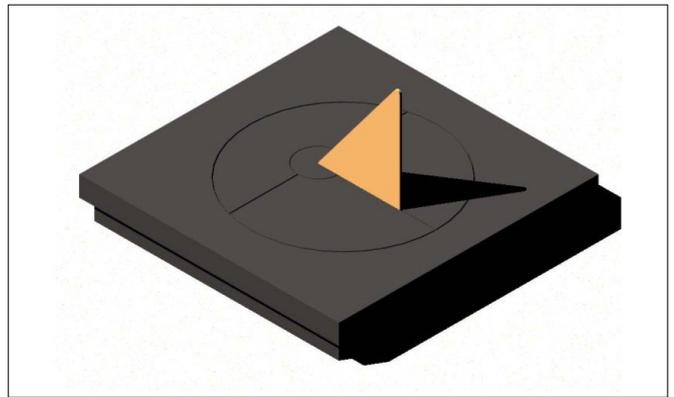


Fig 9. Chosen design of new gnomon for the stone.

stone was not strong, at only 4 cm thick, and because of its flaky sandstone layers, the slot itself could not be cut to fit in case the stone broke or split apart. For the same reason, a proprietary lime mortar type of mix was selected for fixing the gnomon, in a colour to match the stone. Packing with lead would risk splitting the stone (even though it had been done before), and a modern resin bond would be strong enough to split the stone if the gnomon was hit or forced by accident at a later date. Instructions for setting the gnomon correctly were provided (Fig 10).

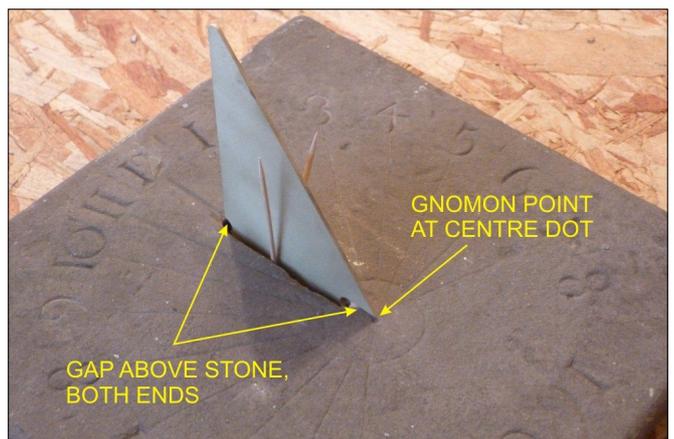


Fig 10. The new gnomon machined in brass and sand-blasted, with instructions for setting it into the stone.

The finished sundial has a pleasing look (Fig. 11) and the gnomon proves to have been correctly set (Fig. 12).

Discussion

The restored sundial now provides a very satisfactory working timepiece with historical associations for its owner to enjoy in their garden. The inscribed 1666 date, the seventeenth century epoch of developing the art of stone sundials in Scotland, the curled but basic style of carved lettering, and the worn and weathered stone coming from a Scottish quarry, all point to a genuine item of three hundred and fifty years old. Over its long lifetime some of the sundial lettering may well have been re-cut where it had become worn away. It is not exceptional for the Museums of Scotland to receive requests for advice on small sundial stones. In fact, sundials do appear as a subject in school textbooks of the period, so amateurs did make sundials for themselves

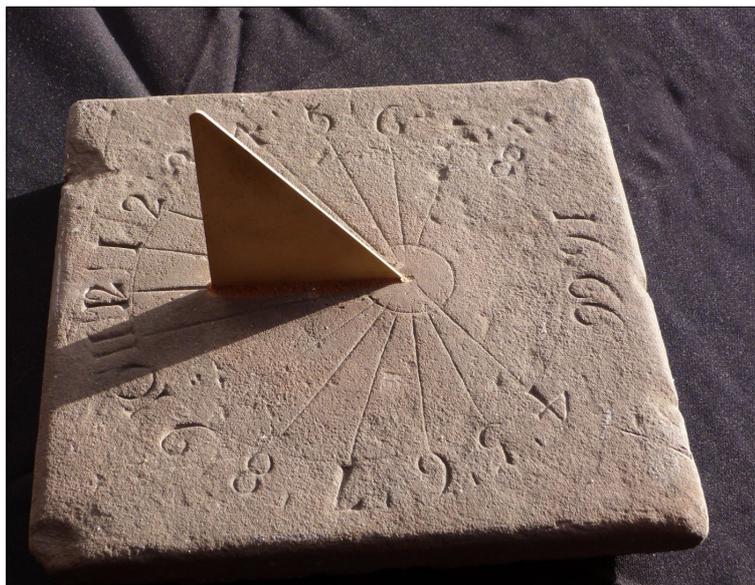
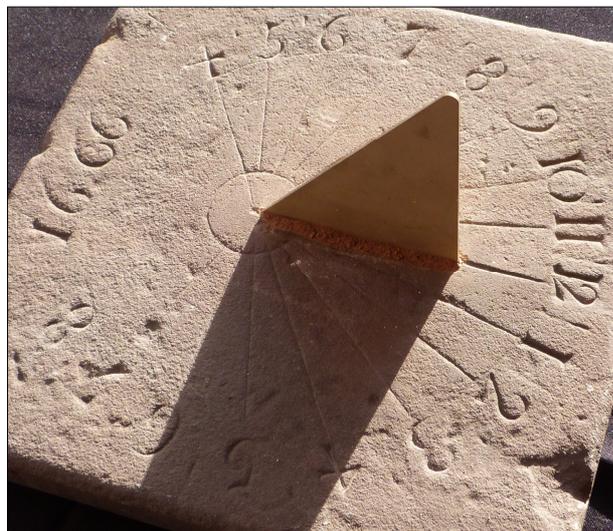


Fig. 11. Restored sundial reading 10am.

Fig. 12 (above right). Gnomon position at the sundial origin verified by shadow along 6pm hour line.



as well as skilled masons who made them for their employers. The apparent inconsistency between the south latitude of the design and the Scottish location for the stone may simply be that the hour lines were copied from another example or from a book. The location at Duncraggan could be where the sundial's owner from some more recent time had moved to live. The decision to use brass for the gnomon is appropriate today, although long ago the choice would have been iron.

Conclusions

The small sundial stone inscribed with the date 1666 found at Duncraggan in the Scottish Highlands appears to be a quite genuine example of work from that period. Characteristics of the lettering, the quarry stone, and the weathering, all support the reckoning that it is three hundred and fifty years old. It is probably amateur work, which was not uncommon at the time. Its design may have been copied from another example or from details in a book. The sundial is now restored with a new brass gnomon and the owner intends to install it in their garden.

ACKNOWLEDGEMENTS

Responding to the original enquiry, our Chairman Frank King in consultation with fellow BSS members, advised on the 1666 date for the stone. Alison Morrison-Low, Principal Curator of Science at the National Museums of Scotland, Edinburgh, advised on the characteristics of stone sundials in 17th century Scotland and on education about sundials at that time. Staff at the Mineralogy Department, Natural History Museum, London, carried out laboratory analysis. Nick Sweeney, stonemason with wide experience of restoring historic stonework in Scotland, advised on sundial restoration.

Alastair Hunter is a retired engineer from Edinburgh. His interest



DC Thomson & Co Ltd.

in sundials was triggered five or six years ago when he thought he would like to have one in his own garden. He looked at what was available but didn't see any he liked, so he decided to design his own.

His idea was to take the ancient technology of the sundial and use it to create

something with a cutting-edge contemporary design. His Macmillan Hunter range of sundials went on display in 2012 for the first time, at both The Chelsea Flower Show and Gardening Scotland. He is currently working on a number of bespoke designs for home and overseas, doing restorations, and giving talks to local societies. He can be contacted at sundials@macmillanhunter.co.uk.

Frank King wins the Sawyer Dialing Prize

The Sawyer Dialing Prize is awarded annually by the North American Sundial Society for services to sundialling. The 2012 Award was to our own Chairman, Frank King, and the citation states that it was "in recognition of his innovative mathematical and astronomical solutions to problems encountered in the modern design of notable sundials".

The prize, a glass Spectra sundial delineated for Cambridge, with details of the award and with the motto ΖΗΘΙ (which is the Greek for *Life!* and is also the numbering on some Greek sundials) was presented at the NASS Conference in August 2012. For his acceptance talk, Frank gave a version of the paper *See Naples and Dial – An Italian Job* which he gave at the BSS Conference earlier in the year.

One of the nice features of this international prize is how it has been won for so many different aspects of dialling—making dials, mathematics and computing, teaching, historical research and so on.



Roger Bailey

JD

THE DIALS OF MIDDLE VERDON

MIKE COWHAM

Travelling through Provence in France last summer we came across a nicely painted dial at the town of Castellane. Its inscription puzzled us as it was written in Provençale. It reads “Lou Souleu es Jamais tant bèu, qu’un Jour monte s’encaminan” and it was dated below MMVII. As the dial was on the local Tourist Office building we went inside (open on a Sunday morning!) to see if they could give us a translation of this inscription. The lady there was very helpful and led us outside to show us a plate on the wall below the dial with the relevant details. It even translated the inscription into English: ‘The Sun is never as beautiful as when you get started’. Reading the rest of the plaque we saw that this was just one of 19 dials in the area, most of which were modern and made around 2007, a special local project. Another visit inside the office produced a leaflet showing the Dial Trail of the region – ‘la Route des Cadrans Solaires’.



Fig. 1. The dial at Castellane. ‘The Sun is never as beautiful as when you get started’.

Unfortunately we were travelling towards our next night’s stop but we decided to see some of the dials on our route.

Below most of the dials we found an information plate explaining the features of the dial and translating its inscription. It also showed a map of the Moyen Verdon region with all of the dials marked and a table for the Equation of Time with longitude corrections for that village.

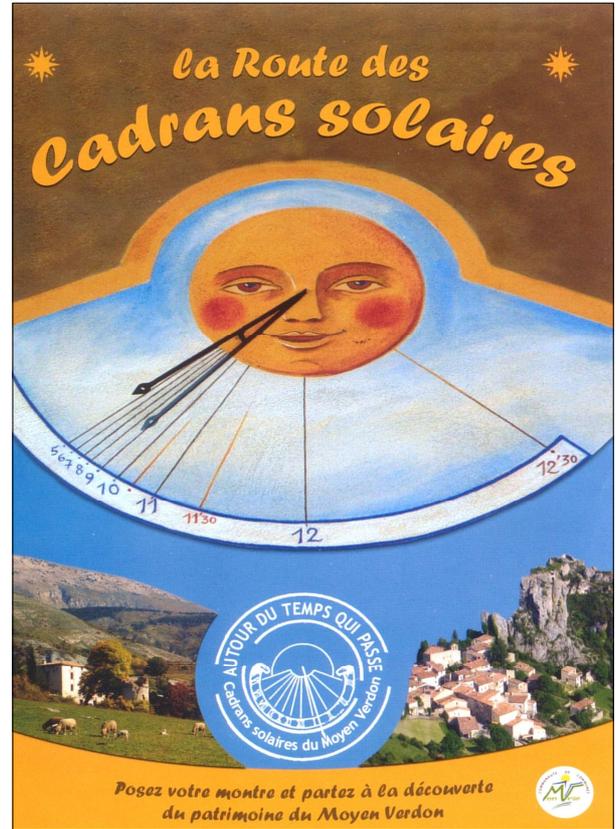


Fig. 2. Dial Trail leaflet of the Moyen Verdon region.

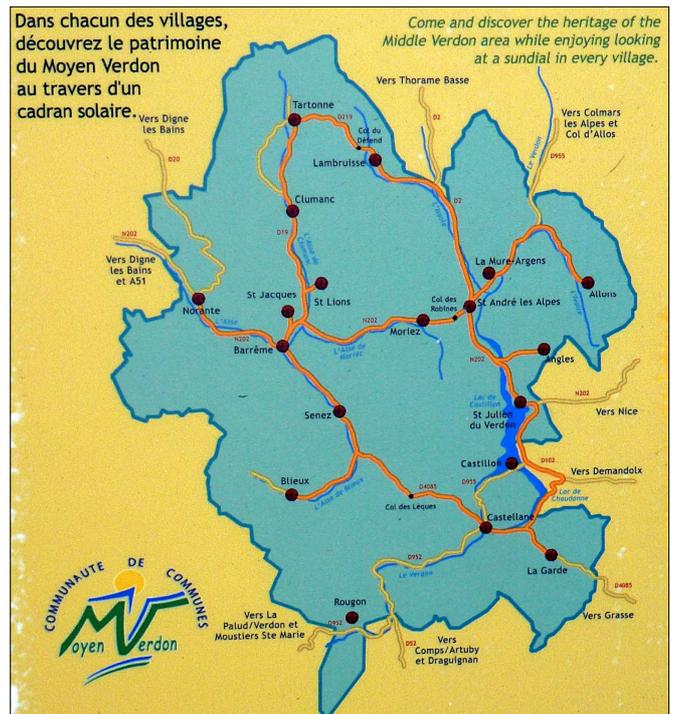


Fig. 3. Map of the dials on a plaque below each one.

Castellane

LATITUDE 43° 51' N LONGITUDE 6° 31' E
Exposition de la façade : 18° 14' O

Ce cadran a été réalisé selon des techniques traditionnelles de décor à la chaux
This sundial has been decorated using the traditional methods of lime pigment

Ce tableau indique le temps à rajouter à l'heure solaire observée sur le cadran pour obtenir l'heure légale à tout moment de l'année.
This panel indicates the time you must add to the solar time observed on the sundial in order to obtain the official time at any time of the year.

Période	janvier	février	mars	avril	mai	juin
1 ^{er} > 15	0 h 37'	0 h 48'	0 h 46'	1 h 38'	1 h 31'	1 h 32'
16 > 30/31	0 h 44'	0 h 48'	0 h 43'	1 h 34'	1 h 30'	1 h 35'
Période	juillet	août	septembre	octobre	novembre	décembre
1 ^{er} > 15	1 h 38'	1 h 40'	1 h 34'	1 h 24'	0 h 18'	0 h 23'
16 > 30/31	1 h 40'	1 h 38'	1 h 29'	1 h 20'	0 h 19'	0 h 30'

Fig. 4. Equation of Time details near the Castellane dial.

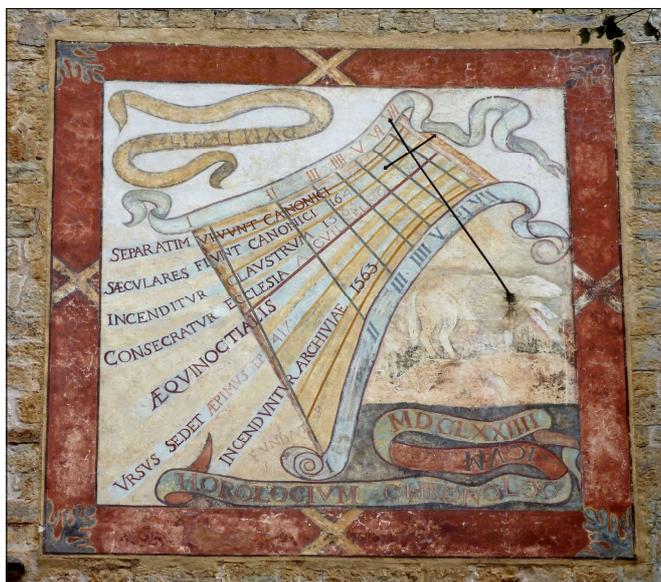


Fig. 5. Early painted dial at Senez.

The first dial that we came to was a very interesting and early dial painted on the west end of the 'cathedral' at Senez, a small village accessed across a very narrow bridge over a small gorge. This ancient building was interesting in its own right but the dial, obviously repainted several times, was particularly interesting. The date on this dial was shown as MDCLXXIII (1674) and it has some local happenings inscribed for various dates, such as "INCENDVNTVR ARCHIVAE 1563", presumably a devastating fire where the local archives were destroyed. It also has a gnomon in the form of a cross, so the time and dates are read from the shadow at the intersection of its two arms. The gnomon root is attached to the dial in the centre of an image of a lamb.

The next village on route was Barrême where the dial was painted on the Mairie. At the top is Napoleon's hat. He visited Barrême on 3 March 1815, hence the date quoted and not the date of the dial. At its lower left corner is depicted a distillery and in the centre a shell as the region is famous for its fossils.



Fig. 6. Dial on the south face of the Mairie at Barrême. 'You are just passing, you know it.'

After Barrême we decided to see two nearby dials before continuing our journey. The first was at Saint-Lions, a small village where the dial was mounted on the south side of their small church. This dial shows a lamb and a chicken with a large blue globe representing a coral reef.

The other nearby village of Saint-Jacques has its dial mounted on the east side of the Mairie. Unusually, this dial has no inscription but does show some local emblems, trades and a building.



Fig. 7. Dial at Saint-Lions. 'O time, suspend your flight, and you propitious hours, suspend your path'.



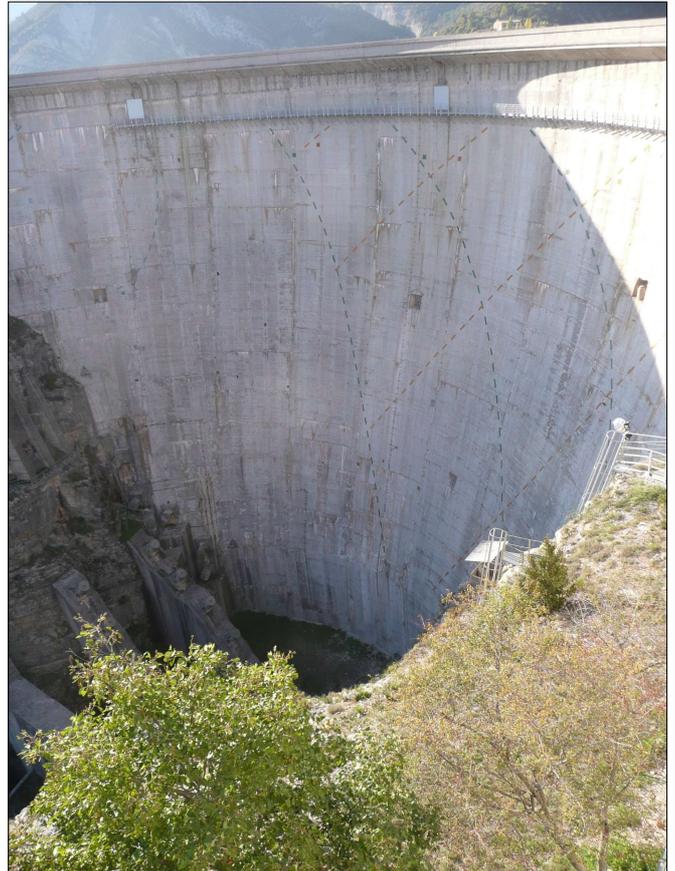
Fig. 8. Dial at Saint-Jacques.



Fig 9. Dial at Chaudon-Norante. 'The Hour passes Slowly: The Year passes Quickly'.

Our final stop was at the village of Norante (or Chaudon-Norante). This attractive little dial is mounted over a window on the south side of the church. We did not find the information plate but were able to get its inscription translated by Denis Schneider.

Having returned home after our trip the Moyen Verdon leaflet was studied and it seems that we missed what is probably the most important dial of the area. This dial is reputedly the 'largest sundial in the World' and is marked on the south side of a local hydroelectric dam at Castillon. The leaflet gives a small image showing the rim of the dam creating a shadow onto the vertical face which is marked with hour lines. It was delineated by Denis Savoie and Roland Lehoucq on this EDF dam and installed in 2009.



Figs. 10 & 11. Castillon Barrage with dial markings across it; details of the hour lines in the lower picture.

The area is certainly worth a further visit, and we plan to do this next summer.

I thank Michel Lalos for kindly supplying the two photographs of the Castillon Barrage.

For further details see:

http://michel.lalos.free.fr/cadrans_solaires/autres_depts/alpes_04/verdon/barrage_castillon.html

mike@brownsover.orangehome.co.uk



AN UNUSUAL GEOGRAPHICAL SUNDIAL

IAN BUTSON

The Geographical Sundial

Whilst visiting Norfolk recently, an interesting horizontal sundial was found in the churchyard at Brandiston, as shown in Fig. 1.



Fig. 1. General view of the sundial at Brandiston.

This unusual brass sundial is fitted with a star-shaped disc which is free to rotate beneath the gnomon as shown in Fig. 2. The disc, which is divided into 24 segments, has the names of various geographical locations around the world inscribed in longhand lettering in a number of the segments. By setting a reference marker fitted on the disc against the local time at Brandiston, the time at the distant locations may then be read-off from a separate scale engraved around the sundial plate. The contemporary names of the few distant locations established so far would suggest that the dial was possibly constructed during the latter part of the 1700s or the early 1800s. The dial plate is also inscribed "W B Fecit", the initials perhaps of a local clockmaker. In other respects the sundial is quite conventional, indicating the time from 4am to 8pm, with the hours being sub-divided down to 5 minutes.



Fig. 2. Sundial showing the star-shaped disc at its centre.

Rotatable Disc

The disc is allowed to rotate freely around a boss fitted centrally to the dial plate as shown in Fig. 3. The boss also provides the fixing points for the two side support brackets for the gnomon.

Of similar material to that of the main dial plate and 6 inches in diameter, the disc is divided into twenty-four 15° sectors, each of which terminates at a point. On one of the points of the star a small stud is fitted, perhaps as a reference point and also perhaps as an aid to assist in its rotation. The metal at the lower edge of the gnomon plate has been cut away to allow this stud to pass freely beneath. Within each of the 15° sectors geographical locations are hand-inscribed, but not all are fully legible.



Fig. 3. Disc fitted around the central boss of the dial plate.



Fig. 4. Points on the disc aligned with numerals on the dial plate.

An inner ring, marked in Arabic numerals, is inscribed on the dial plate, adjacent to and correspondingly aligned with the star points on the rotating disc, as shown in Fig. 4. It is divided into 24 hours, with each hour being sub-divided into half- and quarter-hour divisions. It is also numbered in two similar halves. Starting from the gnomon 'toe' point and moving in a clockwise direction, it is marked from 0 to 12, to end at the gnomon 'heel' (noon) point.

Similarly, again moving in a clockwise direction around the dial plate, but from 0 at the noon point, the numbering finishes at 12(0) at the gnomon toe point. On the WEST side of the dial plate, between 6 and (6.30), the letters "MOR" (Morning?) are inscribed by means of punch-marks, as shown in greater detail in Fig. 5. On the EAST side of the dial plate, "EV" (Evening?) is inscribed between 6 and (6.30).

Possible Method of Operation

The rotatable disc is adjusted such that the point fitted with the reference stud is set against the local time at Brandiston. The time at the various distant geographical locations



Fig. 5. Details of the markings on the western side of the dial plate, with the reference stud also visible.

1	--- ttain
2	(Lettering illegible)
3	Constantinople
4	Arabia Rusia
5	(Lettering illegible)
6	(Lettering illegible)
7	(Lettering illegible)
8	(Lettering illegible)
9	--- Phillepines islands
10	Japan -hon New Guinea
11	New Brittan
12	(Lettering illegible)
13	(Lettering illegible)
14	South Sea
15	South Sea
16	--mtmown Lands
17	Australia?
18	(Lettering illegible)
19	flo ---
20	Jamaica Philadelphia ---
21	(Lettering illegible)
22	(Lettering illegible)
23	(Lettering illegible)
24	--- Maderia

Table 1. Place names on the disc. The Reference Stud is at position 1. Each point has one, two or three lines of text.

as shown in the marked segments may then be indicated directly from the adjacent time scale as shown on the dial plate.

Locations and Lettering on the Star Disc

As the surface of the disc is rather worn, dirty and corroded by the action of bird-droppings, only a few of the locations have been identified so far, but it is hoped that more may be positively established. The lettering that has been possible to identify is shown in Table 1. The list commences from the reference stud, noted here as 1, and moves around the sectors of the disc in a clockwise direction. An example of the lettering is shown in Fig. 6.

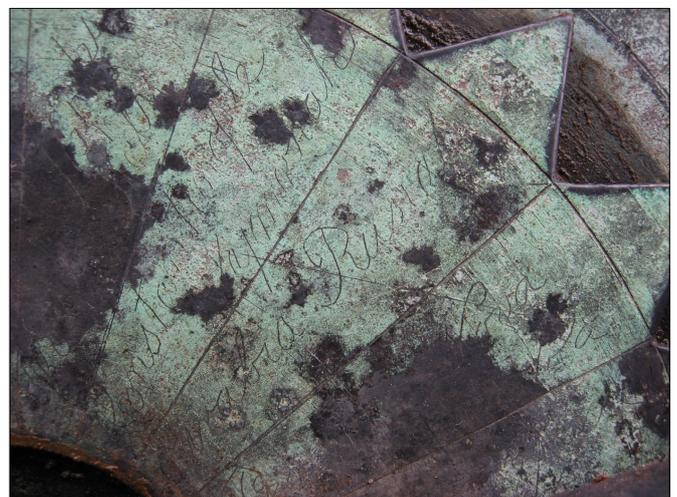


Fig. 6. Locations as inscribed in sectors 3 and 4 of the disc.

Conclusions

Brandiston church is now under the care of The Churches Conservation Trust and investigation of the church and parish records at the Norfolk Records Office made no mention of the sundial or of its provision. The very small rural village of Brandiston is located about 10 miles to the north-west of Norwich, but only about 4 miles from the small town of Aylsham. Reference to *Norfolk and Norwich Clocks and Clockmakers*, edited by Clifford and Yvonne Bird (1996), notes a **William Barber** being apprenticed to Matthew Read at Aylsham about this period. As the two locations are so close to each other perhaps it is possible that WB could in fact be William Barber.

Research continues in an attempt to establish the date and maker of this dial. Any information from members who

may know of dials having similar features would be very welcome to assist in discovering more about this interesting, and possibly unique sundial.

Before retirement, **Ian Butson** was a commissioning engineer, and subsequently a manager, with British Telecommunications. He is actively involved in recording sundials and mass dials in East Anglia and the south-east area of the country. He is currently organiser for the Society's Photographic Competition and was co-author of the BSS Monograph, *Sundials in Museums of the British Isles*.

His other interests include the organisation of and active participation in amateur radio orienteering and direction-finding contests. He can be contacted at ian@tipsdial.orangehome.co.uk.



An Interesting Scottish Slate Dial

This rather interesting slate sundial has appeared in a recent Tesseract catalogue.¹ It is signed "Pat Robertson 1821" and is a sturdy 13 $\frac{3}{4}$ " (35 cm) square and 7/8" (2.2 cm) thick.

The most striking thing about the dial is its copper-alloy gnomon, prominently pierced with the figures "57 $\frac{1}{2}$ " which is presumably the intended design latitude, though the gnomon angle has actually been measured as 56°. This method of labelling the gnomon is thought to be unique. The piercing also includes the compasses and square sign normally regarded as Masonic, although the bent legs of the compasses, which look to be original, could possibly be a coded message or just a stylistic feature. The gnomon has a set of four integral button feet cast into it which suggests the maker had access to a reasonable foundry and was not just an amateur.

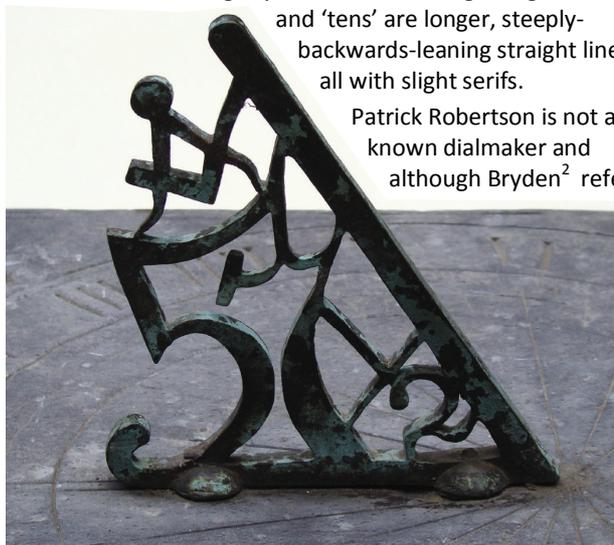
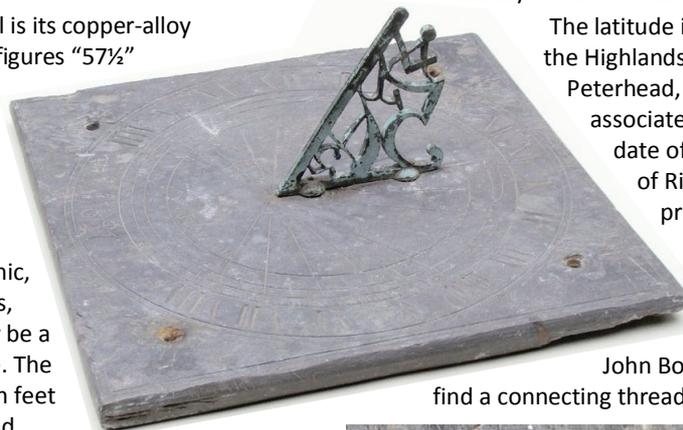
The dial is delineated from IV am to VIII pm, divided to 5 mins. Each hour is labelled with a fascinating system of simplified Roman numeral shapes: 'ones' are straight vertical lines, 'fives' are shorter slightly-backwards-leaning straight lines, and 'tens' are longer, steeply-backwards-leaning straight lines, all with slight serifs.

Patrick Robertson is not a known dialmaker and although Bryden² refers

to a maker/seller of instruments with this name working in Edinburgh in 1778, it is such a common Scottish name that it could well be another man as makers of slate dials were usually not mathematical instrument makers.

The latitude indicates somewhere in the Highlands, perhaps Inverness or Peterhead, neither particularly associated with slate dials. The date of 1821 is before the arrival of Richard Melville, the most prolific of all the slate dialmakers, in Edinburgh. Scotland did have some history of slate dials before that, notably by

John Bonar, but it is difficult to find a connecting thread or link.



Photos and information courtesy of Dr David Coffeen.

REFERENCES

1. Tesseract—Early Scientific Instruments. www.etsesseract.com, email mail@etsesseract.com.
2. D.J. Bryden: *Scottish Scientific Instrument-Makers 1600–1900*, Edinburgh (1972). See p.18, n.88.



BOOK REVIEW

De Cursu Solis – Medieval Azimuthal Sundials. From the primitive idea to the first structured prototype

by Mario Araldi. ISBN 9780955887260. BSS Monograph No. 10. A4, soft covers, vi + 58pp, 55 b&w illustrations. £10 + p&p from BSS Sales (also available from the author, marnaldi@libero.it, for €13 + p&p).

Expanded from the author's three articles (in Italian) in *Gnomonica Italiana*, this treats an area of early dialling likely to be rather unfamiliar to most readers, not least because very little physical evidence survives. Those few stones which may be relevant (in England Aldbrough, Coates, Darlington, Orpington ...) are enigmatic and have been relocated; so our knowledge is derived from instructions, sometimes unclear, contained in a handful of surviving contemporary manuscripts. The author's recent discovery of another of these manuscripts, in the University Library of Darmstadt, has led to this work.

Before readers of the *Bulletin* dismiss the idea of a treatise discussing, comparing and relating a series of medieval Latin texts and diagrams as altogether too forbidding for them to enjoy, I would like to stress that this monograph is surprisingly readable; although necessarily and quite properly scholarly, it is also approachable and can definitely be appreciated by an interested non-specialist.

The author sets the scene with the introduction of the gnomon in classical times, and especially the treatments by Vitruvius and Pliny of its use to determine favourable orientation; but these were not for timekeeping.

In chapter 2 we see that the path of the sun, *cursus solis*, was of interest not only for timekeeping during the day but equally or more so as its annual circuit defined the seasons. The interrelation of the changing directions of sunrise and sunset with changing length of the day allowed a primitive assessment of time from the Sun's direction or azimuth as was shown circa 700 AD in St Willibrord's *horologium*.

Chapter 3 introduces azimuthal sundials from the perspective of the small group of known manuscripts. Seven, in Latin, date from the 10th or 11th to 13th centuries; there is also a letter written by Gerbert of Aurillac in 989. The author also discusses one of two later Arabic manuscripts, which appears to relate to the same tradition. The descriptions lead to similar but differing constructions, and although we can see that from a modern perspective all are fundamentally flawed, they provided instructions for reproducible sundials which, though inexact by modern standards, could have been very useful at the time.

These nine sources are analysed in chapter 4 (supported by transcriptions, translations and further discussions of the relevant parts in Appendices A to E), with tabulation of points of commonality, agreement and difference, and study of errors apparent to the modern diallist. Starting from the premise that an older, more complete, tradition was the source of these written instructions, with generations of copying with incomplete un-

derstanding, as well as attempts at improvement resulting in inconsistencies, the author seeks to establish what such a common origin might have been. To this end he discusses the 'climates' (roughly, latitudes) for which the instructions given in the manuscripts would be appropriate, and examines certain linguistic peculiarities in the texts.

The eight appendices are in total considerably longer than the four chapters of text. Each of the first four is devoted to transcription, translation, and discussion of an individual manuscript. Next the author similarly treats four MSS, which he considers particularly closely related, as a group; all have drawings of a sundial, though with differences.

Appendix F, "The Climates", gives a very useful summary of the medieval and earlier understanding of latitude in terms of bands or *climata*, related to the length of day at the summer solstice, a key concept in the construction of sundials as described in the manuscripts. Two tables compare the views of four classical and three medieval authors. The latter still relied on the geographers of antiquity for many place-names listed which are now little-known, and a list of modern equivalents would have helped the non-specialist; a map could also have been informative.

"The Day-length Formulae" describes how the simple rule of Martianus Capella, originating in Egypt, and its variations were widely used to give the length of the day in each month.

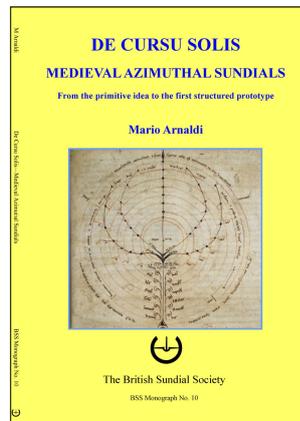
In the last Appendix, "The Calendar", the relationship between calendar months and zodiacal months is examined. Modern readers may take this for granted, but in the Middle Ages there was some confusion, particularly in view of the slow shift of the Julian calendar, eventually corrected by the Gregorian improvements. Bede's calendar is discussed in some detail as is the implication of the alternative months for the calendar scales of sundials.

Finally there is a bibliography of some sixty titles; many are likely to be unfamiliar to most readers of the *Bulletin*.

A few quirks of translation and misprints have slipped past the editor, but nothing that seriously detracts from the content. At times some background knowledge – for example Roman dates (Calends, Ides *etc.*) – is taken for granted, though nothing the enquiring reader will find it too difficult to obtain. Apart from that referred to as *KAR*, we are not told the dimensions of the MSS or the diagrams, which would give more of a 'feel' of the originals to the vast majority of readers who will never see them. Diagrams from those manuscripts which have them are reproduced, but not all very clearly; perhaps several largely blank pages could have been used for larger illustrations.

However, these are minor details as the transcriptions and translations of the texts provide all that most readers will require, and it is the author's deductions from them and his reasoning that form the core of this work. Quite apart from the dialling aspects, in this dedicated scholarship we may all be usefully reminded how painstaking, now just as a thousand years ago, can be the quest for knowledge, how much more difficult its transmission then was, and how precarious has been its survival from age to age; and we may gain a little more insight into that remote time.

Andrew James



DIAL DEALINGS 2012

MIKE COWHAM



The quantity of dials offered by auction houses and by dealers in 2012 was relatively low but a few very interesting ones were still to be seen. Many of these seemed to go for sums well in excess of their auction estimates. Some of the more interesting dials sold are detailed below. Where auction prices are quoted these include the premium but not VAT.

Christie's, South Kensington, Travel, Science and Natural History, 25 April 2012

Several dials were to be found in this sale but the one of most interest was a double horizontal dial by Elias Allen, c.1640. It was inscribed "This Diall belongs to the Garden at Eastwell Park in Kent". It was 12½" diameter and was thought to have a replaced gnomon. Estimated £1,500–£2,000 it sold for just £1250.



Fig. 2. Horizontal dial by John Cuff.



Fig. 1. Double horizontal dial by Elias Allen.

Also in the sale was an interesting garden dial, 12" diameter, by a little known maker John Cuff, working in London 1731–1770.¹ It was made for a latitude of 50° 30'. It sold for £475.

Charles Miller, Maritime and Scientific Models, Instruments and Art, 25 April 2012

Several dials were offered in this sale including a double horizontal dial, also by Elias Allen, but its gnomon had been replaced with an ordinary type gnomon. The dial that was perhaps the most interesting was an early ivory diptych

dial by Johann Gebhart of Nuremberg, dated MDL (or 1550). It had the usual scales for such a dial including on its lid an equatorial dial that is used tilted, being supported by an arm against the latitude scale on the underside of the lid. A pin gnomon is then inserted to show the time in equal hours on the top in the summer and underneath in the winter. The scale for winter is the lower one of the two in the illustration, the upper one being used with the now missing string gnomon. Also on the lid is a list of 18 towns with their latitudes.

The dial sold for £6,600, its top estimate being £4,000.



Fig. 3. Ivory Diptych Dial by Johann Gebhart, 1550. (Right) Face A.

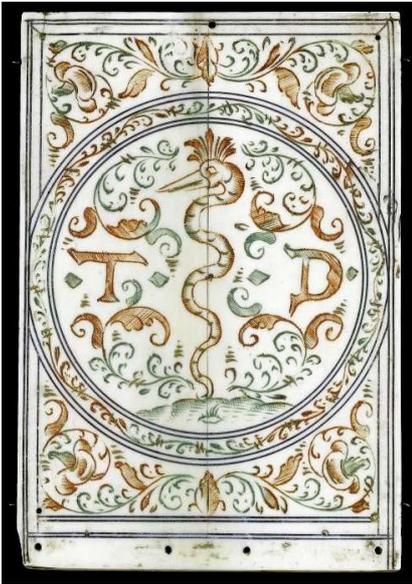


Fig. 4. The lower lid with the initials of Thomas (Ducher) Tucher.



Fig. 5. The lid of the dial with a windrose.



Fig. 7. Ivory triptych dial by Thomas Tucher.



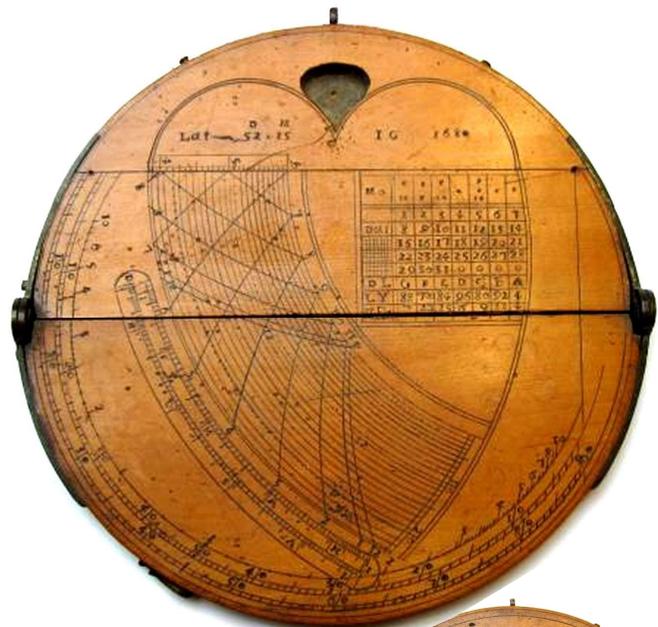
Fig. 6. The underside showing the cavity for the instruction manual.

Also in the sale were two quadrants. The first was a folding wooden disc signed simply I G and dated 1680 for Lat - 52D - 25M. It is almost identical to a quadrant illustrated in my book *A Dial in Your Poke*² differing in just a few details such as the cavity near the top for storing the plumb bob. It also has an interesting inscription on the outside "Valentine Green's Q^t". This interesting quadrant sold for £10,150, it having an estimate of £4,000–£6,000.

Bonham's, Knightsbridge, 3 May 2012

A rather unusual ivory diptych dial was sold, actually not a diptych but a triptych, it having three hinged leaves. Such dials are very rare. This one is by Thomas Tucher of Nuremberg and was also of quite a large size being 12 × 8 × 2 cm. The upper half of the dial is fairly standard with a horizontal dial for three latitudes and two Italian hour scaphe dials (24 hours beginning at sunset) both virtually identical but one labelled WELSC VHR for 45° and the other PEMISC VHR for 49°. The vertical leaf has a pin gnomon dial showing hours and day lengths, and a short list of towns with their latitudes. On its underside is a cavity fitted with a lid that would originally have housed a printed table of latitudes and an instruction manual.

Estimated £6,000–£8,000 it sold for £15,000.



Figs 8 & 9. Folding wooden quadrant by 'I G' dated 1680, with the inscription on the outside of the quadrant.



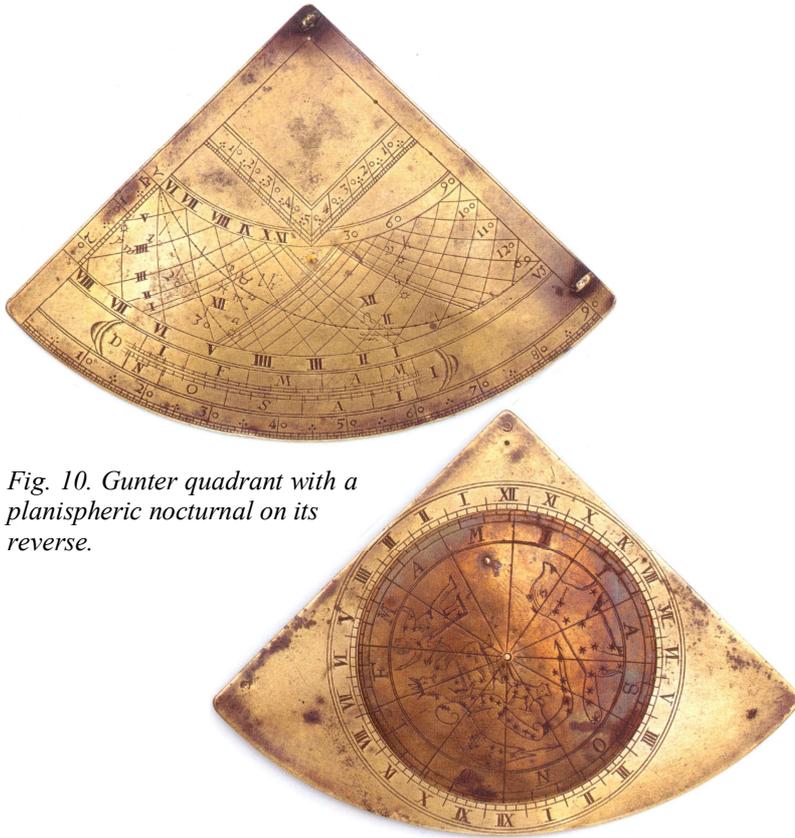
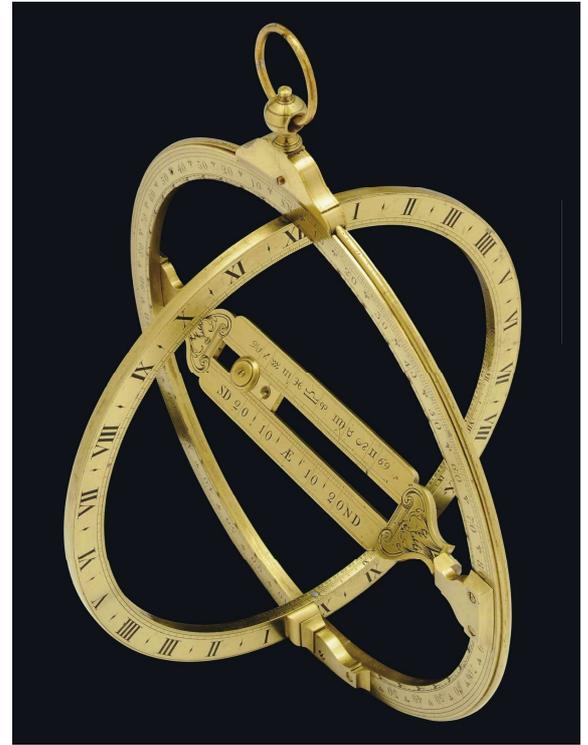


Fig. 10. Gunter quadrant with a planispheric nocturnal on its reverse.



Figs 11 & 12. Large ring dial by Benjamin Cole with detail of hour and minute markings inside the ring.

The other quadrant was a fairly standard Gunter quadrant in brass, unsigned and probably from about 1700, with a planispheric nocturnal on its reverse.

Estimated £1,500–£2,000 it made a healthy £4,750.

Christie's, South Kensington, Travel, Science and Natural History, 9 October 2012

In this sale was a fairly large universal equinoctial ring dial by Benjamin Cole (mid eighteenth century). The outer ring was about 8" diameter. Because of its size it was calibrated with each two minutes of time, making it a rather precise timekeeper. On the inside of the inner ring, where the spot of light falls, it was engraved with the hours and minute numerals for each 10-minute division, each of these divided by five to show down to 2 minute intervals.

Estimated £5000–£8000, it sold for £10,625 including premium.

Bonham's, Edinburgh, 24 October 2012

An interesting Butterfield type dial by Sautout-Choisy of Paris was sold in this sale. Unlike most Butterfield dials, this one was oval, being 56 mm in length. Pierre Sautout-Choisy was working in Paris from about 1682 and before 1714



Figs 13 & 14. Oval 'Butterfield' type dial in silver by Sautout-Choisy of Paris, c.1700. The reverse shows the latitudes of 20 towns.

at the Quai de l'Horologe.³ Its main outer ring was made for 50° with inner scales for 45° and 40°. On its reverse are inscribed the latitudes for 20 European towns. The dial made £2750 including premium.

Bonham's, Knightsbridge, 14 November 2012

An interesting ivory cased dial by Edmund Culpeper, dated 1701, was sold, it being a type not normally expected from him. It is in a round ivory case, with a folding gnomon. It is signed on the chapter ring: Edm. Culpeper Fe^t. and also at the centre of the paper compass card: Edm. Culpeper at ye (*crossed dagger symbol*) in Moorefields Loⁿ. The compass needle is interestingly marked with an N (actually backwards) at the North end.

This fine dial sold for £5625.

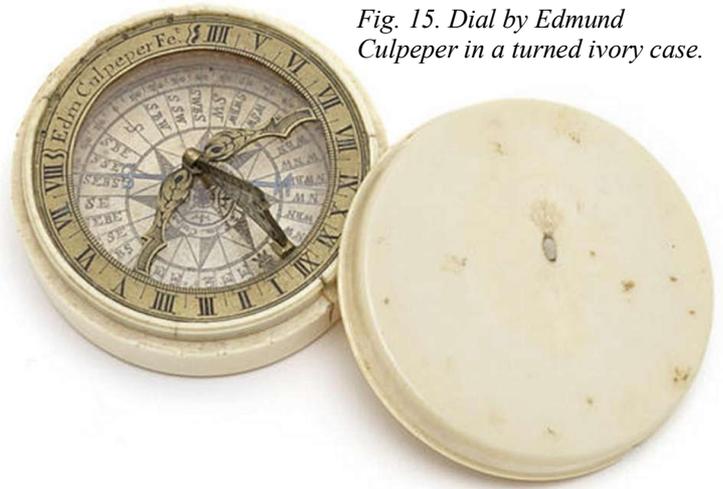


Fig. 15. Dial by Edmund Culpeper in a turned ivory case.



Figs 16 & 17. Backward 'N' indicating North and the signature on the compass card of the Culpeper dial.

REFERENCES

1. G. Clifton: *Directory of British Scientific Instrument Makers, 1550–1851*. Zwemmer (1995).
2. M. Cowham: *A Dial in Your Poke*, (Second Edition). Cowham (2011).
3. F. Marcelin: *Dictionnaire des fabricants français d'instruments de mesure du XV^e au XIX^e siècle*. Marcelin (2004).

ACKNOWLEDGEMENTS

I would like to thank: Christie's South Kensington for Figs. 1, 2, 11 & 12; Charles Miller for Fig. 3; Bonhams, Edinburgh for Fig. 13 & 14 and Bonham's, Knightsbridge for Figs. 4–10, 15–17. These remain their copyrights.

READERS' LETTERS

Grave Concerns About the Future of the Society's Reference Library

After the last AGM closed one member asserted that no one had visited the Society's reference library in Nottingham for ten years. There was no time to challenge this incorrect statement in the few minutes remaining before the final lunch. The member asked that the Council appoint an independent person to advise on the Library's future: the Chairman said that Council would consider the matter.

Members should be aware that the value, merits and cost effectiveness of the BSS Library Collection were discussed in detail by an earlier Council as recently as March 2011. The unanimous conclusion was that the Library is an important affordable asset fundamentally supported by the Objects of the Society. It advertises the Society and is available to the general public and therefore is a vital part of our Public Benefit provision required by the Charity Commission. It is one of only a few collections of general dialling material, books and ephemera publicly available for research in the UK, and it only costs less than 38p per member per annum (1% of a typical subscription). So it cannot possibly represent a significant drain on the

Society's annual income and therefore the overall cost of the Library cannot be an issue.

We are concerned because the present Council is attempting to count the visitors to the Society's collection with the implication that this reflects the viability of the Library. It would be ludicrous to assess the worth of any Reference Library simply by its apparent usage because the number of visitors is quite irrelevant to the library's importance and research potential. Measuring visitor traffic demonstrates both an ignorance of the process of academic research and the very practical difficulty of discovering which specific books anybody actually refers to in any library. We can find no examples of academic reference libraries being measured for their importance and viability by simple measures of footfall.

The extraordinary assertion of 'no visitors' is quite untrue. Although there have been relatively few, there have been visitors to the BSS Collection in the last ten years. Indeed, the Council itself (including the complaining member!) has until recently met at the library annually and on each occasion Trustees have referred to the collection. Numerous BSS members, some from abroad, Bromley House

members and the general public are known to have accessed the collection. The BSS Librarians are frequent visitors. The Bromley House Trustees appreciate the association with the BSS and have expressed it recently in a generous allocation of space in the prestigious Thoroton Room. They believe that Bromley House with its rare meridian line and scientific past is a very appropriate location for a Sundial Library which also complements their other collections.

Members are also reminded that at no cost the Society also maintains other Reference Collections namely the *Mass Dial Archives* at York University and the *Fixed Dial Archives* in Kent. Neither of these unique sets of national records has ever had any significant number of visitors. Are these Collections also candidates for disposal?

Many of the important (and valuable) books in the BSS collection are there only due to the generosity of certain members who specifically wished to share their private collections with others. Therefore the BSS Collection cannot be dispersed without impediment. Many of these donors would wish to have their books returned rather than see them sold to add to the excess of uncommitted funds held by the Society.

There is no issue of cost, there is no issue of space, the Society is very far from bankrupt, its reserves rise even as membership decreases, the Library and Archives bring nothing but benefit, may we suggest that the Council should avoid this distraction and focus its energy and attention on more urgent projects which develop and reinforce our Society?

Nick Orders *Graham Aldred*
Patrick Powers *Gerald Stancey*
 Nick Nicholls

North-facing Mass Dials

I was delighted to read Jackie Jones's article on north-facing scratch dials down in Sussex [*Bull.*, 24(iv), p.22]. We have at least two in this area. One is on Cherington (Warks.) parish church; the other is on the old chapel of St Polycarp at Blackwell (Warks., formerly Worcs.) which has been a cottage since it was closed and sold in the days of Henry VIII.

It is simply not true that north walls are 'sunless'; there are wide swathes of time, from sunrise to early mid-morning and from early evening to sunset, around mid-summer, when the north wall basks in sunlight. Many Moderns will miss the morning swathe – Mediaevals would not have done.

There is therefore no reason why such dials should not have been constructed. Indeed, a recent *Bulletin* article¹ describes and partially illustrates a double-sided Roman scratch dial (as I would call it) which recognizes this very principle. The further south, or north, one goes the more useful it becomes.

The two declining north-facing dials are even more intriguing. For marking an early or late service time, plausibly;

they would certainly 'work'. How could they do otherwise with nothing to check them by?



One query: looking down from above, would their gnomons have been as in (a) or in (b)? Either would 'work' – the latter is more 'scientific' by a whisker but would a mediæval mind have sussed it? On scratch dials like those in (a) the notional noon line would not be vertical: it would not even be constant. On dials like those in (b) the notional noon line would be both vertical and constant. Furthermore, the other hour lines could readily be declined (they would open up around noon and cluster towards the horizontals) so that their readings would agree with those of an ordinary direct scratch dial. I doubt, however, that such technology was applied; it would be a little like installing a 'sat nav' in a traction engine!

Reference

1. J. Bonnin: 'Timekeepers in Britain, 43–780 AD', *BSS Bull.*, 22(iii), 37–8, Fig. 4 (Sept 2010).

Peter Drinkwater
Shipston-on-Stour

Thomas Boleyn's Slate Sundial



This small (7" square by ¼" thick) slate horizontal sundial in a private collection was found in the ruins of a Pembrokeshire mansion once owned by Sir John Perrot (d.1592), a favourite of Queen Elizabeth I. Although dated 1610 its style, with the origin in the plate centre and without a noon gap, it has echoes of the previous century. It is very early for a slate dial.

The name on the dial, presumed to be the first owner, is Tho: Boleyn and the coat of arms, blazoned as *azure, a chevron gules, three bulls' heads sable*, is indeed that used by Anne Boleyn when she was created Marchioness of Pembroke. Anne's father was Thomas but presumably this one is several generations later. Most unusually, it has the initial letters of the tinctures engraved on it. Clearly the maker was unaware of the standard method of rendering them with various hatchings.

The dial has two mottoes: a standard sundial one of *Vt hora, sic vita*, particularly appropriate for this family, and an heraldic one of *Now Thvs* belonging to the elder Thomas Boleyn.

John Davis

A SHORT TRIP TO CANADA FOR SUNDIALS

VALERY DMITRIEV

In the summer of 2012 I made a short trip to Canada, visiting two cities – Montreal and Toronto – and saw some curious sundials which I would like to describe.



Fig. 1. The equatorial dial at Montreal Planetarium.

In Montreal my attention was drawn to the Planetarium where two works of art are located in front of the building – an equatorial sundial and a replica of the Monument to Polish astronomer Nicolas Copernicus. The equatorial sundial (Fig. 1) was executed by the Dutch artist Herman J. van der Heide. On its base is a plaque which carries the following inscription “To the Citizens of Montreal/ Fraternally,/ The Citizens of Rotterdam/ 325th Anniversary/ of the Foundation/ of Montreal/ May 17 1642–1967”. Unfortunately, it must be reported that the dial has a badly misaligned gnomon, rising above the horizontal at an angle of about 60° – far too high for the $45^\circ 30'$ latitude of Montreal.



Fig. 2. The monument to Nicolas Copernicus at the Montreal Planetarium.

The original of the monument to Nicolas Copernicus was created in 1822 by the Danish sculptor Bertel Thorvaldsen and established in 1830 in Warsaw. A plaque affixed to the concrete base of a replica (Fig. 2) reads as follows: “NICOLAS COPERNICUS/1473-1543/ FOUNDER OF MODERN ASTRONOMY/ PRESENTED BY THE POLISH-CANADIAN COMMUNITY/ ON THE OCCASION/ OF THE CANADIAN CONFEDERATION CENTENNIAL/ AND THE MILLENIUM OF CHRISTIAN POLAND”. Again, with regret I report that the monument has lost the armillary sphere which could be seen on old photos.

It was interesting to visit the Stewart Museum which possesses a significant collection of antique sundials. The Curator and Head of Collections, Sylvie Dauphin, was very kind and allowed me to see not only the sundials which were on display in the Museum, but also the storehouse exhibits. It was a pleasure for me to handle and study in detail dials of the 17th and 18th centuries. Here some English-made examples of the Museum sundial collection are shown: in Fig. 3, by Hilkiah Bedford in Fleet Street for George Pope, 1675; Fig. 4, George Adams, 1775; and Fig. 5, by Henricus Sutton, London, 1661.



Fig. 3. In the Stewart Museum storeroom with a Hilkiah Bedford analemmatic double dial.

Fig. 4. A very unusual dial by George Adams (the younger). [It is a form of equatorial dial with a declination scale on the right-hand upright, so it is like an early form of Gunning heliochronometer. Ed.] Photo courtesy of the Stewart Museum.





Fig. 5. A low-latitude compass dial by Henry Sutton.

Not far from Montreal, there is a modern, stainless steel dial, made by J. Serge Dion in 2008, located in the Port of Quebec, (Fig. 6).



Fig. 6. The large modern dial in the Port of Quebec.



Fig. 7. With NASS members Jean and Paul Lapp and my friend Jorge Cobos.

It is worth noting that there are two sundial societies operating in Canada: the North American Sundial Society (NASS) and La Commission des Cadrans solaires du Québec. Unfortunately, I was unable to meet André E. Bouchard, the general secretary of the sundial society of Quebec province. But in Toronto I met Paul Lapp – one of the

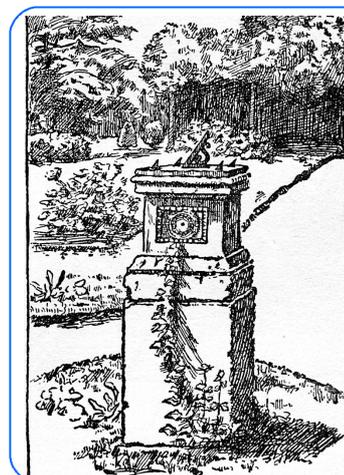


Figs 8 and 9. At Toronto University – a substantial equatorial dial and a meridian line.

earliest members and founders of NASS. His history of Canadian sundials was very interesting for me (Fig. 7).

At Toronto University there is a well-made sundial for TORONTO TIME (Fig. 8) with an associated meridian line (Fig. 9). An inscription on the pedestal reads: “Fabrication of the sundial was made possible through funding by the Class of 4T3 Applied Science and Engineering University of Toronto to commemorate the Fiftieth Anniversary of its Graduation and the Bachelor of Applied Science Degree, 1993”.

sundials_spb@mail.ru



An illustration from Henslow's *Ye Sundial Booke*, pub. 1935, with the drawings by D. Hartley, c.1913.

It purports to show a sundial at Cookham, Berks, with a design that looks very much like the multiple slate dials of Richard Melville.

The only dial shown in Cookham by the *BSS Register* is a vertical – what happened to this one?

A HOLOGRAPHIC SUNDIAL

JOHN DAVIS

Optics Letters is not the sort of journal where one would normally look to find designs for new types of sundial. But in 1990 a team of scientists at the Dept. of Electrical and Computer Engineering, University of Colorado, USA, published an article entitled ‘Holographic sundial’.¹ In their abstract, they state: “A holographic sundial, to our knowledge the first sundial that does not use a gnomon [sic] or shadow-casting device, is designed and demonstrated. The accuracy of the device is measured and analysed.” Notwithstanding the fact that there are many sundial types which do not cast a shadow, ranging from dials using a sun ray to those using polarised light, there is indeed something novel in the proposed holographic sundial. (It is also noted that another article on holographic sundials was published by a different team later in the same year.²)

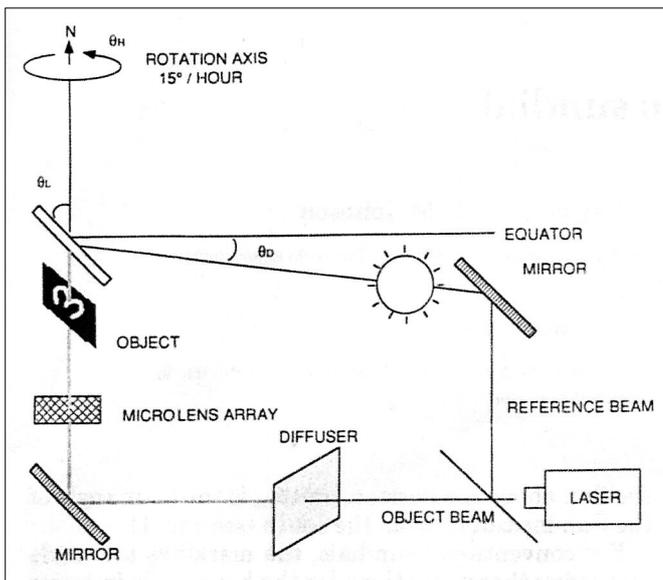


Fig. 1. Earth-Sun illumination geometry duplicated in the laboratory using the azimuth-altitude plateholder, which rotates about the vertical (north) axis in 5°, or 20 min, intervals. After Penland et al.¹

The sundial, which is a development of the lead author’s MSc thesis, is based on a normal equatorial design. The hologram, containing holographic images of the hour numerals, is placed at the gnomon angle and facing south. The device is thus very similar in operation to the digital sundial published in 1995 by Robert Kellogg and which uses a precision set of stacked shadowmasks to produce the hour indications, either by direct viewing or in a mirror.³ In Fig. 1, the arrangement for either viewing or for creating the holo-

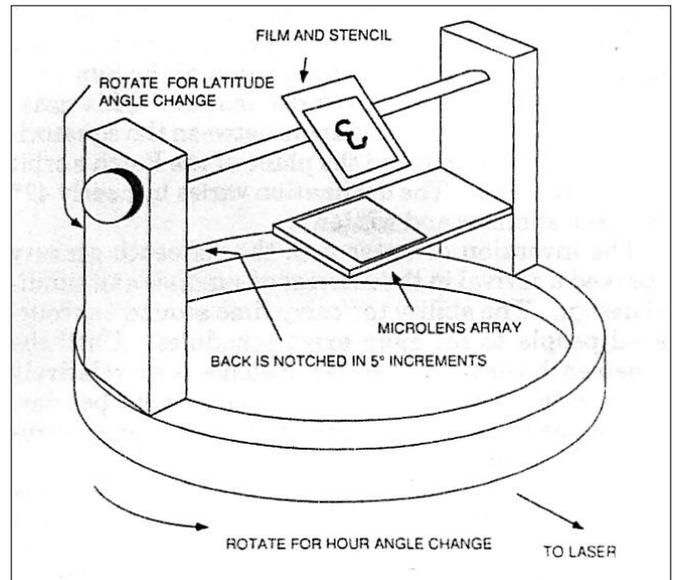


Fig. 2. The azimuth-altitude plateholder. After Penland et al.¹

gram is shown, using a simple He-Ne laser. When creating the hologram, the photographic film and the appropriate number stencil for the angular settings are mounted in the holder shown in Fig. 2. Multiple exposures allow the complete time range to be covered.

The article shows that the holographic sundial does work, which a resolution of about 20 minutes. The prototype devices were relatively limited in the time range they could indicate and also in their ability to handle the full annual range of the sun’s declination. These limits were related to the characteristics of the photographic film then available. One nice feature of the device was that the colour of the displayed numerals changes with the seasons. Nothing more on the device has been located since 1990 so the idea seems to have been a curiosity, much like the polarisation sundial.

REFERENCES

1. R. Penland, R. Cormack, J. Carsten, S. Sayhun & K.M. Johnson: ‘Holographic sundial’, *Optics Lett.*, 15(17), 929–931 (1990).
2. A. Gongora-T, R.G. Stuart: ‘Holographic Sundial’, *Applied Optics*, 10, 4751–4752 (10 Nov 1990).
3. R.L. Kellogg: ‘A Digital Sundial’, *NASS Compendium*, 2(3), 4–10 (Sept. 1995). A commercial version of the device is available at www.digitalsundial.com.



HONORARY OFFICIALS OF THE BRITISH SUNDIAL SOCIETY

Patron: The Hon. Sir Mark Lennox-Boyd

President: Mr Christopher St J H Daniel

Vice-Presidents: Mr David A Young & Mr Frederick W Sawyer III

COUNCIL MEMBERS

Dr Frank King 12 Victoria St CAMBRIDGE CB1 1JP	(Chairman & Restoration) Tel: 07766 756 997 chairman@sundialsoc.org.uk	Mr Chris H K Williams c/o The Editor	(Secretary) Tel: 01233 712550 secretary@sundialsoc.org.uk
Mr John Foad Greenfields Crumps Lane ULCOMBE Kent, ME17 1EX	(Registrar) Tel: 01622 858853 registrar@sundialsoc.org.uk	Mr Graham Stapleton 50 Woodberry Avenue NORTH HARROW Middlesex HA2 6AX	(Treasurer) Tel: 020 8863 3281 treasurer@sundialsoc.org.uk
Ms Jackie Jones 51 Upper Lewes Rd BRIGHTON East Sussex, BN2 3FH	(Membership Secretary) Tel: 01273 673511 membership@sundialsoc.org.uk	Mr Chris Lusby Taylor 32 Turnpike Rd NEWBURY Berks, RG14 2NB	(Conference Organiser) Tel: 01635 33270 conferences@sundialsoc.org.uk
Mr David Brown Gibbs Orchard, Sutton Rd SOMERTON Somerset, TA11 6QP	(2014 Anniversary Coordination) Tel: 01458 274841 2014@sundialsoc.org.uk		

SPECIALISTS

Dr John Davis Orchard View, Tye Lane FLOWTON Suffolk, IP8 4LD	(Editor) Tel: 01473 658646 editor@sundialsoc.org.uk	Mr Mike Cowham c/o The Editor	(Advertising & Safari) Tel: 01223 262684 ads@sundialsoc.org.uk
Mr A O (Tony) Wood 5 Leacey Court CHURCHDOWN Gloucester, GL3 1LA	(Mass Dials) Tel: 01452 712953 massdials@sundialsoc.org.uk	Miss R (Jill) Wilson Hart Croft 14 Pear Tree Close CHIPPING CAMPDEN Gloucs., GL55 6DB	(Biographical Projects) Tel: 01386 841007 biographical@sundialsoc.org.uk
Mr Dariusz (Darek) Oczki ul. Konski Jar 4/88 WARSAW Poland	(Webmaster) Tel: +48 512 259 629 webmaster@sundialsoc.org.uk	Mrs Elspeth Hill 4 The Village Stonegate Nr WADHURST East Sussex, TN5 7EN	(Sales) Tel: 01580 201720 sales@sundialsoc.org.uk
Mr J Mike Shaw 3 Millwood Higher Bebington WIRRAL, CH63 8RQ	(Newsletter Editor) Tel: 0151 608 8610 newsletter@sundialsoc.org.uk	Mr David Pawley 8 Rosemary Terrace Enborne Place NEWBURY Berks., RG14 6BB	(Newbury Meeting Organiser) Tel: 01635 33519 newbury@sundialsoc.org.uk
Mr Nick Orders 14 Gordon Rd Burton Joyce NOTTINGHAM NG14 5GN	(Librarian) Tel: 0115 9314313 librarian@sundialsoc.org.uk	Mr Ian R Butson 60 Churnwood Rd Parsons Heath COLCHESTER Essex, CO4 3EY	(Photographic Competition) Tel: 01206 860 724 photos@sundialsoc.org.uk

The British Sundial Society
c/o The Royal Astronomical Society
Burlington House
Piccadilly
London, W1J 0BQ

The Society's website is at www.sundialsoc.org.uk
The British Sundial Society is Registered Charity No. 1032530

