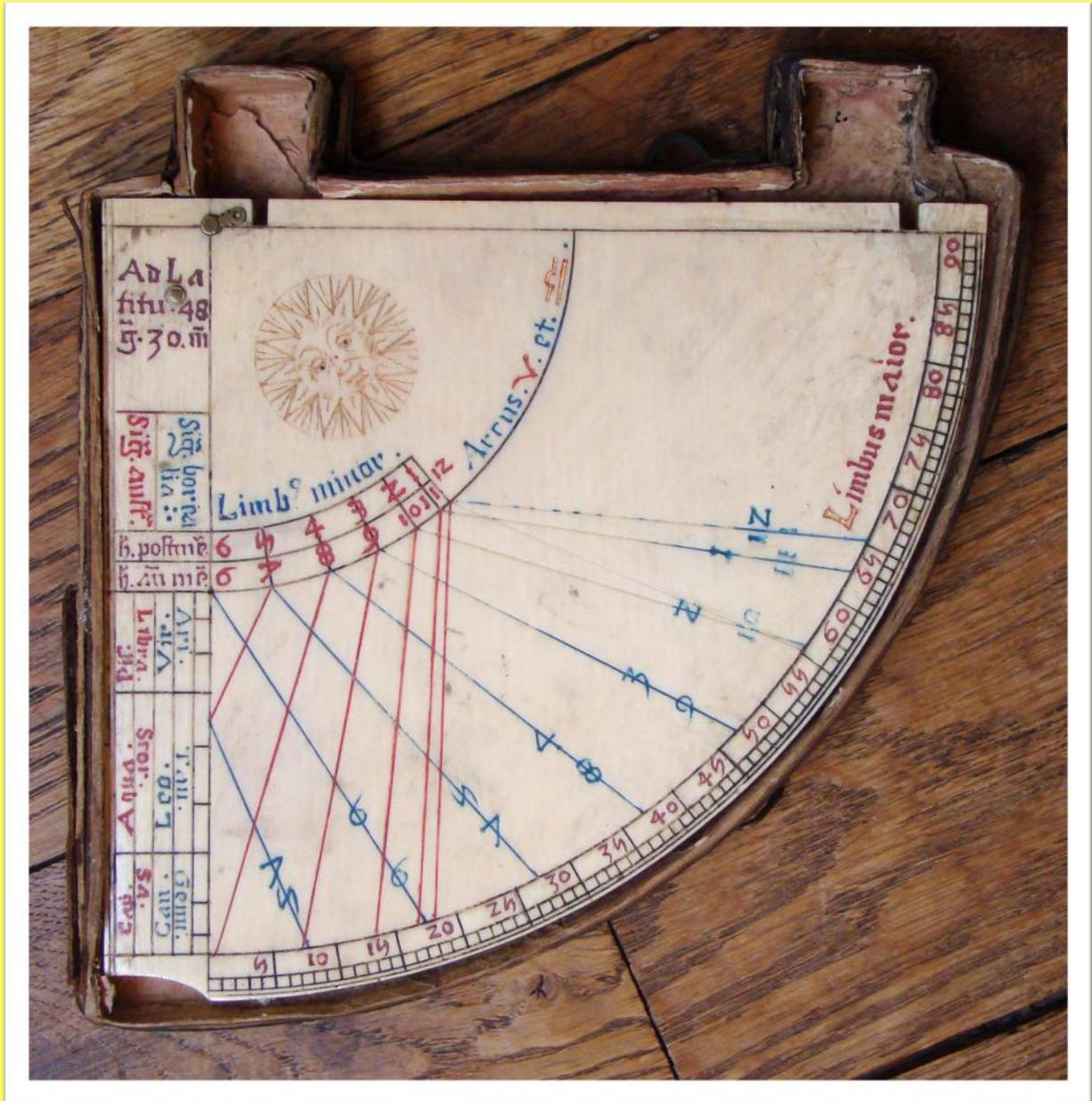


The British Sundial Society

BULLETIN



VOLUME 35(ii)

June 2023

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EDITORIAL

The April 2023 BSS Conference in Exeter was a particularly enjoyable occasion thanks largely to the organisational skills of Doug Bateman and the splendid hosting by Martin and Janet Jenkins: no one will forget the visit to their garden where there are sundials almost everywhere you look. The Conference talks were very much up to their customary high standard and our Andrew Somerville speaker was Stephen Johnston from the History of Science Museum in Oxford. A full report on the Conference and the bus tour is included in this issue and this is followed by the BSS accounts for the calendar year 2022. The accounts will be noted at the Newbury Meeting on 23 September as an agenda item for this year’s AGM.

Our lead article is by David Coffeen who describes an intriguing French horary quadrant dated 1518. The quadrant is equipped with an elaborate carved leather carrying case which is of great interest in its own right.

The Belgian altitude dial introduced by Sue Manston in last September’s *Bulletin* proved an inspiration to Frans Maes who reviews alternative ways of using it. Peter de Groot describes how to make a wooden sundial puzzle.

Our regular Norwegian contributor, Johan Wikander, presents us with three dials from ancient Norway. These

dials nicely illustrate a transition period in Norway when the old scheme of dividing the horizon into eight parts was giving way to the system of using unequal hours.

Irene Brightmer introduces us to more sundials in North Wales and these are characterised by having the dial cut directly into the top surface of a stone column.

Nicola Toop describes a sundial which was unearthed at Ledston Hall in West Yorkshire. This is a very battered sundial and it is most impressive just how much could be determined about the dial from careful study.

A freelance archaeologist, Sophie Hay, sent John Davis some fascinating photographs of 3rd and 4th century mosaics which show almost cartoon-like depictions of sundials. The accompanying text explains the jokes!

In the final article, Graham Stapleton writes about a dial that has already been described by John Foad. Despite the dial no longer existing, Graham has managed to conjure up some additional inferences.

The Editorial Team wish all our readers happy dialling this summer and hope that this sunniest time of the year will result in articles for future issues.

Frank King

A NEWLY DISCOVERED HORARY QUADRANT FROM THE FRENCH RENAISSANCE

DAVID COFFEEN

Oronce Fine was a French polymath of the highest order.¹ Born in the late 15th century, he led a true Renaissance in mathematics, astronomy, horology, and cartography. His dozens of publications include much on innovative sundials, quadrants, etc. Despite this, only two instruments by him have been recorded, a navicula sundial and portions of a sophisticated planetary clock. A third one has just come to light, that a quadrant sundial of 1518. Although unsigned, the attribution is certain, based on design, numeral and letter shapes, and notably the tangible provenance to Fine's supporter and benefactor. Here we present the instrument and the evidence.

The quadrant is constructed of a fine large slab of yellowish elephant ivory, measuring 137 mm and 126 mm along the sides, and with a thickness varying from 5.0 to 5.5 mm. There are a notch probably for plumb bob storage, two notches for sight vanes, a swivelling brass suspension for plumb line, and a swivelling index arm of whitish ivory. The decor consists of an engraved gilt sun face on the front, plus a system of engraved compass arcs on the reverse. The rulings, notations, etc. are hand-engraved throughout, with red, blue, black, burgundy and gold in-fill. Various numerals are engraved, others stamped.

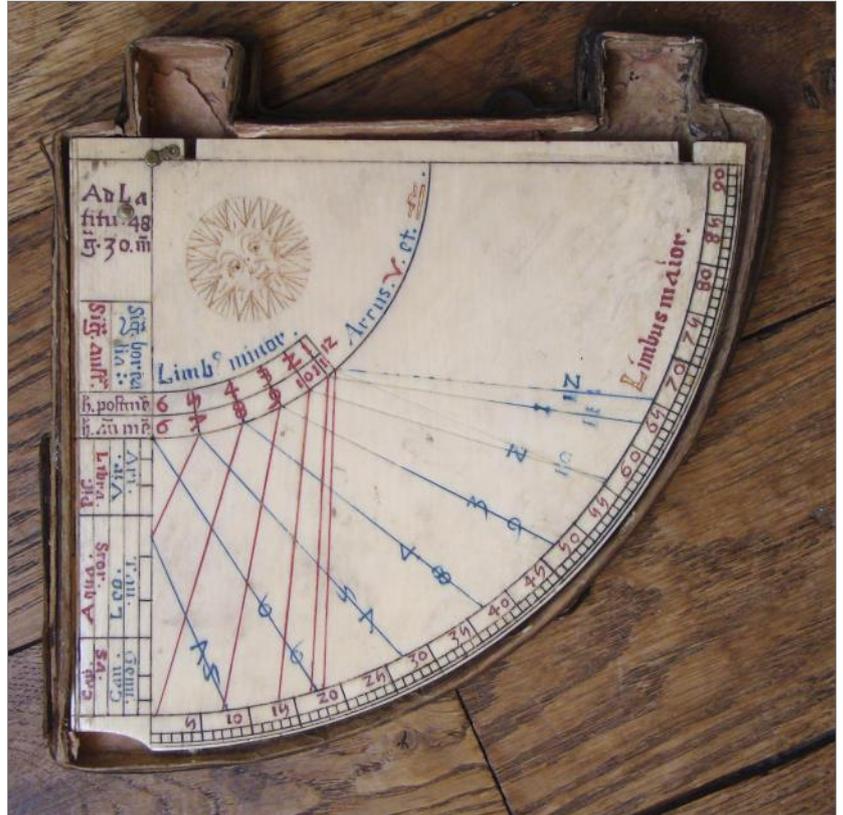


Fig. 1. The recently discovered horary quadrant by Oronce Fine, 1518.

The Front – Altitude and Horary Quadrant

The front (Fig. 1) is labelled “Ad Latitu. 48g. 30m” (thus designed for 48° 30' latitude – see Fig. 2), and bears a 90° altitude quadrant centred on the apex with plumb support and divided every degree counter-clockwise, labelled every 5° noting the very distinctive ‘zig-zag’ shape for the numeral ‘5,’ as well as the ‘z’ shape for the numeral ‘2.’ An horary quadrant, for time telling, is laid out between the arcs of “Limb’ minor” and “Limbus maior.” All the hour lines are straight (see discussion below), with one group colour-coded all in blue (for summer, and running from 5 am until 7 pm), the other in red (folded back for use in the six months of winter, the hours from 6 am to noon labelled “h an me,” those back from noon to 6 pm labelled “h post me” for “hours post-meridian”).

In use a cord with plumb weight and sliding bead would hang from the quadrant's apex. The bead would be positioned at a height corresponding to the time of year, the quadrant would be held up with the sights aligned with the



Fig. 2. One of numerous explanatory labels on the quadrant, this one specifying that it has been designed for use at latitude 48° 30'.

sun, the cord would hang vertically, and the position of the bead on the hour lines would indicate the time. For setting the bead at the correct date, there is engraved along the left edge a Zodiacal scale, again colour-coded, all the engraving in blue again for summer, labelled “Sig. borealia” and divided every ten degrees through the Zodiacal houses of “Ari, Tau, Gemi, Can, Leo, Vir.” Red is applied to the winter, labelled “Sig. aust.” and incorporating the houses “Libra, Scor, Sa, Cap, Aqua, Pic.” The top end of the Zodiacal scales, i.e., for the dates of the equinoxes, is labelled “Arcus” followed by the signs for Aries and Libra. And here we note another of the maker’s very distinctive letter forms, the lower case ‘c’ which invariably lacks its lower edge, being formed more like an ‘r.’ And speaking of idiosyncrasies, a mistaken summer hour line originally was drawn down from 12 noon to about 56°, intersecting the 10 am/2 pm line. If we measure on the quadrant the sun’s altitude at noon at the equinoxes, we find the design latitude as about 48° 20’, very close to that intended.

The Back – Calendar Conversion

The reverse (Fig. 3) is again hand-engraved, but with numerals punched, noting distinctive 1, 2, 3, and 5 shapes. Here the colour infills differentiate the lines and arcs (blue), the numerals (red), and the words and letters and Zodiacal symbols (black). There are four calibrated quadrantal arcs, centred on an apex (different from that on the front side) to which is mounted a rotating straight index arm made of thin ivory and decorated with simple circles with blue infill. The two central bands give the calendar date throughout the year, with divisions every two days, and respecting the correct 30-, 31-, and 28-day months. Months are identified by their capital letters, noting stylistically that all vertical lines in these letters are crossed in the centre. An inscribed centre line gives the equinoxes as 11 March and 13.5 September. We note that in 1518 (as dated – see Fig. 4) the equinox occurred on 11 March at about noon, in the Julian

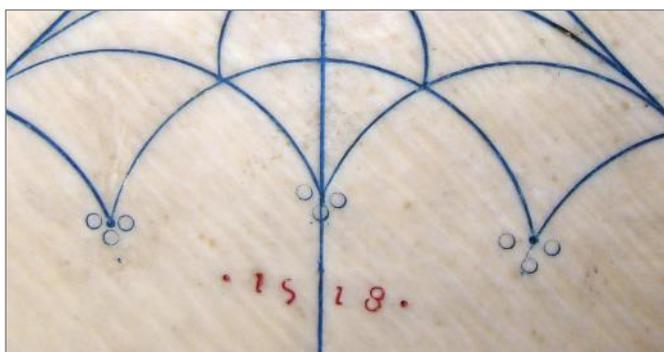


Fig. 4. Symmetrical decorative arcs, and the date of fabrication (1518).

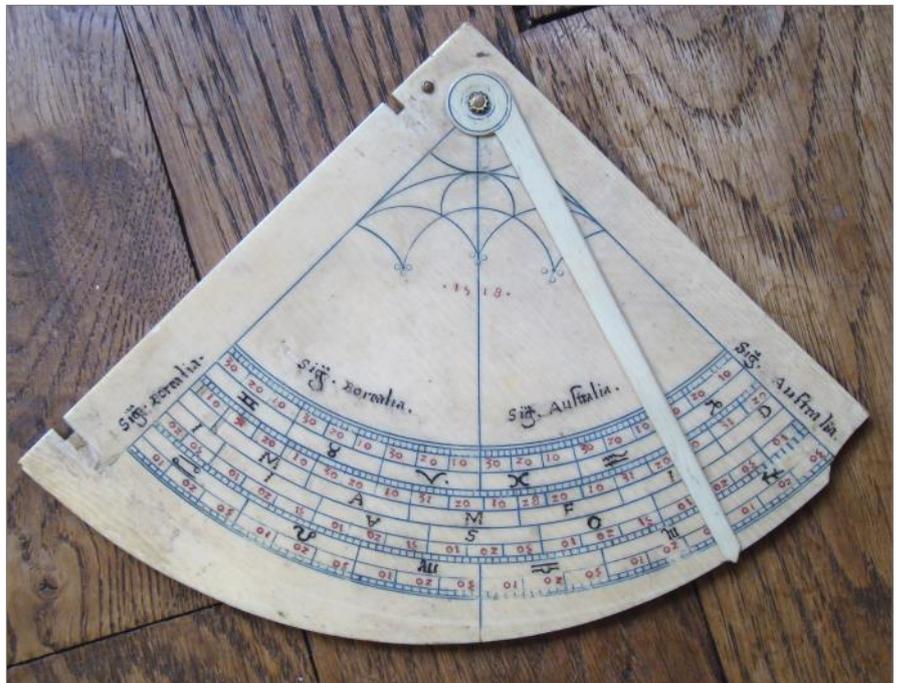


Fig. 3. The reverse, with its high-resolution scales for converting back-and-forth between calendar date and the sun’s position in the Zodiac, using the index arm for precision. Note that the vernal equinox is on 11 March.

calendar. (The Gregorian calendar would not be introduced for another 60+ years.) The left half of the layout is for summer, marked twice “Sig. Borealia,” the right half winter “Sig. Australia.” The outer two bands give the Zodiacal houses, each with 30 degrees and divided every two degrees. Thus we have precision conversion between calendar date and sun’s position in the Zodiac, necessary for setting the bead position on the front side. The condition of the quadrant is fine, lacking of course the two sight vanes (which were probably very simple bold vanes pierced with holes, to be compared with the single surviving vane on the astrolabe-quadrant in Rouen²) and the plumb bob. The ivory surface is somewhat scraped, and some coloured infill was possibly repainted at some time. Overall the instrument presents beautifully, and is in extraordinary condition for its age.

The Case

The wonderful case (Figs 5, 6, 7) is made of wood covered in thick hard blackened brown shaped calfskin, lined with rose-coloured paper, and fitted with brass attachments. The leather is fully hand-chiselled, with wonderful floral (with appearance of lilies, acanthus, and climbing plant) and geometric designs and with a cut and struck blazon in polychromed patterns. The latter, after forming, was apparently fully gilt and then covered in places with azure, red and silver (some of which pigment has faded). The workmanship on the case cover is remarkable for the period, with a great finesse of execution, and with original and elegant asymmetrical floral decor. It stands out compared with the perfect symmetry of even the most sumptuous French Renaissance book bindings. The style



Fig. 5. The hand-carved leather case, with its elegant asymmetric floral patterns and bearing the gilt and polychromed blazon of Michel Boudet, Fine's protector and supporter.



Fig. 6. The case bottom, hand-incised with a triangular / rectangular latticework.

evokes that of the Italian Renaissance, suggesting the possibility that the master craftsman of the case cover was of Italian origin, installed in Paris. The case extensions for the missing sight vanes are a bit puzzling; they are curiously quite large, and wide in the plane of the quadrant, and not well centred on the vane attachment notches. Were the sights of an unusual design, or was there a bit of miscommunication between Fine and the case maker, or did perhaps the latter work from one of Fine's published two-dimensional drawings where the sight vanes are always shown flat in the plane of the quadrant, rather than in a three-dimensional view? Case closure is by a hook on the circular edge, with two eyes on the straight opposing edges for lacing a cord to carry. It may be compared with the case on the earlier astrolabe-quadrant in Rouen, and that on a



Fig. 7. Details showing the case-work extension for a sight vane, plus one of the original brass eyes for cord to bind and carry the instrument.

medieval horary quadrant recently recorded.³ The condition is fine noting minor losses and some warping. It is an extraordinary survival with the quadrant.

Technical Design

So here we have an early quadrant, clearly designed for time-telling, as announced by the bold gilt surface, and made for the specific latitude $48^{\circ} 30'$. Notre Dame in Paris is at $48^{\circ} 51'$, and in Fine's *Protomathesis*, wherein many complex dials are fully detailed, we note that the fixed-latitude quadrants are all specified for latitude $48^{\circ} 40'$. If we take the quadrant's stated latitude literally, it is designed for use on an East–West line passing 39 km south of Notre Dame in Paris. Interestingly, and unlike many quadrants, this one is engraved with numerous cryptic 'instructions', identifying the various arcs and tables. It is an early horary quadrant, calibrated for equal hours (as opposed to unequal hours, popular a century before), and with the date lines folded back for half the year to give greater resolution. The present quadrant shows the sophistication of having changed the spacing of the Zodiacal dates to give mathematically straight, rather than curved, hour lines. Cowham⁴ discusses the various types of, and evolution of, the horary quadrant. The earliest similar straight-line form which Cowham reports is the 1558 design of Gebhart von Baeinen (recorded by Zinner⁵ as being in the Vienna Kunsthistorisches Museum). And we find an illustration of the form in Fine's works⁶ (Fig. 8). By comparison Fine's other quadrants, and of course the later Gunter's quadrants, always have curved hour lines.

The survival and recent appearance of the present Renaissance quadrant is noteworthy. Horary quadrants are illustrated in various 16th-century books, but we find a remarkably similar one hiding in the most famous 1533 painting by Hans Holbein the Younger, *Les Ambassadeurs* (Figs 9 & 10). The material of the quadrant would appear to be the same, and the layout is again the uncommon design with straight hour lines.

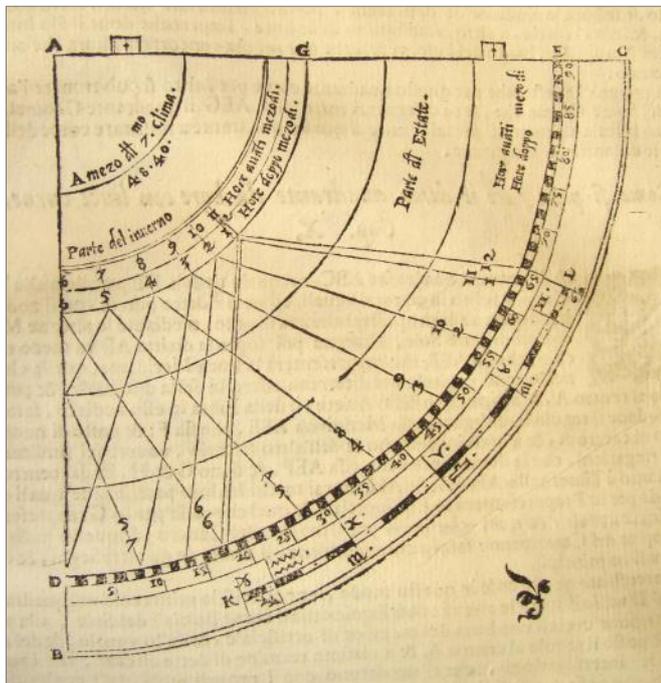


Fig. 8. Illustration from Oronce Fine's Works, showing a quadrant much like the present, where the Zodiacal scale has been expanded and contracted to give all hour lines as straight lines.



Fig. 10. Detail of the horary quadrant in *Les Ambassadeurs*, remarkably similar to the present quadrant, of the same uncommon form with straight equal-hour lines.



Fig. 9. The 1533 painting *Les Ambassadeurs*, by Hans Holbein the Younger, now in the National Gallery in London.

The Maker

The undeniable maker is Oronce Fine, born in Briançon in 1494, educated in Paris at the Collège de Navarre, going on to receive a degree in medicine in 1522, becoming famous as a mathematician and cartographer. Fine arrived in Paris, fatherless, c.1510, and entered studies which led to a master's degree in 1516. By 1518 he was teaching at two institutions in Paris and had published editions of several scholarly books including Sacrobosco's *De sphaera*. A

prolific author and engraver, Fine is also known as a fine craftsman of instruments; surviving are a signed ivory 'navicula' sundial dated 1524, and Fine's work on an extraordinary 15th-century planetary clock modified by him c.1553 and held in the Bibliothèque Sainte-Geneviève in Paris, exhibited in 1971⁷ and recently studied in detail.⁸ His ivory navicula is in the Museo Poldi Pezzoli⁹ in Milan, discussed and illustrated by Eagleton.¹⁰ Studying the numerals on that dial, we find again the same distinctive punched 1, 2, and 3 shapes, as well as the 5, although its 's' shape now (six years later, and after Fine's imprisonment c.1523/4¹¹) less dramatically rotated (Figs 11 & 12). And we see the same terminal symbol representing the "us" of Opus, as for the "us" of Limbus on the quadrant.

The Benefactor

With the quadrant's case we find a remarkable further connection with Fine. The blazon is that of Michel Boudet, who served as évêque (Bishop) of Langres (in eastern France) from 1512 until his death in 1529. He held numerous distinguished royal appointments under Kings Louis XII and François I. Boudet's coat of arms is preserved in the 16th-century stained glass in the church at Monliot-et-Courcelles west of Langres (Fig. 13), as well as on several surviving seal imprints. The device on the case matches this, complete with the quarters of fleur-de-lys, roses, etc., and it is surmounted by the bishop's crozier. The Fine family inhabited the Dauphiné in the vicinity of Briançon, in southeastern France, for centuries.¹²

Despite Oronce's genius and successes in astronomy and mathematics, for which he received acclaim throughout his life, he never achieved financial security, and in fact often

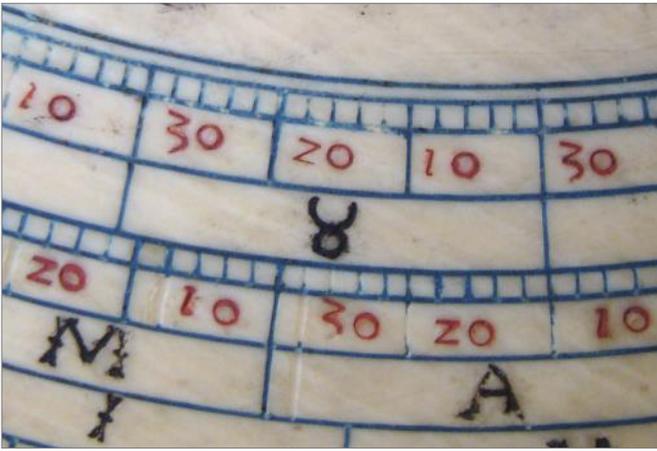


Fig. 11. Details of numeral shapes on the present 1518 quadrant.

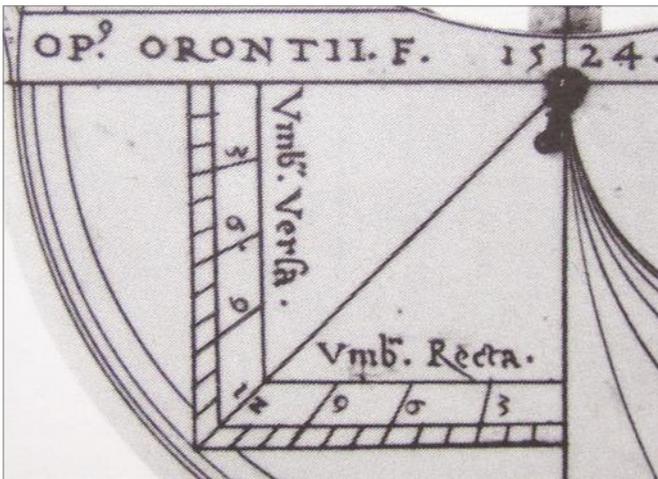


Fig. 12. Detail of the 1524 ivory navicula sundial, the one other recorded sundial by Oronce Fine. Note the fine similarities of the punched 1, 2, and 3 shapes in the shadow square, to the same numerals in Fig. 11.

suffered. Adolphe Rochas¹³ writes of Fine's difficulties (here translated):

"Except for a bishop of Langres, Michel Boudet, who had been his protector from the beginning of his studies, the great lords whom he implored remained deaf to his prayers: in exchange for the base flatteries to which poverty made him descend, he received only letters of thanks or sterile praise: often even the generousities of his Patrons were limited to a gift of paper, wax and parchment, thus abandoned to his own..."

Thus Boudet supported and mentored Fine in his early years.

Further evidence is found in two dedications Fine published in works he edited, the first in 1517 in Bassolis' *Opera in quattuor Sententiarum libros* where his praises of Boudet include a poem and his armorial. The second appears in the encyclopedic 1523 *Margarita Philosophica*,¹⁴ where Fine expresses his thanks and declares his indebtedness to Boudet for all his benefits, and describes him as one of his most faithful friends. Fine explains that this edition was



Fig. 13. The 16th-century coat of arms of Bishop Boudet, Oronce Fine's protector, in the church at Monliot-et-Courcelles southeast of Paris. It is to be compared with that on the case (Fig. 5).

requested by Boudet himself. Thus we have clear evidence of the strong intellectual and supportive bond between the two.

The conclusion is clear. At age 24 Oronce Fine, working in Paris, created this quadrant for his protector and supporter the Bishop of Langres.

ACKNOWLEDGEMENTS

Thanks to the following for consulting in their various fields of expertise: Phillippe Palasi, Jean-Marc Dechaud, Henri-Claude Randier, Luca Moiola, Enza Tartaglia, Yola Coffeen.

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13. A. Rochas: *Biographie du Dauphiné*, Vol. 1, pp. 384-393 (1856), who writes:
“Excepté un évêque de Langres, Michel Boudet, qui avait été son protecteur dès le commencement de ses études, les grands seigneurs qu’il implora restèrent sourds à ses prières: en échange des basses flatteries où la misère le faisait desendre, il ne recevait que des lettres de remerciements où de stériles louanges: souvent même les libéralités de ses Mécènes se

- bornaient à un cadeau, de papier, de cire et de parchemin, ainsi abandonné à ses propres...”*.
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David Coffeen PhD, former planetary astronomer, has been full-time dealer in early scientific instruments (Tesseract) since 1982, publishing 113 catalogues to date, and *Rittenhouse* journal for 23 years. He can be contacted at david@etesseract.com



HOLIDAY PICTURES

Nan Lian Garden, Hong Kong

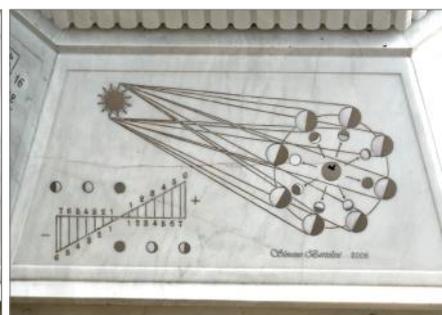
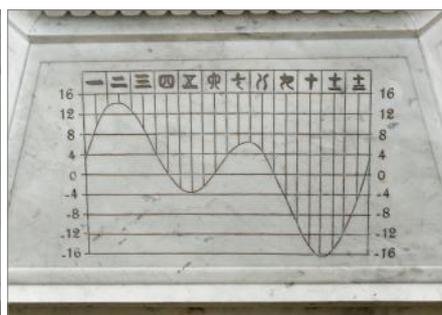
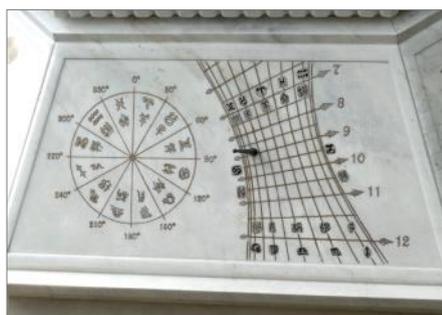
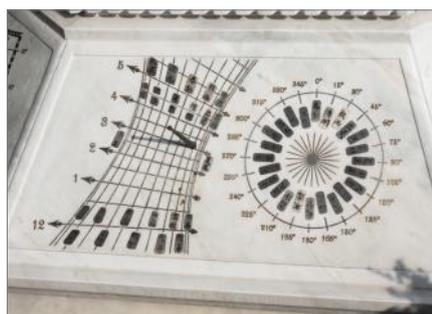


The Light of Enlightenment statue and fountain, in the shape of a lotus flower, is in the Nan Lian Garden, an 8½-acre public park in the Diamond Hill area of Kowloon, Hong Kong.

The Nan Lian Garden was built by the neighbouring Buddhist Chi Lin Nunnery between 2001 and 2006; it was designed in the Tang dynasty style with features including bonsai trees, rocks, waterfalls, pavilions, wooden bridges and lotus pools. The garden and the nunnery are connected by a bridge, beside which is this sculpture, designed by Simone Bartolini in 2006. The eighth panel on the octagonal base, not shown here, depicts a map of China.

We are grateful to Trevor Clifford for permission to publish these photographs, and to his brother-in-law, Ben Jones, for forwarding them to the *Bulletin*.

CHN



HOW TO USE THE BELGIAN ALTITUDE DIAL?

FRANS MAES

Recently a mysterious portable altitude dial turned up (Fig. 1). It was described in detail by Sue Manston.¹ She suggested two ways the dial might have been used:

Method 1: place the cord at the groove on the time of sunrise (which can be read from a date table on the back), aim the short edge of the dial at the sun, and read the time from where the cord with plumb bob crosses the hour scale;

Method 2: place an alidade in the groove on the time of sunrise, suspend the dial by the cord so that the long edge

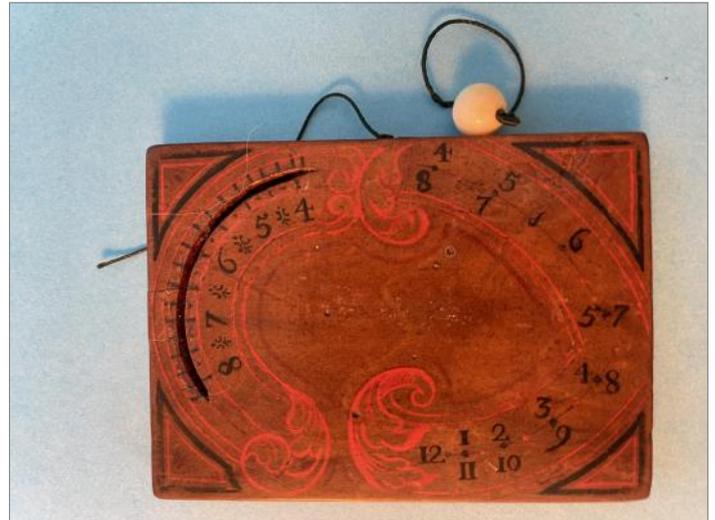


Fig. 1. The front of the dial (photo: François Juge).

of the dial is horizontal, aim one end of the alidade at the sun and read the time where the other end is pointing.

Note that in the latter case an alidade is not necessary: a gnomon (peg) in the groove would cast its shadow on the hour scale and so indicate the time.

Equivalence of the Two Methods

It was not immediately obvious to me that the two methods are equivalent, that is, would give the same time reading. A bit of geometry confirms that this is the case (Fig. 2).

A peg is placed in the date groove at an arbitrary time of sunrise: here 5.30 h, and an arbitrary solar time is chosen: here 9.00 h. Let the sun's altitude be h . With both methods, the angle with the green asterisk is $90^\circ - h$ (Fig. 2), so both methods measure the same solar altitude.

How to Use the Dial?

Both methods have their problems. For method 1, no sights are present at the short edge, and the hour numerals are oriented on their sides when in use, as Sue pointed out already.¹ For method 2, the suspended dial may spin round in the breeze, as Sue recognised. Moreover, it is unusual to have no suspension ring, but just a nail in the side of the dial, clamping the thread in an unpredictable way. Also, there is no alignment mark to check the horizontality of the long edge, which would vary when the peg is placed at different positions in the groove. And what purpose would the bead at the end of the cord have?

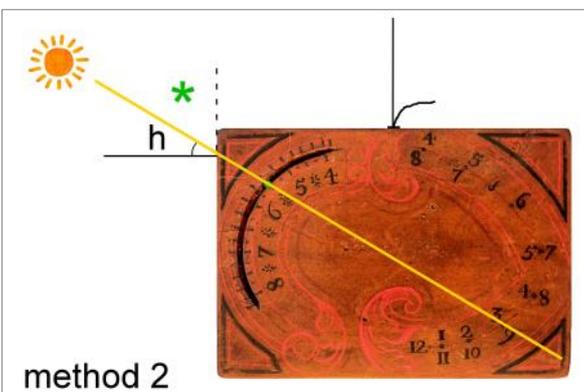
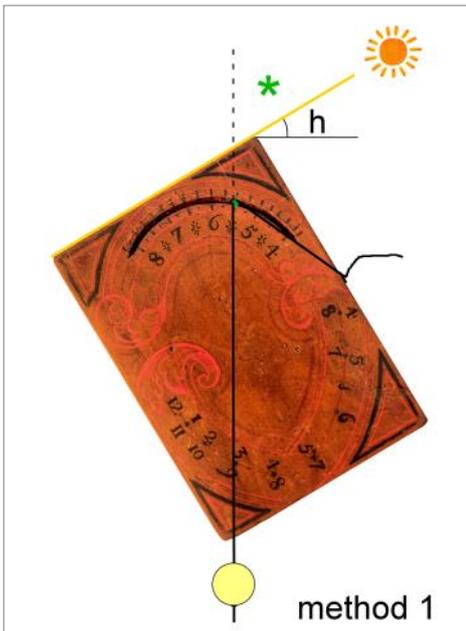


Fig. 2. The geometry of the two proposed methods of using the Belgian altitude dial. Above: method 1; below: method 2.



Fig. 3. The dial model is used according to method 1. The dial is tilted so that the shadow of the peg is parallel to the short edge.

In a follow-up paper, Steve Lelievre and Sue Manston identified the sundial as a Hevelius dial.² The paper focuses on how the dial could have been calculated, but in the introduction it is suggested that method 2 was used with this dial.

Because of the serious problems with method 2, I wondered whether method 1 would be workable in practice. I made a model from a block of cork, about 10% larger than the original. A tooth pick served as gnomon (Fig. 3).

I aimed the short edge at the sun by tilting the dial so that the shadow of the peg was parallel to this edge. This appeared to be not too difficult, even with the camera in the other hand and one eye on its display. I estimate that an accuracy of 10-15 minutes is feasible. On a dial with only full hours marked, this is anyhow the maximum resolution obtainable.

One might argue that it might be equally feasible to use method 2; not by suspending the dial by the cord, but by holding it and keeping the long edges horizontal. One would just need a ‘carpenter’s eye’ to achieve this. This leaves the question, however, why the cord and plumb bob?

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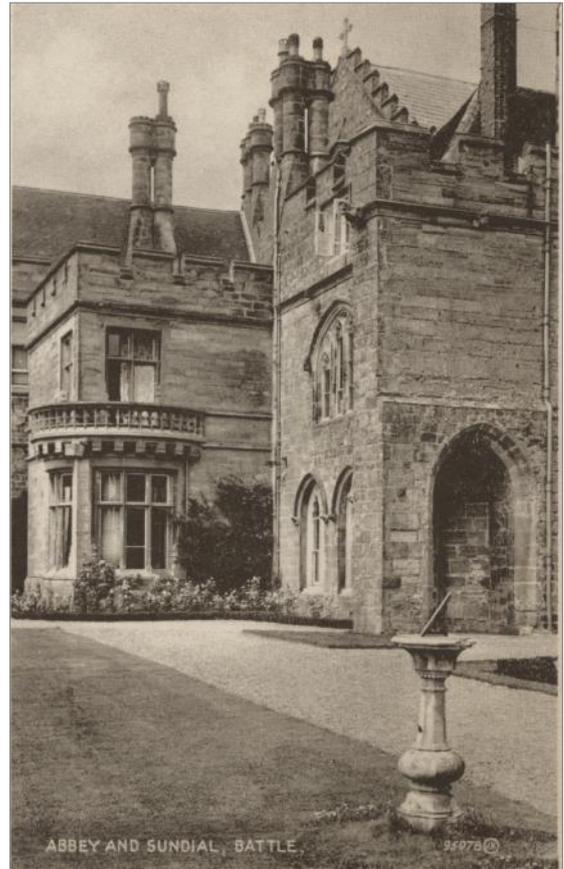
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Postcard Potpourri 63 Battle

Peter Ransom

This postcard features a horizontal sundial at Battle Abbey, a partially ruined Benedictine abbey in Battle, East Sussex, the significant site of the Battle of Hastings.



I cannot find this dial in the Fixed Dial Register, so it is either missing, or not yet recorded. Without any date on the postcard, it is hard to date the picture. However, a search for similar cards (Valentine’s “Sepiatype” Series is printed on the back) yields that a different card with a serial number of 94810 was registered in 1925. The postcard here has number 95078 on it, so my guess is that it dates from the mid to late 1920s and a small “28-1” printed in the space for the stamp suggests January 1928.

Valentine and Sons was a printing company founded in Dundee, Scotland in 1851 by James Valentine (1815–79) that grew to become Scotland’s leading manufacturer of picture postcards. Following James Valentine’s death, the company was run by his sons, William Dobson Valentine (1844–1907) and George Valentine (1852–90). The company was purchased by John Waddington Limited in 1963, who sold it in turn to Hallmark Cards in 1980. Dundee operations ceased in 1994.

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OCTAVAL AND UNEQUAL HOURS: THREE NORWEGIAN SUNDIALS

JOHAN A. WIKANDER

We were informed in the December 2022 issue of the *BSS Bulletin* about three Scandinavian sundials, the oldest one a mass dial made about 1200.¹ That particular mass dial was carved with hour lines for both octaval hours and unequal hours. These two systems were used throughout the Middle Ages and also after the end of this period. We will describe three other sundials, giving information about the use of these two systems.

The Giske Church Mass Dial – Octaval Hours

Giske is an island on the west coast of Norway, 62° 30' N, 6° 1' E. The church was built about 1130–40 as a private chapel for a very rich and powerful noble family, the owner of the Giske estate. Giske is shown on the map ‘*Carta Marina*’, published in Venice, Italy in 1539 (Fig. 1).

The portal and its ornamentation, on the south wall of the church, is one of the best-preserved portals in Norway amongst stone churches of the Middle Ages.² The mass dial is carved on a block of very hard white marble, on the left side of the portal (Fig. 2).



Fig. 1. Part of the map ‘*Carta Marina*’, created by Olaus Magnus (1490–1557), Archbishop of Uppsala, Sweden and published in 1539. We see Giske island (“*GISKE*”), Kråkvåg island (“*KRAKAVAD*”), and to the right Trondheim city (“*TRONDEM*”). ‘*Carta Marina*’ is a map of Scandinavia.

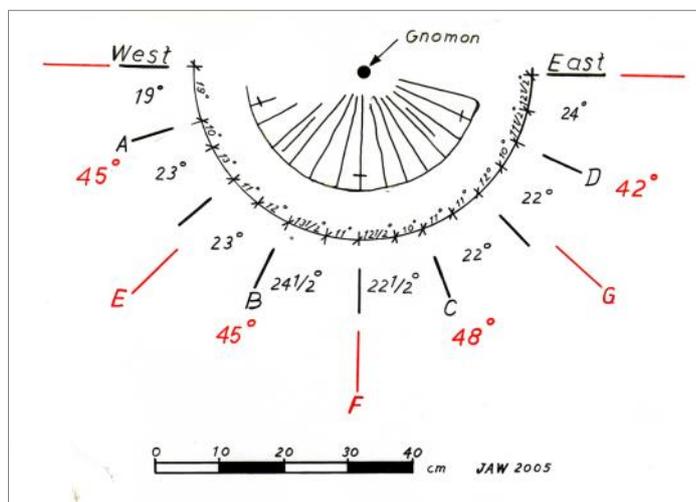


Fig. 2. Giske Church mass dial, carved in the middle of the 12th century when the church was built. The unequal hours are indicated in red.

I have identified all the hour lines and made an exact drawing of the mass dial at scale 1 : 1, using transparent plastic. The original horizontal gnomon, perpendicular to the wall, was lost a long time ago.

The mass dial is carved according to the octaval hour system, showing quarters of each octaval hour. An octaval hour is 45 degrees on a sundial, and one quarter is 11¼ degrees. I have measured the angles, and they vary from 10 to 13½ degrees. It is almost impossible to carve the lines exactly at a distance of 11¼ degrees. The conclusion is that the mass dial is rather accurately carved.

We add the angles to half of an octaval hour (22½ degrees). The angles then vary from 22 to 24½ degrees, quite exact. The octaval hours (see Fig. 2) are:

West–A: This is the last half of the octaval hour *morginn* or *rismál* (19 degrees). The Old English name is *Morgan*, the early morning.³ The Old Norwegian and Old English languages are related.

A–B: This is the octaval hour *dagmál* (46 degrees). The Old English name is *Daeg-mael*, also related to Old Norwegian. We notice that the hour line identified as *A* is crossed. This symbol is common on mass dials.

B–C: This is the octaval hour *hádegi* (47 degrees). This means “when the sun is highest in the sky”. The Old English name is *Mid-daeg*. This is related to the Old Norwegian *miðr dagr*. This means *midday*, not exactly the

octaval hour *hádegi*. The hour line identified in red as *F*, the middle of the octaval hour, is crossed.

C–D: This is the octaval hour *undorn* or *eykt* (46 degrees). *Undorn* means in Old Norwegian “intervening time”, and *undorn* was also the name of a meal. The Old English name is *Ofanverthr dagr*. We also find this term in Old Norwegian and written “*ofanverðr dagr*”. This means “the end of the day”, obviously the end of the working day out on the field or in the woods, where hard work was done. Afterwards the easier work had to be done at home.

D–East: This is the first half of the octaval hour *aptann* (24 degrees). The Old English name is *Mid-aften*, also related to the Old Norwegian language. The hour line identified as *D* is also crossed.

The Giske Church Mass Dial –Unequal Hours

Two lines are not carved according to the octaval hour system. They are identified in red as *E* and *G* in Fig. 2. These lines, and also the red line identified as *F*, are carved indicating unequal hours. An unequal hour on a sundial is 15 degrees. Then we get:

West–E: This angle is 45 degrees, and the hour line *E* shows the end of the 3rd unequal hour. Specific hours were important for the Church. These hours were the times for prayer and mass in the church and were called *canonical hours*. The 3rd hour was at that time obviously a canonical hour.

E–F: This angle is also 45 degrees which is exactly correct. The hour line *F* shows the end of the 6th unequal hour. This hour line is also crossed, a common symbol on mass dials.

F–G: This angle is 48 degrees. The hour line *G* shows the end of the 9th unequal hour, a canonical hour.

G–East: This angle is 42 degrees, and *East* shows the end of the 12th hour, the hour of sunset.

Kråkvåg Horizontal Sundial

Kråkvåg is a harbour on the west coast of Norway, at 63° 38' N, 9° 20' E. The sea route along the very long Norwegian coast was for centuries our main highway. Ports like this where ships could stay overnight and during bad weather were very important.

Kråkvåg, a bay facing east and well protected against the open sea by Kråkvåg Island, was one of these important harbours. This particular harbour is also just outside the mouth of the Trondheim fiord, and is important for sailing vessels bound for the city of Trondheim. Kråkvåg is shown on the famous map ‘*Carta Marina*’ (Fig. 1).

Kommersøya is a small island on the south side of the bay. At the top of this island there was in former days a lookout for seamen visiting the Kråkvåg harbour; the seamen relaxed here. A NATO fort was built on this island, and a cannon was later installed at the top of the island. Soil, and guano left by the seabirds, was then removed, and many

carvings made by the seamen were discovered. Several carvings are still hidden under soil and not removed. The rock at the top is a very hard and fine-grained sandstone, perfect for such carvings. Some of these carvings are shown in Figs 3 and 4.



Fig. 3. Some of the carvings at the local lookout, Kråkvåg harbour. The years 1604 and 1812 are carved next to each other. We understand that these carvings, made by visitors to the harbour, are rather old.

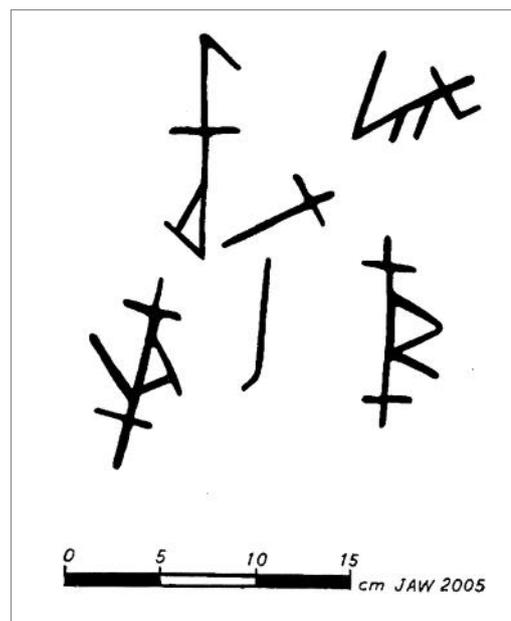


Fig. 4. A group of personal marks made in the same manner. They were obviously carved by the crew of a ship visiting Kråkvåg harbour.

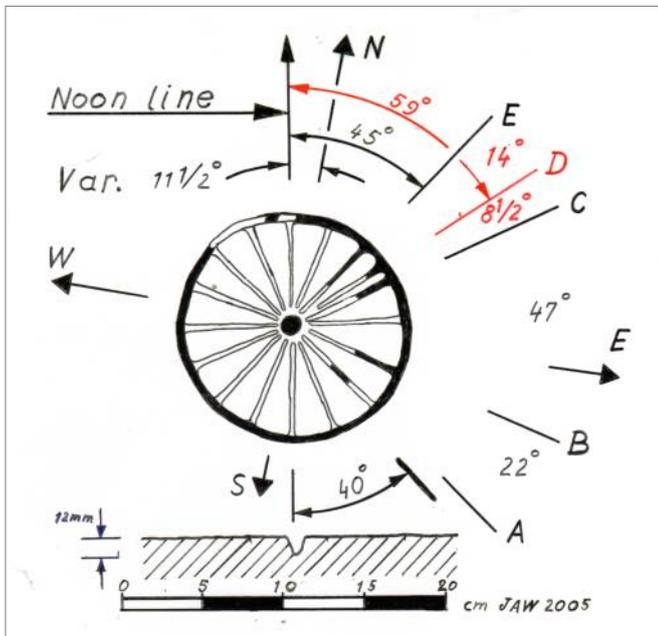


Fig. 5. Reconstruction of the sundial carved at Kråkvåg harbour. The dial shows octaval hours. However, one unequal hour line is added, shown in red. The noon line is thus easily identified. The sundial was most probably carved about 1640 or about 1670.

A horizontal sundial is also carved with, however, only a few hour lines. The missing hour lines were obviously painted on the fine-grained sandstone, which was suitable for painting. The reconstructed complete sundial is shown in Fig. 5.

The sundial is made according to the octaval hour system. The angles $A-B$, $B-C$ and $C-E$ are respectively 22, 47 and 22½ degrees. The hour line D , in red, is an unequal hour line. This is correct: the sundial originally had a vertical gnomon. The carved hole in the centre of the dial, 12 mm deep, is made for a vertical gnomon. Most probably the seamen held a small stick vertically in the hole when they used the sundial.

We have to determine the noon line: The angular distance from the hour line E is a multiple of 22½ degrees. The distance from the red hour line D is a multiple of 15 degrees. The noon line is thus easily determined, 11½ degrees to the west of true north (Fig. 5).

A mariner's compass would have been used to determine the noon line on the sundial by aligning it with the N-S line on the compass rose. It should be noted that, until the end of the 17th century, mariners' compasses were constructed so that the magnetic needle was fastened under the compass rose one 'point' (11¼ degrees) or half a point (5⅝ degrees) to the east of the N-S direction shown on the compass rose.

This is described in some detail by Robert Norman (London, 1581 and 1584).⁴ At that time, the magnetic variation in Norway was to the east, but this construction of the mariner's compass continued to be used after about 1640, when the magnetic variation turned westerly! The conclusion then is that the sundial was carved about 1640 or about 1670.⁵

This old-fashioned construction of the compass ceased at the end of the 17th century, and thereafter the magnetic needle was fastened in accordance with the N-S line on the compass rose. If a mariner's compass of this modern construction was used, the sundial would have been carved about 1720. The magnetic variation was then about 11½ degrees to the west. It is rather difficult to give a certain conclusion about the age, but most probably the sundial was made about 1640 or about 1670.

The hour line C is the end of the octaval hour *eykt* or *undorn*. However, the language had changed through the centuries. We did not use the Old Norwegian terms this late. This octaval hour was in Norway now called "*nons-økten*". "*Nons-*" is then the 9th unequal hour and also the name for the meal called "*nons*". "*Økten*" is the Norwegian name for "the octaval hour".

The red hour line D is the end of the 10th unequal hour (or the end of the 4th hour after noon). Most probably this hour line is linked to the meal "*nons*", and then perhaps the end of the meal.

A radial line is carved outside the sundial (Fig. 5), but not according to either the octaval or the unequal hour system. It is difficult to explain its meaning. Perhaps this was the time for a rather late meal or the time to go to bed? The seamen usually worked very hard at sea the whole day!

The Mandal Horizontal Sundial

This horizontal sundial is carved on the rock, very hard gneiss, on a local lookout by the bank of Mandal River on the south coast of Norway 58° 2' N, 7° 29' E (Fig. 6). At the lookout only the river and the surrounding hills can be seen, not the ocean. Nearby there was a small village and a harbour called Casperboden named after a man called Casper. He was most probably a local merchant.

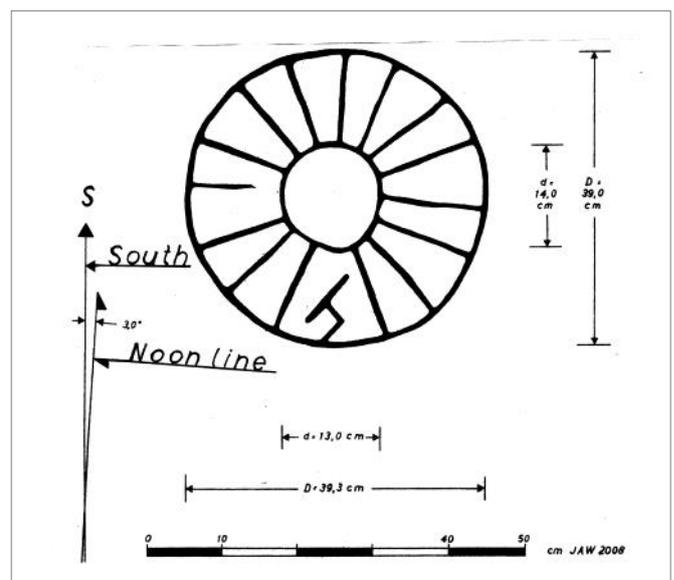


Fig. 6. The Mandal horizontal sundial carved on the south edge of a cliff, octaval hours. However, the runic letter 'K' is used as a noon mark, the end of the 6th unequal hour.

For centuries there was an important sea route just off the southern and southeastern coast of Norway, linked directly to the trade between central Europe and Baltic waters. The vessels then preferred to sail along the coast of Norway. When a contrary wind happened, the vessels put into our very good outer harbours for safety.⁶

We were informed in 2021 about the sundial and its symbol (see Fig. 6) in my article ‘Symbols found on Scandinavian Sundials from the Middle Ages’.⁷ The symbol is the K-rune, which is the 6th rune in the Younger Futhark runic alphabet. The sundial shows octaval hours. However, the runic symbol shows the end of the 6th unequal hour. We will now discuss the age of the sundial:

The Younger Futhark, containing 16 runic letters, was used in Scandinavia along with three ‘new’ special runes as a numerical system to represent the 19 golden numbers. This practice began about 1300 and was mostly used in Sweden.⁸

The sundial is carved on the south edge of a cliff, and almost exactly according to true south–north. The sundial therefore had to be inspected from its north side and towards south, as shown in Fig. 6. The sundial is also carved almost exactly according to true south–north. The variation, 3 degrees towards east of true north, is within the margin of error we have to include when the noon line was determined. The question then is: Which method was used when the noon line was determined?

1. The first alternative is that a mariner’s compass was used. Robert Norman (London, 1581 and 1584), wrote about the construction of the mariner’s compass. The magnetic needle was fastened one point or half a point to the east of the compass rose’s south–north direction.¹³

The magnetic variation had a maximum about 1540, 17 degrees to the east of true north, and then decreased almost linearly to zero degrees about 1640. Then the magnetic variation changed to the west, increased and had a maximum about 1820, about 22 degrees.¹⁴ The conclusion is that the sundial was carved about 1570 or about 1600.

2. The second alternative is that inspection of the Pole Star was used when the noon line was determined. The Pole Star was well known here in Scandinavia. The star was called *Leiðarstjarna* in the Old Norwegian language. This means: “The star which points out the way”. If this alternative was used, it is not possible to determine the age of the sundial. However, the conclusion at least is that the sundial is rather old and definitely not more recent than about 1600.

The Change from Unequal Hours to Equal Hours

Mechanical clocks appeared in Europe early in the 14th century. Unequal hours then began to be displaced by equal hours.⁹ The counting of hours then changed little by little. The 1st hour started at midnight, and the 12th hour ended at noon. Then the counting continued from 1 to 12.

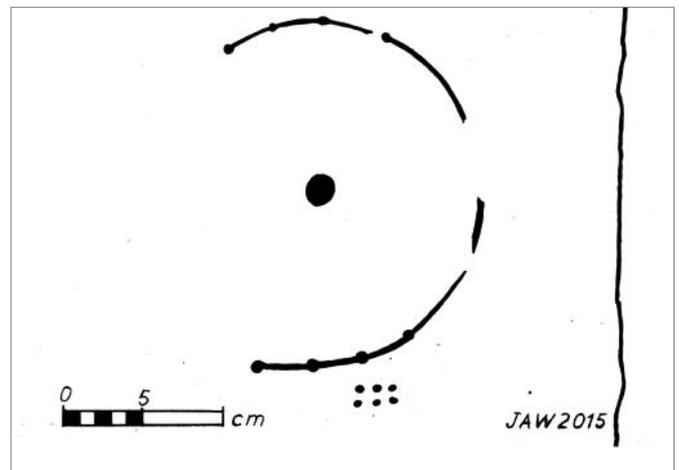


Fig. 7. Mass dial carved on the south wall of the chapel of St Milburga’s Church, Wixford. The noon line goes from the centre to the middle of the dot numeral, the end of the 6th unequal hour. The hour lines are not carved: originally they were most probably painted. The vertical edge of a window frame is seen to the right.

A mass dial carved on the south wall of the chapel of St Milburga’s Church, Wixford, Warwickshire, gives interesting information about the counting of the hours. The chapel was built about 1400 by Thomas de Crewe, whose tomb, one of the finest in the country, stands in the middle. His wife Juliana died 1411, but the date of Thomas’ death has never been filled in. This particular mass dial was carved after 1400, but we do not know exactly when.

There are several carvings on the south wall, among them the mass dial shown in Fig. 7. The noon line is identified with a dot numeral – six dots – and the end of the 6th unequal hour. The counting of the hours is still according to the original system, not the ‘new style’!¹⁰

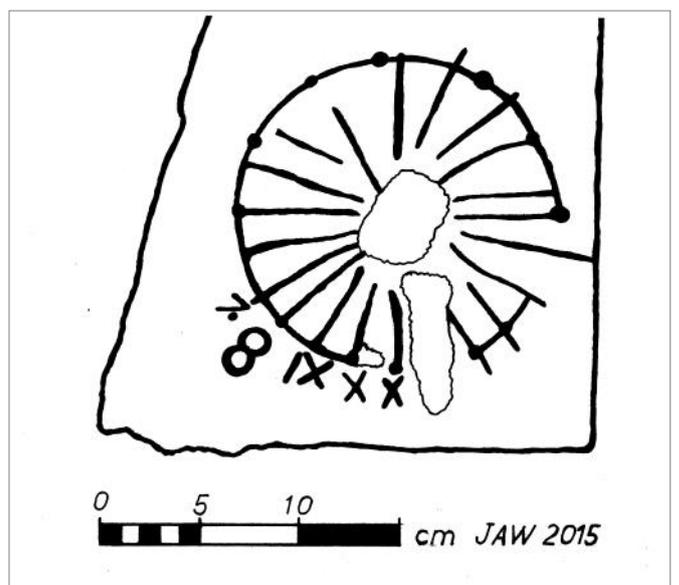


Fig. 8. Mass dial carved on the south wall of the chapel of St Milburga’s Church, Wixford. The dial is damaged and both the carved noon line and the Roman numeral XII, the end of the 12th hour, are lost. The south wall is not exactly west–east, but is turned more towards north. Then the noon line is not vertical, but is turned to the right. The vertical edge of a window frame is seen to the right.

There is another interesting mass dial carved on the south wall (Fig. 8). The numerals are carved partly with Arabic numerals and partly with Roman numerals: 7 – 8 – IX – X – X(I) – (XII) – I – I(I). The numerals lost through the centuries are put in parenthesis. The counting of the hours is according to the ‘new style’. This mass dial is therefore more recent than the mass dial in Fig. 7. We notice that the Arabic numeral ‘7’ is written in the modern way.¹¹

When did the ‘new style’ come to Scandinavia? We do not have reliable information about that. The conclusion so far is that it happened towards the end of the 15th century.¹² However, out in the countryside people were conservative. The quoted conclusion is then rather optimistic.

REFERENCES and NOTES

Kulturhistorisk Leksikon for Nordisk Middelalder (KLNLM), published in Copenhagen 1956–78, 22 volumes. This encyclopedia contains articles dealing with culture and daily life in Scandinavia in the Middle Ages; it is very detailed and has many references to older literature.

The Mandal sundial (Fig. 6) is briefly mentioned by Mario Arnaldi: *Tempus et Regula*, Ravenna (2010), Chapter 7.2 – Scandinavian Countries, pp. 307–12. Johan Anton Wikander: ‘Norwegian medieval sundials’, Fig. 7.10.

1. Johan A. Wikander: ‘Three Scandinavian Sundials’, *BSS Bulletin*, 34(iv), 31–4 (December 2022).
2. Øystein Ekroll and Morten Stige: *Kirker i Norge*, Vol. 1, Oslo 2000, pp. 192–5. This book deals with medieval churches built of stone.
3. John Davis: *BSS Sundial Glossary*, Third Edition, BSS Monograph No. 13 (2020), p.63, Appendix II. Anglo-Saxon Tides.
4. Robert Norman, Hydrographer: *The Safeguard of Sailors, or Great Rutter*, London (1584), p.76, about the two types of mariner’s compass. A second issue of this book, facsimile, was published by Theatrum Orbis Terrarum, Amsterdam (1976). This construction is also described by Robert Norman: *The newe Attractiue, Containyng a short discourse of the Magnes or Lodestone ...*, London (1581), pp. 24–6. Johan Anton Wikander: ‘Kompassrosen på Haaø og Merdø’, *Agder Historielag* (Historical Society, Agder County), Annual publication, No. 46, 1968, pp. 36–72. It is very well documented that the compass rose carved 1654, pilot’s lookout, island of Merdø outside the city of Arendal, south coast of Norway, was carved according to a mariner’s compass with magnetic needle half a point to the east of true north.
5. Johan Anton Wikander: ‘Solur eller kompassrose ved uthavnen Kråkvåg?’, *Fosen Historielag* (Historical Society, Fosen District, Trøndelag County), Annual publication 2005, pp. 23–48. I have written in detail about the seaway, Kråkvåg harbour, the carvings, and the magnetic variation and the construction of the mariner’s compass. It is not necessary to write in so much detail about this in the *BSS Bulletin*.
6. Johan A. Wikander: *Gamle havner ved Grimstad*, Grimstad (1985 and 1989), pp. 1–191, folio: The subject is the out-ports, the landfalls, mapping, moorings, chapels in the important out-ports, beacon fire sites etc.
7. Johan A. Wikander: ‘Symbols found on Scandinavian Sundials from the Middle Ages’, *BSS Bulletin*, 33(iii), 38–43 (September 2021).

8. Sam Owen Jansson: ‘Gyltentall’, *KLNLM*, Vol. V, 1960, column 615–18. The subject is the golden numbers.
9. John Davis: *BSS Sundial Glossary*, Third Edition, BSS Monograph No. 13 (2020), pp. 57–62, Chronology to 2000, see p.59.
10. I was told about these two mass dials, Figs 7 and 8, by the late Tony Wood, member of Mass Dial Group. Booklet: *St Milburga’s Church, Wixford, Warwickshire*, 7 pages, illustrations by I.M. Iliffe. I was also given information by the vicar when I visited the church in 2015. I spoke in 2019 about these two mass dials at the BSS Conference in Bath, *BSS Bulletin*, 31(ii), 40 (June 2019).
11. David Scott and Mike Cowham: *Time Reckoning in the Medieval World. A Study of Anglo-Saxon and Early Norman Sundials*, BSS Monograph No. 8 (2010), p.15, ‘Arabic numerals, first introduced into Europe ...’
12. Sam Owen Jansson ‘Dygn (och dess indelning)’, *KLNLM*, Vol. III, 1958, column 389–94, see column 391. The subject is timekeeping.
13. See above, note no. 4. The construction of the mariner’s compass described by Robert Norman, 1581 and 1584, was most probably not used in the 15th century and early 16th century.
14. Johan Anton Wikander: ‘Solur eller kompassrose på Halten’, *Fosen Historielag*, Annual publication 2004, Fosen Historical Society, pp. 7–34. The subject is the horizontal mass dial, Halten fishing village. In this article I refer to observations etc. about the magnetic variation. This is also the subject in Johan Anton Wikander: ‘Kompassrosen ved uthavnene’, *Agder Historielag*, Agder Historical Society, Annual publication, No. 67, 1991, pp. 7–90. The subject is compass roses carved at the out-ports, mostly at pilots’ lookouts. I refer here to several observations about magnetic variation. This is also my subject 1968, note no. 4 above.

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Battle Abbey Sundial



This drawing by Dorothy Hartley appears in T.G.W. Henslow’s *Ye Sundial Booke*. For a Postcard Pourri version, see p.9 of this issue.

WOODEN SUNDIAL PUZZLE

PETER de GROOT

This article was first published in Dutch in *ZON & TIJD*, 2023.1, 28-29 (March 2023).

On the Internet I saw a picture of a nice puzzle, which I drew and copied. It is 125×125 mm and is made from plywood 4 mm thick (see Fig. 1). It is easy to change the size of the sundial.

For a birthday gift I might send it as a card, or add it to a bouquet of flowers. I include some text with the place and latitude – you can see the paper through the gaps – and it says:

SUNDIAL PUZZLE

The polar gnomon, the thin rod in the puzzle, is so-called because it points to the North Star. The angle between the lines to the horizon and the North Star is for [place] at [degrees]°.

The sundial indicates solar time, it is twelve o'clock local time when the sun is at its highest point.

The sundial is easy to assemble (Fig. 2) and put away again. I hear afterwards how nice it has been for children to make the dial and read the time when the sun is shining.

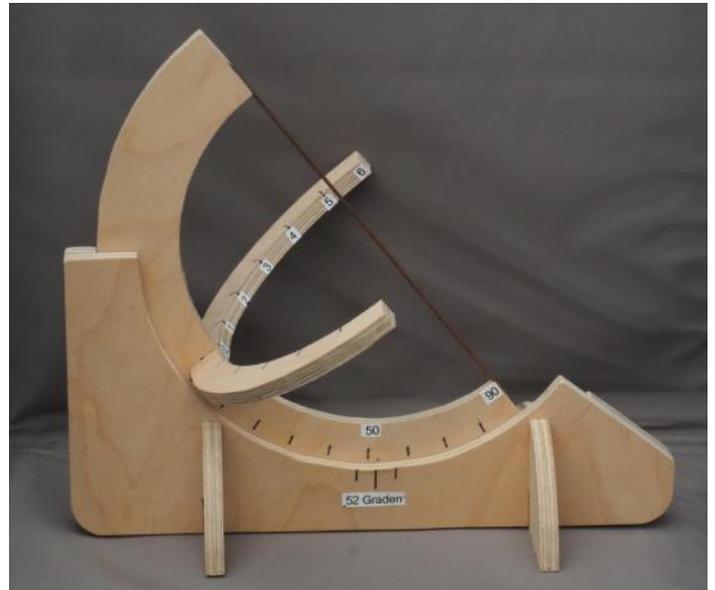


Fig. 2. The sundial assembled for 52° N.

Materials: two pieces of plywood each 125×125 mm and 4 mm thick (or two squares of cardboard), glue and a satay stick for the gnomon.

Tools: jig saw, knife and sandpaper.

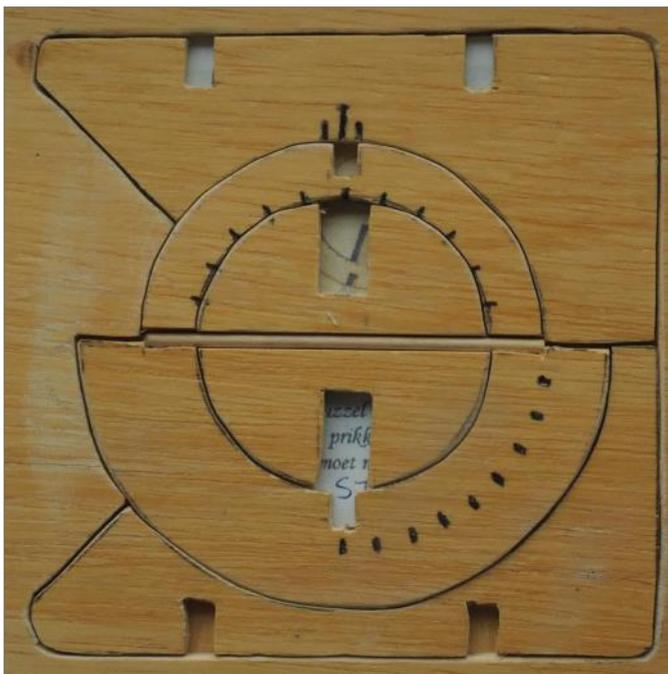


Fig. 1. The puzzle. The 'leaflet' you see through the slots contains the brief explanation.

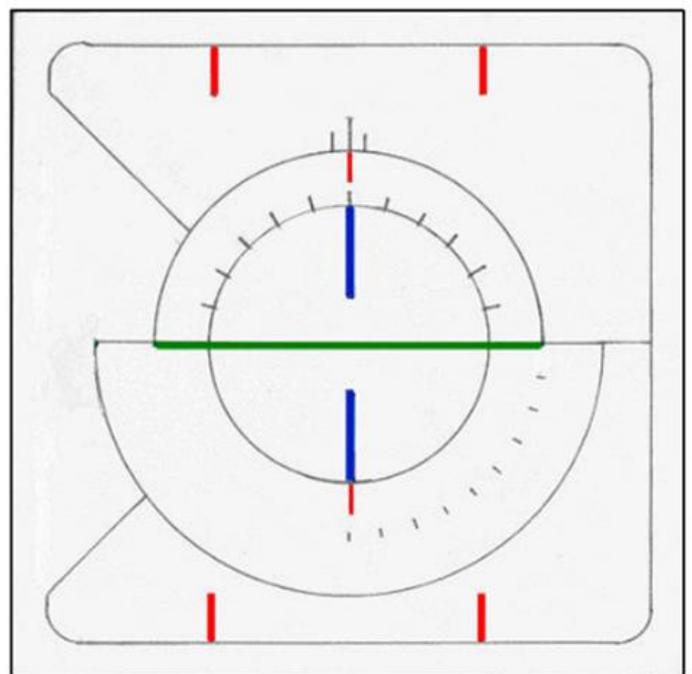


Fig. 3. The drawing.

Method

- Copy the drawing (Fig. 3) or download it from the website www.zonnewijzerkring.nl >zonnewijzerkunde>Artikelen and print it.
- Choose your material, either two squares of plywood or two squares of cardboard.
- Taking one of the squares, saw or cut along the dark grey lines as shown in Fig. 3. Leave the second square alone.
- Adapt the red lines to the thickness of the material used and saw or cut – for 4 mm plywood it is 4 mm.
- Adapt the blue lines to twice the thickness of the material – for 4 mm plywood it is 8 mm.
- The green line is the thickness of the satay stick; cut this out and glue a suitable satay stick to the larger half ring.
- Mark the tick marks on the larger half ring for the latitude.
- Mark the tick marks on the smaller half ring for the hours.
- Glue the sawn-out frame onto the second square; it is easy to fit the puzzle pieces into this frame for safe storage. to make the puzzle easy to put away.

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BSS ANNUAL CONFERENCE

Exeter, 21–23 April 2023

The 2023 Conference, organised by Doug Bateman with help from the Trustees and local members Martin Jenkins and Ben Jones, was based at the Mercure Exeter Southgate Hotel, very near the Cathedral Close and the City Wall.



Friday 21 April

Members from near and far gathered for tea and conversation in the hotel and then there was a chance to relax before informal dinner in our own section of the restaurant. After this we moved to the commodious Seymour Suite, where Kevin Karney had set up the audio-visual equipment, and then followed the first two presentations of the Conference...



Ben Jones: *Scratch Dials*

Ben showed pictures of dials from the Mass Dial Register (Figs 1-3). He began with four 'displaced' dials. The odd thing about three of these dials is that they seem to have been deliberately placed inside the church and next to a doorway. The fourth dial is set into the entrance way of a porch. What value or function did these dials represent that they should be kept in this way? Alas, these too-few examples cannot answer that question.

A second oddity is the symbol to be found on the church at Shute in Devon. It is said to be a Mass/scratch dial. If it is, then it is an example of a very rare type. It does have a central hole with metal in the base of it.



Fig. 1. With lines for eight hours, this dial is now built upside down into the wall behind the south door inside the church at Woodbury, Devon.

Lastly, Ben showed a few pictures of the vast amount of historic graffiti to be found in Ashwell Church in Hertfordshire. Amongst the texts and symbols carved



Fig. 2. The puzzling symbol at Shute, Devon.



Fig. 3. Dial-like graffiti at Ashwell, Hertfordshire.

into the walls inside the church there are texts dating from the time of the Black Death and an astoundingly detailed illustration of Old St Paul's (or is it Westminster Abbey?). Ben also showed pictures of three pieces of graffiti that look very much like Mass/scratch dials but could hardly have been so. Their positions inside the church, carved into the pillars and walls, strongly suggests that they are not 'displaced' dials from an earlier church brought inside when the current church was built.

As with all things Mass Dials, more research is required.

Geoff Parsons: Taormina Heliochronometer

Geoff Parsons provided a talk about a Pilkington and Gibbs Heliochronometer serial no. 633, which was obtained in its



original transportation box, with installation tools and shipping information (Fig. 4). The dial was shipped to Villa San Georgia, Taormina, Sicily from the P&G factory in Preston. The Villa was designed by Charles Robert Ashbee, a prominent architect in the Arts and Crafts movement on commission for Colonel Thomas Shaw-Hellier, and is today the 5-star Ashbee hotel. The Colonel died in 1910 but the

heliochronometer was sent shortly afterwards to his nephew Evelyn Shaw-Hellier who inherited the estate, hence the name on the shipping box. The latitude/longitude setting of the heliochronometer is normally set at the factory for the intended location before dispatch and corresponds precisely to the Taormina location of 38° N and 15° W. Its condition suggests that it may never have been installed.

Saturday 22 April

After breakfast, there was time to look at Elspeth Hill's extensive and beautifully-arranged display of books and other BSS merchandise, and to cast our votes for Photographic Competition entries, organised by David Hawker.

Frank King: The Queens' Dial: Shrinking a Millennium

In July 1980, almost on a whim and knowing nothing about sundials, Frank thought it might be entertaining to reverse engineer all the gnomonic lines and curves that feature on the well-known dial at Queens' College, Cambridge. He explained how he wrote a transformation function to map any point on the celestial sphere onto a point on the dial. Frank then referred to a remark made by Fred Sawyer about antique hour lines at the 2022 NASS Conference. Fred had convincingly demonstrated that, for 1000 years, people disagreed about whether or not these lines were straight.

Frank recalled that in 1980 he had never heard of antique hour lines and, although he had no trouble delineating them, he wasn't at first convinced as to their correctness. It wasn't their straightness or otherwise



that bothered him; what he had noticed was that, as drawn, their direction of travel appeared to take them across the horizon line into the realm of darkness where they couldn't possibly have anything to do with sub-dividing the daylight period. To resolve this issue, Frank simply extended the lines above the winter solstice curve and found that they naturally terminated at the point due south on the horizon line which corresponds to a declination of the

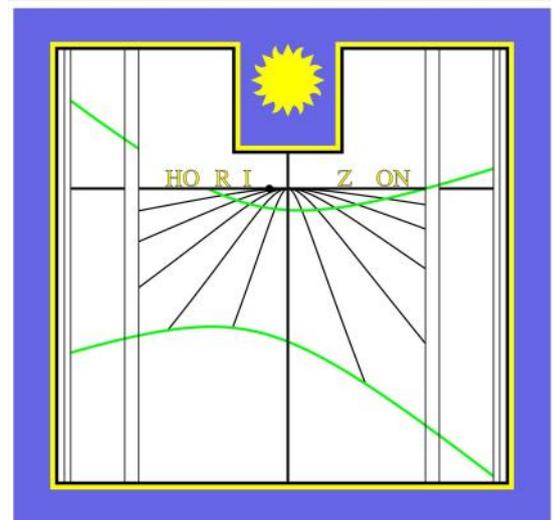


Fig. 5. The antique hour lines all converge on the south point on the horizon.



Fig. 4. Taormina heliochronometer with transportation box.



Elspeth Hill's bookstall, extending across the full width of the room.

negative of the observer's colatitude. To reach this point the lines curved quite sharply (Fig. 5). There was no question of these lines being straight. Frank concluded with two examples, 2nd- and 3rd-century dials, where the designers had been very close to discovering that their lines were not as straight as they seemed!

Geoff Parsons: *Discovering Sundial Coats of Arms*

Given the forthcoming Coronation, Geoff Parsons gave a presentation on Coats of Arms and how to interpret them. He explained that the main components comprise: the shield which is the actual coat of arms, the helm which may also include a crown or coronet indicates the persons rank, and a crest on top of the helm. A coat of arms with all components including supporters is correctly termed a Full Achievement and most sundials, particularly those located in stately homes, are engraved with a



Fig. 6. Geoff's Coat of Arms designed by the College of Arms: it shows a lion's jamb holding an armillary sphere to indicate his interest in sundials.

Full Achievement. This provides a useful means to identify and date the original owner of the dial. Stately homes still in use often fly the owner's heraldic banner and the coat of arms can be seen on the estate sundial. Any Society member wishing to add a coat of arms to their dials may petition the Earl Martial for a grant of arms (see Fig. 6).

Kevin Karney: *A Brief History of Solar Astronomy and the Equation of Time*

In the beginning, solar astronomy was mainly concerned with the prediction of the equinoxes and the solstices. But the Babylonians started serious astronomy as a means to provide the appropriate astrological predictions – particularly for the king. In so doing, they made and recorded thousands of astronomical measurements and predictions.



The story continues when the Greeks were making the first philosophical arguments about the cosmos. Most importantly, Plato stated, *a priori*, that everything in the heavens should move at uniform speed, in perfect circles and without change. Subsequently, Aristotle developed a complete cosmological model, based on observation and 'common sense', involving sun, moon, planets and stars – all moving subject to Plato's philosophy. This was the super-lunary world. The sub-lunary earth – at the centre of things – was imperfect and subject to change.

When Alexander conquered Babylon, the Babylonian astronomers' measurements became available to the Greek astronomers. This eventually allowed Hipparchos to solve the difficult issue of planetary regression (in which some planets, travelling mainly in one direction, temporarily reverse their course). The behaviour appeared to be against Plato's edict.

Greek astronomy was concerned with ...

- (a) 'saving the phenomena' (i.e. understanding the mechanisms so that predictions could be made), and
- (b) 'respecting the philosophy'.

Hipparchos did this by two methods, one of which had the planets and the sun moving uniformly in a small circle, which was carried uniformly around a larger circle – the epicycle/deferent method. He thus saved the phenomena and respected the philosophy.

However, Hipparchos' methods did not explain the observable fact that the seasons were not of equal duration. It was Ptolemy who solved this problem and first explained why the solar day was not of equal length throughout the year and thus 'invented' the Equation of Time. He admitted that this was of little use for planetary

astronomy, but was essential if one was considering the fast-moving moon.

Ptolemy achieved the 'saving the phenomena' but he erred away from 'respecting the philosophy' by introducing the Equant Point, which was not at the centre of things. The *Almagest* of Ptolemy and its following works, including the EoT, were the basis for all observational astronomy for some 1400 years until the early 17th century. Then the work of Tycho Brahe, Copernicus and Galileo finally debunked Aristotelianism. This ancient tradition lasted so long for any number of reasons, amongst which

- (a) astronomers strove to build models that did 'respect the philosophy',
- (b) the Aristotelian cosmology fitted perfectly in the religious requirements of both Christian and Muslim faiths,
- (c) the *Almagest* was very, very difficult to understand.

The golden age of the Equation of Time began in the Enlightenment when clocks became accurate. Initially, the EoT was required to correct clocks to give God's/ True/Solar time. A hundred years later, the sextant and the naval chronometer, combined with the EoT, allowed latitude and longitude to be computed. Tables, variable length pendulums, cams, gears and differentials were all employed in clocks to provide the Equation of Time.

However, over a period of about 150 years, the use of EoT moved:

- (a) from correcting clocks to give God's Time;
- (b) to using God's Time (as read from a sundial) to set the clocks.

The introduction of the telegraph signals was the end of the working life of the EoT. Mean time, as calculated from astronomers' transit telescopes, could be widely broadcast, ending the need for sundials.

In its old age, the Equation of Time finds some life as a 'complication' in



Entries for the Photographic Competition. A report and larger versions of the pictures will appear in the September Bulletin.

Photos: David Hawker.

exceptionally expensive clocks and watches. And, of course, as a delight to gnomonists in designing/making mean time sundials.

Fred Sawyer: Francis Line's Dial in the King's Privy Garden

Fred's talk described the 195 distinct sundials on the often-depicted but seldom understood Francis Line pyramid dial of glass boxes and globes that briefly stood in the Privy Garden of King Charles II.



Fred used Line's original images and instructions to review each of the many innovative varieties of dials Line created for the pyramid. Although it cost a fortune and was described as the most advanced scientific instrument in western Europe, the fragile dial was left unprotected and soon fell victim to 'court revels'. After standing for only six years, the entire structure was demolished by John Wilmot, 2nd Earl of Rochester and his drunken cronies.

Saturday Afternoon

After lunch we travelled by coach through the Devonshire lanes, some of them very narrow, to Hazels, Martin and Janet Jenkins' house in Venn Ottery.

Bad weather had been forecast but fortunately it was sunny for the scheduled hour in the gardens, where

there was a splendid collection of dials: fifteen in front of the house and eight at the back. The majority had been made by Martin himself, but also on show were works by others including Ben Jones, Anton Schmitz and Andreas Galanakis.

Martin had helpfully provided a brief illustrated guide to the dials, along with the programme for the afternoon, which included "Tea and biscuits plus a BSS examination on sundial knowledge (fabulous prizes to be won)".

As the sky grew darker with the threatened rain it was time to go back to the coach for the short ride to Tipton St John village hall. Outside, there was a

brief stop to look up at a sundial by Ben Jones, commemorating HM Queen Elizabeth II's Diamond Jubilee, and inside there were tea and biscuits followed by



Dial by Ben Jones on the end gable of Tipton St John Village Hall dated 2012 but now in need of a wash and brush-up.



Declining slate dial with dot numerals outside Hazels, now an official way point marker in Devon walkers' guides!



Kinematoskopon by Andreas Galanakis.



"Early Bird" Combination part east-facing vertical and part horizontal dial.



At the "Plato Socrates Dial". Photo: Doug Bateman.

Martin Jenkins explains the "mystery dial with American influence". Photo: Jackie Jones.





In the Jenkins' garden. Photo: Doug Bateman.

the half-hour quiz. After this, Martin gave us the answers and we marked each other's 'examination papers' (35 questions, some multi-part, almost all with photographs).



Vertical dial at St Mary's Church, Ottery St Mary.



Ben Jones and his inclining dial outside Ottery St Mary Hospital. He had brought along some spare umbrellas, in anticipation of rain.

Photo: Jackie Jones.

Then it was back to the coach for another short ride, this time to Ottery St Mary, to see the vertical break-arch dial on a buttress (SRN 1035) on St Mary's church. The impressive interior of the church included an 14th-century astronomical clock attributed to Bishop John de Grandisson. The Chairman entertained himself spotting tombs of his Haydon ancestors, who had owned Cadhay, a grand house in the area. For others, there was a chance to remind themselves of Geoff Parsons' talk on the components of a Coat of Arms.

Chairman Frank King thanked everyone involved in making the Conference such a success, especially Doug Bateman, but also Martin and Janet Jenkins, Ben Jones, Graham Stapleton and the other Trustees.

Martin Jenkins announced the examination results, describing the scores as "abysmal", for no one got even half marks! Top of the list was Fred



Coat of Arms on the tomb of John Haydon in the church at Ottery St Mary.

The final stop, in pouring rain, was at the entrance to Ottery St Mary Hospital to visit an interesting declining slate dial (SRN 5654) by Ben Jones at the hospital entrance.

In the evening, a most enjoyable Gala Dinner took place in the Seymour Suite transformed for the purpose, after which



Before the Gala Dinner.

Sawyer, who was followed by Ben Jones and Frank King. There were prizes of sundial cards, books, bottles and other well-chosen items, not just for these three, but for everyone who had attempted the test. Werner Riegler's prize was a BSS tie, which he wore to give his presentation the following day.

David Hawker then announced the results of this year's Photographic Competition: the winner was Mike Shaw with 'The Early Bird', second was John Allen with 'Creeping Towards Noon' and third was Jackie Jones with 'A Dance to the Music of Time'. These pictures, together with the other entries, will appear in the September *Bulletin*.

Sunday 23 April

Werner Riegler: An Inverse Sundial

Werner Riegler presented an idea for an 'inverse sundial', an astronomical clock that realises the definition of mean solar time (Fig. 7). The dial shows the zodiac, where the true sun and the mean ecliptic sun are moving with a period of a sidereal year. The mean equatorial sun is moving in a plane with a tilt angle of 23.44 degrees that also carries a world map in polar projection that rotates once



per sidereal day. The Greenwich Mean Time (GMT) is then given by the angle between the Greenwich meridian and the mean equatorial sun. The sidereal time is given by the angle between the vernal equinox and the Greenwich meridian.

If one imagines the true sun to shine onto a gnomon perpendicular to the equatorial plane, one can realise the shadow of a sundial and therefore solar time and the equation of time, hence the name 'inverse sundial'. Of course, it is not proposed to have a lamp in the dial, but the shadow is an indicator that is driven by the clock mechanism.



Fig. 7. The 'inverse sundial'.

A special feature of the clock is the precise movement of the true sun according to Kepler's laws. The Kepler equation is solved by a differential gear that subtracts a sinusoidal motion from a uniform rotation. The true anomaly is then generated by a so-called 'universal joint' or 'Hook joint'. The projection on the equatorial plane as also achieved with the same type of universal joint.

In summary, this clock produces the precise movement of the sun according to Kepler's laws and then derives and visually represents the mean time, sidereal time and solar time. Werner plans to work out a detailed design of the clock during this year and will then try to find a sponsor for the realisation.

David Brown: Before and After

David Brown opened by reminding us that we should not worry too much about the future, but just remind ourselves how far we have come. Applied to sundials, it is often very satisfying to look at recently-completed projects and reflect on how they were at the outset –



often years earlier – and gave examples of several instances where he had originated or helped with the creation or restoration of a sundial.

At East Harptree he had advised a conservation specialist on the restoration of a sundial at the very top of a 17th century church tower. Although the dial was not painted as suggested, at least the cleaned-up face is now more visible than it was previously.

In his capacity of Master of the Somerset Guild of Craftsmen in 2012 he met HM Queen Elizabeth II in Yeovil during her Diamond Jubilee tour and was able to show her a sundial he had recently made for a local

recently-retired Methodist Minister which had the motto "Our God Reigns". Prince Philip wanted to confirm that the slate was Welsh.

At Kingswood School in Bath where he had been Head of Physics for fourteen years, he had created three sundials – a vertical, a horizontal and an analemmatic – soon after the formation of BSS. All of them had been 'first attempts' and had not survived for very long. All had now been replaced in more durable materials (Figs 8 and 9).



Figs 8 and 9. 'Before' and 'After' versions of a horizontal sundial at Kingswood School, Bath.

Other examples included restoration of a Melvin horizontal dial, two polyhedrals two analemmatics and a new vertical slate dial in New York.

Chris Lusby Taylor: *Ptolemy Was so Nearly Right*

Chris Lusby Taylor continued the theme of looking into the history of our understanding of our orbit. He expressed huge admiration for the ancients' record keeping, trigonometry and models of the solar system. But then he showed a simple change he has found to the Ptolemaic model that greatly increases its accuracy. His basic change can be seen on Kevin Karney's excellent Equation of Time web site but for the first time he presented a way to improve it further. He believes he was the first to find these improvements but admits that he's been proved wrong in this regard before, notably by Fred Sawyer.

Martin Jenkins: *A Noon Line Discovered by Ben Jones*

On the church of St Peter ad Vincula in Combe Martin, North Devon, there is an unusual shadow-casting stone and noon indicator (Fig. 10). The presentation discussed the operation of this unique noon indicator, the computer modelling of its operation, and the anomalies found. Currently there is no information about this noon-indicating dial, its date



Fig. 10. At the church of St Peter ad Vincula in Combe Martin. South Porch east wall noon dial showing wall shadow-casting edge, corbel shadow-casting stone, and two ground stones.



of construction or indeed its purpose. Analysis so far has determined that the noon shadow is cast by the corner edge of the porch wall. The corbelled wall stone is used for another purpose, probably in conjunction with the two ground stones. The two ground stones appear to have been relocated at some time, most likely when the concrete drainage was installed, as they do not align with the shadow of the shadow-casting stone for any significant dates. The ground stone closest to the wall stone may have been connected with indicating the summer solstice or the equinox but clearly does not do so now. The rearmost stone aligns correctly for noon with the wall edge shadow but does not appear to indicate anything of significance. Computer modelling by Martins Gills provided clear shadow images upon the stones throughout the year in order to complement the analysis of this noon dial.

Douglas Bateman: *Julian Time, Gregorian Time, Sidereal Time and Mean Time*

This talk centred on the process of recording the 'clock stars' by transit telescope to deriving mean time. The talk followed on from the lecture on the Greenwich time ball, as given at the 2022 York conference. Following a brief summary of Julian time and its



application to computers and astronomical calculations, details were given of the corrections that were applied to the telescope observations, namely, telescope optical axis collimation, tilt, and alignment along the meridian. A table was shown of the time recorded against the 'clock' stars, but what is missing – the main thrust of the talk – is that there is no record of the steps taken by the young men 'computers' to reduce the observations into mean time (and after 1855 to the clocks by telegraph around the country!). Reference works report that the calculations, with the aid of seven-figure log tables, took several hours. It is this sequence that is missing from the archives, and it was hoped that some of the members present would help to recreate these steps.

The Andrew Somerville Memorial Lecture

Dr Stephen Johnston: *The Many Faces of Time – Polyhedral Dials in the Renaissance*

This year's lecture followed closely in the footsteps of Andrew Somerville himself but, by way of introduction, opened with astrolabes. Partly as a plug for the speaker's own institution (History of Science Museum, University of Oxford) – home to the world's largest collection of astrolabes – but also because these are such close relatives of dials. While they are extraordinarily ingenious and often beautiful historical objects, they are also now more (digitally) accessible than at any time in their long history. The outstanding online version created by Alex Boxer at <https://alexboxer.com/astrolabe/> was demonstrated (Fig. 11).

The inspiration for the lecture itself sprang directly from Andrew Somerville's work on "The Ancient Sundials of Scotland" (1987), which documented the unique Scottish tradition of monumental masonry dials from the 17th and early 18th centuries. Amongst the distinctive forms favoured by Scottish designers were polyhedral dials, and the lecture began properly with a broad survey of polyhedral dials across 16th-century Europe, to provide a larger context for Somerville's Scottish work.

All kinds of shapes were used, in sometimes elaborate and even extreme forms. Balancing the exotic figures there was also enormous intellectual and aesthetic value attached to geometrical regularity. Euclid's *Elements* had



Fig. 11. Screen shot of Alex Boxer's astrolabe (by permission).

demonstrated that there could be only five perfectly regular solids, with identical regular polygons as faces. Dials were made using not only these well-known Platonic solids (tetrahedron, cube, octahedron, dodecahedron and icosahedron) but also what are now known as the Archimedean solids. The latter were still under active investigation in Renaissance Europe, and would not be definitively enumerated until the work of Johannes Kepler in the early 17th century. With faces composed of different types of regular polygon arranged around identical vertices, these semi-regular solids provided a rich basis for dialling exploration. Drawing principally on museum collections, examples were shown in painted wood, printed paper and gilt brass, and with both pin and polar gnomons – all revealing the enthusiasm with which diallists exercised their art on the multiple planes of polyhedra (Fig. 12).



Fig. 12. Archimedean dial on painted wood, made by Ludwig von Hohenfeld for Prince Johann Friedrich von Württemberg, Stuttgart or Tübingen, 1596 (Landesmuseum Württemberg, inv. KK rosa 13; CC BY-SA).

The lecture then focused on a particular case study of a now-lost monumental polyhedral dial, commissioned by England's Lord Treasurer in the 1570s.

The dial was an Archimedean solid in the form of a truncated tetrahedron, with dials on six of its eight triangular and hexagonal faces. The anonymous manuscript describing it was first publicised by Andrew Somerville as a single-page note in the very early days of the *Bulletin* (the second ever issue in November 1989). The detail of the manuscript description leaves no doubt that this was an actual structure rather than an unrealised project. To avoid confusion on its busy surfaces, different colours were used for ordinary hours, the sun's sign, the rising and setting time, the quantity of day and night, the planetary hours, almucantars, azimuths and astrological houses.

Somerville suggestively juxtaposed this design with an almost contemporary letter by the mathematician Thomas Digges offering a polyhedral dial to the very same patron. That letter, from two years earlier in 1574, envisaged a Platonic solid for the architecturally important garden-palace complex which Lord Burghley was then creating at

Theobalds. Was Digges responsible for the design of the anonymously described truncated tetrahedron? Somerville did not quite say so. The lecture presented new evidence from the manuscript itself and from Digges' publications to argue explicitly that Digges was indeed the likely author.

It was especially appropriate for this memorial lecture that Andrew Somerville's work motivated both the broad context and the specific case study. In his 1989 note on the "Geometrical Puzzle" of the tetrahedral dial he hoped that the next *Bulletin* issue would carry a perspective rendition of the Digges dial. There duly followed an amusing version with a Christmas greeting as well as a net for cutting out and assembling (Fig. 13). Both of these were limited to showing only a few faces with common hours. Hopefully the next issue of the *Bulletin* will be able to follow historical precedent and carry a full reconstruction of the Digges dial, with all its lines and in colour – though the speaker finished with an earnest plea for a more skilled diallist to collaborate on its realisation.

Finally, Chairman Frank King thanked Doug Bateman again for arranging a most successful and enjoyable Conference, and looked forward to seeing everyone again at Newbury in September 2023 and at the 2024 Conference. It was then time for lunch, goodbyes and the journey home, perhaps with a few more days to enjoy Devonshire on the way.

The photos of the speakers are by Doug Bateman, and the notes (and most of the accompanying illustrations) are by the speakers themselves. Other photos are by Frank King and Christine Northeast, except where indicated.

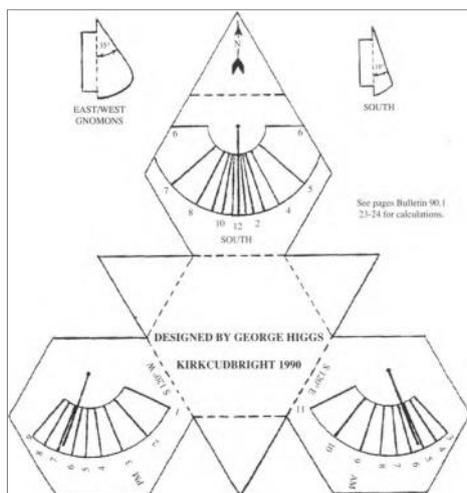


Fig. 13. Reconstruction of the 'Digges Dial' by George Higgs, 1990.

A GROUP OF EARLY STONE HORIZONTAL SUNDIALS IN NORTH WALES

IRENE BRIGHTMER

This study began some time ago, and with the late Tony Wood I prepared a presentation on the subject for our Newbury meeting, which included an example from Tony's home county of Gloucestershire.¹

Revisiting the subject recently with the idea of airing it in the *Bulletin*, I asked the BSS Registrar, John Foad, whether it was possible to search the latest Register to discover any similar examples of horizontal dials, where the hour lines are engraved directly into the stone of the pillar, rather than on a separate dial plate. John came up with a further eighteen dated prior to 1800, but did not rule out that there might be more. (There are also others dated post-1800 which we did not look at this time.) They were geographically scattered. However, none of them resembles the simplicity of the Flintshire examples; many are elaborate and have more complex gnomons and pillars. Therefore they are not being included here. I am also excluding the Gloucester example shown in the original presentation because neither does it match the Flintshire examples. However, several do have the same simple flat sheet gnomons, resembling the 1637 Flintshire dial described below, inserted directly into the stone dial.

In the small Flintshire group we note that the hour lines are carved directly into the horizontal surface of the stone pillar, although heavily weathered. Where they are still visible, Roman numerals are used, read from the inside. One has a remnant of a simple flat triangular gnomon, which is likely to be original. Another has what appears to be a replacement gnomon, and the other two are missing their gnomons. There is evidence that the gnomons had been inserted into the stone, embedded in lead. They all have initials and dates on the pillars, the dates ranging from 1588 to 1637.

In each example the pillar is approximately 4 feet high and is square in cross-section with chamfered edges with stops. The stone is fine-grained sandstone, greenish-grey in colour. It is likely that this is Gwespysr stone from quarries in the parish of Llanasa. Gwespysr stone has been used for building since Roman times and is used locally, for instance in St Asaph Cathedral, Flint Castle, as well as further afield, and was proposed for major building projects in 19th-century Liverpool. There are no working Gwespysr stone quarries surviving; the last closed in the 20th century.



Fig. 1. Dial at Golden Grove, Flintshire, dated 1590.

1588 Dial

This dial is known only from the listing details. I attempted to locate it in rough scrubby woodland in the company of the owner, but we gave up, intending to try again when the vegetation had died down, but for various reasons I have not re-visited.

The listing information suggests that the dial may not be in its original location, but may have been re-sited here when the adjacent summer house (also listed) was built in the early 19th century.

The dial was listed in 1987 and described in <https://britishlistedbuildings.co.uk/> as "Similar to the sundial in the grounds of Kentigern Hall, dated 1696; important as a rare early example." The stone stem is described as approximately 4 feet high with chamfered edges, and the front face is inscribed "IC MC 1588". Also included in the description are the weathered time lines on the top and evidence that there was formerly a gnomon.

I have so far been unable to identify the family which may be represented by the initials.

1590 Dial (SRN 7164; Fig. 1)

This is located at the west end of the south front of Golden Grove, an Elizabethan house in Llanasa parish. The house and the sundial were both listed in 1962; the house is Grade I and the sundial Grade II. The latter was listed because it is an "exceptionally early surviving sundial".



Fig. 2. 1590 dial showing date, hour lines and evidence of a gnomon, now lost, but originally inserted in lead.



Fig. 3. 1590 dial with indistinct initials on the side of the pillar, also showing signs of the insertion of the original gnomon.

Weathered hour lines are visible on the top of the stone, as well as a slot with remnants of lead for the insertion of the original gnomon (Fig. 2).

A date stone on the house indicates that it was built in 1578 by Edward Morgan. The initials on the side of the pillar may well be his, because the date on the dial would be right for him to be the person who commissioned it. But the initials are difficult to decipher (Fig. 3).

Sir Edward Morgan (d.1611) was a successful London lawyer in the Middle Temple, working for notable North Wales families. He made a fortunate marriage which brought him additional lands in Flintshire. His wealth enabled him to rebuild the house where his family had already been based for centuries. Sir Edward's eldest son, Edward Morgan junior (1576-1640), was MP for Flintshire. He married Ann, daughter of John Conwy of Bodrhyddan, but they were childless. So Edward junior bequeathed his estate to his younger brother Robert, who died only a few months after him, but Robert's children carried on the Morgan line, and the Morgans remained at Golden Grove until 1877.

A daughter of the first Sir Edward Morgan, Mary, also married into the Conwy family of Bodrhyddan, marrying John Conwy. It may be significant in this story that Bodrhyddan possesses a sundial in this group we are describing (see below).

1596 Dial (SRN 5083; Fig. 4)

This is in the garden of the house which was formerly the Canonry of St Asaph diocese, now known as Kentigern House which stands opposite the cathedral. The dial was listed Grade II in 1987.



Fig. 4. Is this a 1596 or a 1696 dial??

On the pillar below the date the initials "TBA" are engraved. This dial appears to have a later, replacement, gnomon, wrongly placed. And perhaps at the same time there was some attempt at re-engraving the hour lines on the stone surface (Fig. 5). These alterations may also have included changing the 1596 date to 1696.

1637 Dial (SRN 4717; Fig. 6)

This dial is in the formal gardens of Grade I listed Bodrhyddan Hall which is regularly open to the public during the summer. The present hall was built in the 1690s, on the site of earlier homes of the Conwy family who have been here for over 500 years. It is the only dial in this



Fig. 5. Top of 1596/1696 dial showing engraved hour lines and replacement gnomon.



Fig. 7. 1637 dial showing remains of flat gnomon.



Fig. 6. 1637 dial showing initials and date and remains of original gnomon.

group which retains its original gnomon, albeit with a broken tip. The date is engraved on the pillar beneath the initials “IHK” (Fig. 7).

The weathered hour lines are visible on the top of the pillar, as well as the numbering of the hours in Roman numerals, read from the inside (Fig. 8).

CONCLUSION

It is tempting to assume that these dials belong to a single genre and may have been the work of one maker or workshop. They are located in close proximity to one another in the historic (pre-1974) county of Flint, and there were close family links through marriage in two of the cases. The similarity in stone, height and pillar style are further hints to a historical connection between them.



Fig. 8. 1637 dial showing top of pillar with neatly inserted gnomon and weathered hour lines, with Roman numerals marking hours.

Pillars like these are not unusual in churchyards of North Wales, and have been described by archaeologists as probably the cut-down shafts of pre-Reformation churchyard crosses. (It is therefore intriguing that this small group of sundials are all located in gardens rather than churchyards.) Some of these old churchyard pillars now carry more modern dials from the 18th and 19th centuries. Whilst visiting churchyards in North Wales over the years, I have frequently spotted these old-looking stone pillars. On closer examination some of them were plain, but others revealed an existing sundial or evidence of a fixed dial plate now lost. These pillars resemble those which have been described with hour lines inscribed directly into the top of the pillar.

At Tredfraeth in Anglesey, I recorded such a pillar in 2008 (Fig. 9) with evidence of neither a dial plate nor hour lines engraved in the top. However, in the BSS Fixed-Dial Register a 1754 dial plate with gnomon was reported on this pillar in the 1980s (SRN 0744; Fig. 10). Comparing the images suggests that the stone capital holding the dial was removed from the pillar in the intervening years. Without



Fig. 9. Tredfaeth churchyard, Anglesey, 2008.



Fig. 10. Tredfaeth churchyard, 1980s with 1754 dial.



Fig. 11. Dyserth churchyard, historic Flintshire.



Fig. 12. Carrog churchyard with Meredith Hughes dial plate.



Fig. 13. Gwaenysgor churchyard, Flintshire.



Fig. 14. Cilcain churchyard, historic Flintshire.



Fig. 15. Trelawnyd churchyard, historic Flintshire.

the Register entry we would never have known of the previous use of this churchyard pillar.

The old pillar in Dyserth churchyard in historic Flintshire similarly has a separate stone on top which formerly supported a sundial plate, now lost (Fig. 11).

At Carrog near Corwen in Denbighshire, another simple pillar supports a portion of a broken dial plate which was the remaining part of a 1768 dial by Meredith Hughes, described in the December 2022 issue of the *Bulletin* (SRN 7871; Fig. 12).²

A similar pillar in the overgrown churchyard at Gwaenysgor in Flintshire had no sign of use as a sundial. However, on the side are the date 1663 and the initials “RE PE” (Fig. 13), very much in the style of the four dials discussed in this article. A much closer examination of the top (when the nettles have died down perhaps?) may reveal evidence of engraved hour lines.

There are similar old pillars in Cilcain churchyard and Trelawnyd churchyard (Figs 14 and 15), both in historic Flintshire, which deserve further close investigation.

It could be that these four early stone horizontal dials are rare relics of a larger group once existing in the area, and possibly elsewhere too. It must not be assumed, however, that the region was a ‘backwater’ in sundial history, as there are numerous examples of sophisticated London dials in the area, including a John Marke double horizontal (DH-53). Moreover, the garden containing the 1637 early horizontal dial belongs to a house with a fine vertical dial (SRN 5085).

ACKNOWLEDGEMENTS

Many thanks to BSS Registrar, John Foad, for taking up the challenge to find examples in the register of dials where the hour lines are engraved directly into the top of the pillar.

I am grateful to the owners at Golden Grove for permission to view and photograph their dial; also to Jen Brownlie for recent images of the dial.

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A RECENTLY DISCOVERED 17th-CENTURY SUNDIAL AT LEDSTON HALL, WEST YORKSHIRE

NICOLA TOOP

Ledston Hall, West Yorkshire, is a magnificent Grade I Listed 17th-century hall set within a designed landscape and parkland of late 17th- to 18th-century date (Fig. 1). The hall has medieval origins, but its current form is attributed to development by its 17th-century owners, in particular Sir John Lewis, who leased the property from c.1616 and eventually acquired it in 1653. Sir John was made baronet in 1660, but was the sole holder of the title.

The hall has been undergoing extensive restoration works on behalf of the Wheler Foundation, which has included excavation in the surrounding gardens, carried out by archaeologists from FAS Heritage (York).¹ Within a walled garden to the north of the main hall, close to a building

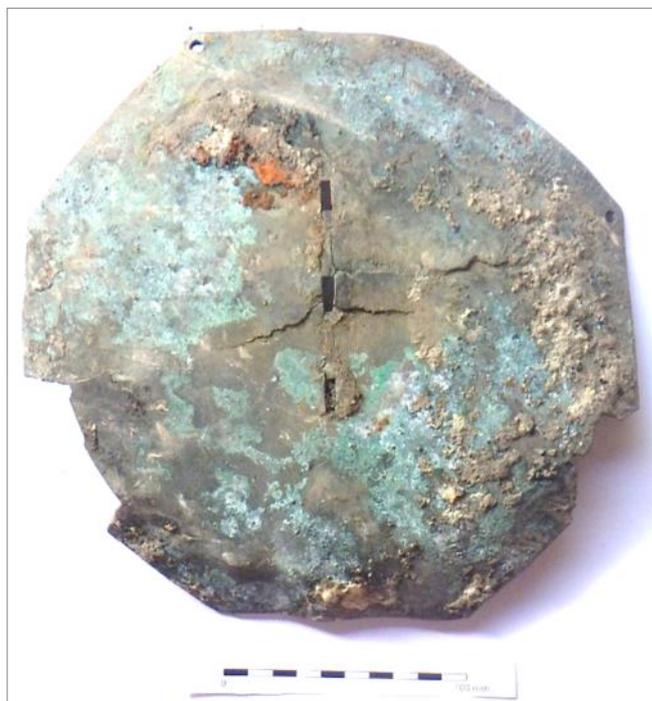


Fig. 3. Sundial prior to restoration. Photo © Karen Barker.

known as ‘The Bothy’, a copper-alloy sundial was discovered within a relatively recent, 19th- or 20th-century, rubble layer (Figs 2 and 3).

The sundial is octagonal, 25 cm (10 in) across the flats and consistently 2 mm thick. The dial has unfortunately suffered damage; the flat form is now domed and misshapen, some edges are broken along the line of an engraved circle around the dial (resulting in the loss of Roman numerals ‘V’, and ‘VI’ on both sides). The plate has three slots for the tenons on the gnomon, indicating considerable effort in its production and showing that this was a quality dial. Unfortunately, the gnomon is missing, but the dial is sufficiently complete to allow its form to be understood. Careful conservation work by Karen Barker (Antiquities Conservation Service) has revealed the detailed, incised design on the sundial, which has provided fascinating information relating to the date, maker, and likely commissioner of this otherwise unassuming object (Fig. 4).

Of particular interest is the survival of an inscription at the top of the face – *Antonius Thompson Fecit* – and a coat of arms, which together allow this object to be tied firmly to the history of Ledston Hall (Fig. 5).



Fig. 1. General view of Ledston Hall. Photo © FAS Heritage.



Fig. 2. Aerial view of the site. Google Earth © Infoterra Ltd & Bluesky.



Fig. 4. Sundial post-conservation. Photo © FAS Heritage.

Inscription

Antonius Thompson Fecit – “Made by Anthony Thompson”

Anthony Thompson (1638-65) was an instrument maker based in Hosier Lane, London. The firm of Thompson (or Thomson) was well known in the 17th century; advertisements for John Thomson exist from 1610, and references to Anthony Thompson occur in books dated to 1650 or 1660,² and he published on the ‘art of reflex dialling’ in 1658.³

Two of Anthony Thompson’s trade cards survive in the Science Museum Group collections, including one which bears the inscription “Delineavit Antonius Thompson” in



Fig. 5. Detail of design. Photo © FAS Heritage.

near-identical script to that found on the Ledston sundial. A sector attributed to him is held in the British Museum, again inscribed *Antonius Thompson fecit*.⁴

‘Thomson the instrument maker’ appears to have been well known and is referenced in the diary of Samuel Pepys, for 18 July 1663:

“Up and to my office, where all the morning, and Sir J. Minnes and I did a little, and but a little business at the office. So I eat a bit of victuals at home, and so abroad to several places, as my bookseller’s, and then to Thomson the instrument maker’s to bespeak a ruler for my pocket for timber, &c., which I believe he will do to my mind.”

Notably, Pepys was also acquainted with Sir John Lewis, then owner of Ledston Hall, noting on 22 March 1661/2:

“At the office all the morning. At noon Sir Williams both and I by water down to the Lewes, Captain Dekins, his ship, a merchantman, where we met the owners, Sir John Lewes and Alderman Lewes, and several other great merchants; among others one Jefferys, a merry man that is a fumbler, and he and I called brothers, and he made all the mirth in the company. We had a very fine dinner, and all our wives’ healths, with seven or nine guns apiece; and exceeding merry we were, and so home by barge again, and I vexed to find Griffin leave the office door open, and had a design to have carried away the screw or the carpet in revenge to him, but at last I would not, but sent for him and chid him, and so to supper and to bed, having drank a great deal of wine.”

Coat of Arms

The coat of arms on the sundial needs careful study to understand the design, but interpretation has been helped by another discovery made during the restoration works –



Fig. 6. Coat of arms at Ledston Hall. Photo © FAS Heritage.

an intricately carved coat of arms found in the hall (Fig. 6). This shows the shield divided into at least seven with helmet and crest over. Beneath the shield is the motto of the Lewis family – *Spe Tutores Armis* – “Safer by hope than by arms.”

Summary

Given the known date of Anthony Thompson’s career, and the presence of the Lewis crest and motto, it is logical to conclude that the sundial was commissioned by Sir John Lewis between his purchase of Ledston Hall in 1653, and prior to Thompson’s death in 1665. Lewis was raised to the baronetcy of Ledston in 1660; the title became redundant after his death in 1671.

In the years up to his death in 1671, Sir John Lewis saw the addition of a north wing to the hall, reworking of the east front and extension of the west range northwards. He is also credited with the creation of the kitchen garden to the north of the house, within which the sundial was found, and so this commission may have formed part of this period of change at Ledston.

REFERENCES

1. Field Archaeology Specialists Ltd, trading as FAS Heritage.
2. H.R. Calvert: ‘Thompson of Hosier Lane, Instrument Makers of the Seventeenth Century’, *Isis* 26(1), 50-2 (1936), JSTOR, <https://www.jstor.org/stable/225052>
3. A. Thompson: *The Whole Art of Reflex Dialling, Shewing the Way to Make All Manner of Dials which Shall Shew the Houre by a Spot of Light Reflected from a Glasse; Performed by an Easie Instrument, Etc* (1658).
4. British Museum Accession No 1956.0501.1. Image online at https://www.britishmuseum.org/collection/object/H_1956-0501-1

Dr Nicola Toop is a senior archaeologist at FAS Heritage, York, and undertakes wide-ranging projects across the UK. Nicky studied Archaeology and History at the University of Leicester, before studying for an MA in Medieval Archaeology and a PhD at the University of York. She can be contacted at nicola.toop@fas-heritage.co.uk



SUNDIALS ON MOSAICS

JOHN DAVIS

The Hatay district in Turkey has sadly been in the news recently due to the devastating earthquakes in the region. Just before this happened, though, I received information about some mosaics which are now in the Hatay Archaeological Museum, Antakya, which was the Roman province of Antioch. The mosaics have only been excavated relatively recently and they depict sundials in a rather humorous manner. The pictures in Figs 1 and 2 come from Dr Sophie Hay who lived and worked in Italy for 19 years, gaining her PhD for fieldwork with the British School in Rome’s Pompeii Project. She is now a freelance archaeologist living in London: we are most grateful for the material.

Probably the best way to describe the mosaics is simply to quote the labels which are now on the displays. For Fig. 1, the labels say:

“Rescue excavations carried out during the construction of the modern funicular system between the city and the top of Silpius Mountain in Antakya has revealed the remains of a settlement area with multiple layers dating back to the Ottoman, Medieval, Crusader, Byzantine, Late Antique and Early Roman periods. The excavation has revealed a Late Antique house in Antioch with figural mosaics decorating the triclinium (dining hall) and the cubiculum (bedroom). According to archaeological evidences, the construction and settlement phases of this house can be dated between 276 A.D. and 337 A.D.”

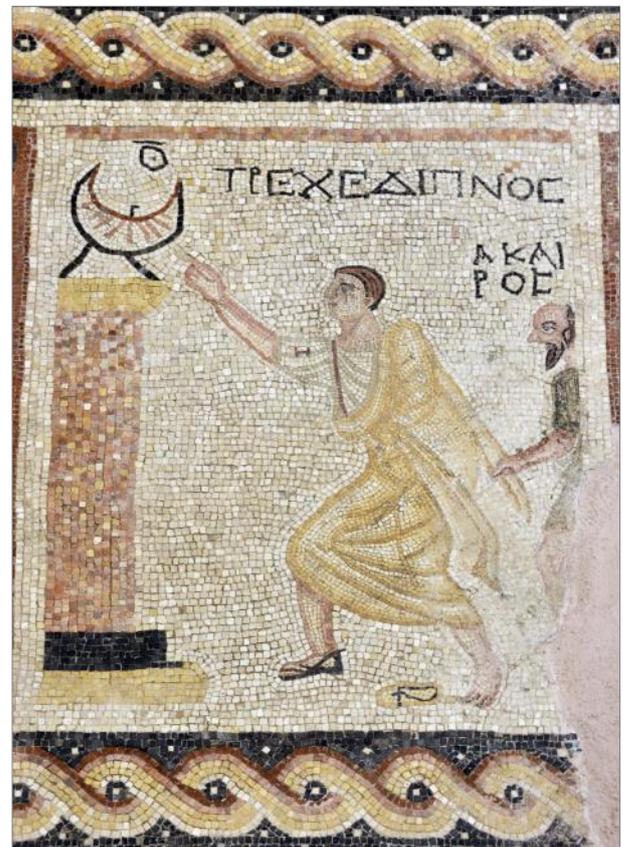


Fig. 1. Photo courtesy Sophie Hay.



Fig. 2. Photo courtesy Sophie Hay.

“The Sundial Scene. The decorative field of the mosaic decorating the triclinium consists of three different panels. The central panel depicts a male figure looking at a sundial on a column. The Greek letter θ (theta) above the sundial indicates that the ninth hour has already passed. In Roman daily life, this marks the end of the official working day and the beginning of dinner time. The young male figure is depicted with one of his sandals flown off and the Greek inscription above his head reads ΤΡΕΞΕΔΙΠΝΟΧ (Trechedipnos), “run to dinner”. In Greek literature, this

term was used by New Comedy writers, referring to the “parasites who run to dinner”. In the right of the scene is a caricaturized [sic] male figure inscribed ΑΚΑΙΡΟΧ (Akairos), “ill-timed, inappropriate timing”. The panel can thus be interpreted as the depiction of a belated guest or parasite rushing to the banquet, in a humorous manner.”

and for Fig. 2 we have:

“Third century AD, Antakya, Daphne

SCROUNGERS

“The first panel depicts an old and bearded man advancing toward the column topped with a sundial. Gazing at the sundial and his mouth slightly ajar, the old man is draped in a greyish-white and yellow-brown shawl. His arms wrapped with the shawl are raised to his chest as if he is beating his chest with them and his open mouth suggests he is shrieking. The ancient Greek text in the upper left corner of the panel actually explains this posture – the text reads ΕΝΑΤΙ ΠΑΡΕΛΕΣΑΝ (Enati parelesan), i.e. “it is past nine/dining time”. The scene [not shown] in the second panel in the same room is almost the same as this one. The unbearded man in the second panel seems to be leaping onto the column, whose top is missing. It is noted that the man is about to throw a stone at the sundial. Both scenes depict scroungers, one old and one young, who had the habit of freeloaded at the dinners of the wealthy, shrieking and one, to avenge, throwing a stone at the sundial for their late arrival.”

Although the sundials are not depicted particularly accurately, they are significant in showing that the Romans did actually make use of their public sundials and also that vandalism to sundials is nothing new.

john.davis51@btopenworld.com

THE “POOR MAN’S DYAL” REVISITED

GRAHAM STAPLETON

It is not easy to write about a dial which no longer exists and whose only surviving written reference does not actually describe. That reference is a pamphlet dated 1689, written by Sir Samuel Morland, promoting his “Poor Man’s Dyal”. In his 2003 *Bulletin* article,¹ John Foad gave the full text and deduced as much as could be securely inferred from the pamphlet that assumedly accompanied the dial. Coming across the pamphlet again,² I wondered if any more light could be thrown on the nature of the dial.

The text of the pamphlet divides into three roughly equal parts. The first describes a method of establishing an East–West line upon which to set the dial. The second is a list of

British towns and cities, with the amount that the dialplate must be raised to correct for it being delineated for the latitude of London. The remainder is taken up with a general diatribe against the makers of what we might now call ‘garden centre dials’ and a specific one against the maker of an inferior copy of this dial.

The only illustration is in the first part, showing in plan view how to use the “small instrument” (which we have to imagine was sold alongside the actual dial) to determine an East–West line. That found, and the 6–6 line of the dial placed over it, the dial would be set. This instrument clearly has a circular base, with its circumference divided

into exact quarters. The drawing of the shadows cast by the instrument implies a pointed vertical shadow-caster, overall suggesting something akin to an outsize drawing pin. Whether the ‘instrument’ was made from metal, wood, or even papier-mâché, since it was only likely to be used once to set an inexpensive dial, it cannot itself have been complex or expensive to manufacture.

The list of British towns and cities is almost exactly the same as that in the 3rd edition (1700) of *Leybourne’s Art of Dyalling*.³ This suggests that Morland copied the list from the second edition of 1681, or at least a common source. For each location, the amount that the North (or South) side of the dial needs to be raised is given: almost all of them are very small fractions of an inch. This certainly illustrates Morland’s dedication to precision, but it seems unrealistic that those buying the dial would ensure they had a perfectly level surface before making a wedge for a twentieth of an inch. What these measurements do give us – with the help of some modest trigonometry – is the diameter of his dial. Taking all the values for the list of places, I concur with Foad’s deduction that it was about four inches in diameter.

The final third, in being a riposte to his imitators’ dial and its defects, lets us partially infer the nature of his own and also that it must have been sold for a certain time before the pamphlet. It appears to have been a modest, plain horizontal dial, probably only divided down to quarter-hours. To produce any number economically, they would have to be cast: a mould such as he might have used is to be seen at the Metropolitan Museum, New York.⁴ This mould was used for pewter and produced dials in one piece, the convenience of which is slightly negated by making it less easy to remedy faults occurring in the casting process. That said, fineness of finish would not be such a concern for a cheaper item.

The inflamed language of the pamphlet obscures what metal the dial was made from. If the pamphlet’s final paragraph is read as suggesting that the dial was cast in tin from ingots, then that would be an extraordinary choice. Tin (and by extension pewter) is subject to ‘tin pest’, where at sustained low temperatures, the crystal structure eventually degrades and crumbles.⁵ If neither of these was used, the only practical option was brass. For all he says about brass workers, there were a good number of small foundries in London who could have produced batches of dials, whole, or in parts for assembly.

Samuel Morland’s list of engineering accomplishments is a long one. If an exceptional engineer, he was not so adroit at getting payment for his inventions or maintaining the patronages and pensions that he relied on to sustain his work. It seems that this small dial was an enterprise to raise funds at a particularly low ebb. Judging by Morland’s letter (also in 1689) to the Archbishop of Canterbury, Thomas Tenison, his life was at a turning point. The long letter gave an account of his life and concluded with the declaration that his only wish was to retire and spend his life “in



Mr Punch’s Country Life (Project Gutenberg) (1910).

Christian solitude”; and he begged the primate’s “helping hand to have his condition truly represented to his Majesty.” This latter eventually worked, as there is a letter dated March 1695, thanking him for “favours and acts of charity.”⁶

There is one other dial that Morland was responsible for, which was also short-lived, but perhaps offers us a glimpse of his humour. Many different figures have been bearers of dials, but his Pulcinella of the *commedia dell’arte* – otherwise known as Mr Punch – appears to be unique. John Aubrey tells us:⁷ “At *Vaux-Hall*, Sir *Samuel Moreland* built a fine Room, *Anno* 1667; the Inside all of Looking-Glass, and Fountains very pleasant to behold, which is much visited by Strangers; it stands in the Middle of the Garden, ...Foot square, ... high, cover’d with *Cornish* slat[e]; on the Point whereof he plac’d a Punchanello, very well carv’d, which held a Dial; but the Winds have demolish’d it.”

Perhaps Mr Punch should be revived; his form certainly suggests a multiple dial.

REFERENCES

1. John Foad: ‘The Poor Man’s Dyal’, *BSS Bull.*, 15(ii), 85-7 (June 2003).
2. Samuel Morland: *The Poor Man’s Dyal with an Instrument to set it*, London (1698) Reprinted by R.B. Prosser (1886) Online at <https://babel.hathitrust.org/>
3. William Leybourne: *The Art of Dyalling*, London (1700) Wellcome Collection online.
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5. Center for Advanced Life Cycle Engineering, University of Maryland Online at <https://calce.umd.edu/tin-pests>
6. Dictionary of National Biography 1885-1900 Online at <https://en.wikisource.org/>
7. John Aubrey: *The Natural History and Antiquities of the County of Surrey*, 1, 12, London (1719) Online at <https://babel.hathitrust.org/>

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The British Sundial Society
Report of the Trustees and Unaudited Financial Statements
For the year ended 31 December 2022

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Report of the Trustees

Independent Examiner's Report to the Trustees

Statement of Financial Activities

Statement of Financial Position

Notes to the Financial Statements

Detailed Statement of Financial Activities

**The British Sundial Society
Report of the Trustees
For the year ended 31 December 2022**

The Trustees have pleasure in presenting their report and the financial statements for the charity for the year ended 31 December 2022. The Trustees have adopted the provisions of Accounting and Reporting by Charities: Statement of Recommended Practice applicable to charities preparing their accounts in accordance with the Financial Reporting Standard applicable in the UK and the Republic of Ireland (FRS 102) (effective 1 January 2019).

(The Trustees' Annual Report 2022 was published on pages 26-28 of the March 2023 Bulletin)

OBJECTIVES AND ACTIVITIES

Objectives and aims

The trustees have considered the Charity Commission's guidance on public benefit, including the guidance 'public benefit: running a charity (PB2)'.

FINANCIAL REVIEW

Reserves

The trustees have considered the level of reserves they wish to retain appropriate to the charity's needs. This is based on the charity's size and the level of financial commitments held. The trustees aim to ensure the charity will be able to continue to fulfil its charitable objectives even if there is a temporary shortfall in income or unexpected expenditure. The trustees will endeavour not to set aside funds unnecessarily.

RISK ASSESSMENT

The trustees actively review the major risks which the charity faces on a regular basis and believe that maintaining the free reserves stated, combined with their annual review of the controls over key financial systems, will provide sufficient resources in the event of adverse conditions. The trustees have also examined other operational and business risks which they face and confirm that they have established systems to mitigate the significant risks.

REFERENCE AND ADMINISTRATIVE INFORMATION

Name of Charity	The British Sundial Society
Charity registration number	1155688
Principal address	99 Western Road Lewes East Sussex BN7 1RS

Trustees

The trustees and officers serving during the year and since the year end were as follows:

Frank King
Chris Williams
(Resigned: 27 May 2022)
Jackie Jones
Graham Stapleton
Bill Visick
Ben Jones
(Appointed: 28 June 2022)

Independent examiner

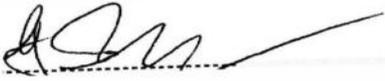
Andrew M Wells FMAAT
Counterculture Partnership LLP
Unit 115 Ducie House
Ducie Street
Manchester
M1 2JW

**The British Sundial Society
Report of the Trustees Continued
For the year ended 31 December 2022**

Bankers

The Co-operative Bank plc
PO Box 101
1 Balloon Street
Manchester, M60 4EP

Approved by the Board of Trustees and signed on its behalf by

A handwritten signature in black ink, appearing to be 'G. Stapleton', written over a horizontal dashed line.

Graham Stapleton

22 April 2023

The British Sundial Society
Independent Examiners Report to the Trustees
For the year ended 31 December 2022

I report to the trustees on my examination of the accounts of the charity for the year ended 31 December 2022.

Responsibilities and basis of report

As the charity trustees, you are responsible for the preparation of the accounts in accordance with the requirements of the Charities Act 2011 ('the 2011 Act').

I report in respect of my examination of the charity's accounts carried out under section 145 of the 2011 Act and in carrying out my examination I have followed all the applicable Directions given by the Charity Commission under section 145(5)(b) of the Act.

Independent examiners statement

I have completed my examination. I confirm that no matters have come to my attention in connection with the examination giving me cause to believe that in any material respect:

1. accounting records were not kept in respect of the Charity as required by section 130 of the 2011 Act; or
2. the accounts do not accord with those records; or
3. the accounts do not comply with the applicable requirements concerning the form and content of accounts set out in the Charities (Accounts and Reports) Regulations 2008 other than any requirement that the accounts give a 'true and fair view' which is not a matter considered as part of an independent examination.

I have no concerns and have come across no other matters in connection with the examination to which attention should be drawn in this report in order to enable a proper understanding of the accounts to be reached.



22 April 2023

Andrew M Wells FMAAT
Counterculture Partnership LLP
Unit 115 Ducie House
Ducie Street
Manchester
M1 2JW

The British Sundial Society
Statement of Financial Activities
For the year ended 31 December 2022

	Notes	Unrestricted funds £	Restricted funds £	2022 £	2021 £
Income and endowments from:					
Donations and legacies	2	1,259	-	1,259	2,292
Charitable activities	3	23,129	-	23,129	10,689
Investments	4	524	-	524	6
Total		24,912	-	24,912	12,987
Expenditure on:					
Charitable activities	5/6	(23,512)	(464)	(23,976)	(11,063)
Other expenditure		(3,857)	-	(3,857)	(3,072)
Total		(27,369)	(464)	(27,833)	(14,135)
Net expenditure		(2,457)	(464)	(2,921)	(1,148)
Reconciliation of funds					
Total funds brought forward		76,155	7,146	83,301	84,449
Total funds carried forward		73,698	6,682	80,380	83,301

The British Sundial Society
Statement of Financial Position
As at 31 December 2022

	Notes	2022 £	2021 £
Fixed assets			
Tangible assets	11	17,228	17,228
		17,228	17,228
Current assets			
Debtors	12	3,921	11,735
Cash at bank and in hand		60,634	55,564
		64,555	67,299
Creditors: amounts falling due within one year	13	(1,403)	(1,226)
Net current assets		63,152	66,073
Total assets less current liabilities		80,380	83,301
Net assets		80,380	83,301
The funds of the charity			
Restricted income funds	14	6,682	7,146
Unrestricted income funds	14	73,698	76,155
Total funds		80,380	83,301

The financial statements were approved and authorised for issue by the Board and signed on its behalf by:



22 April 2023

Graham Stapleton
Trustee

The British Sundial Society
Notes to the Financial Statements
For the year ended 31 December 2022

1. Accounting Policies

Basis of accounting

The financial statements have been prepared under the historical cost convention, except for investments which are included at market value and the revaluation of certain fixed assets and in accordance with the Charities SORP (FRS 102) 'Accounting and Reporting by Charities: Statement of Recommended Practice applicable to charities preparing their accounts in accordance with the Financial Reporting Standard applicable in the UK and Republic of Ireland (FRS 102) (effective 1 January 2019)', Financial Reporting Standard 102 the Financial Reporting Standard applicable in the UK and Republic of Ireland (FRS 102), and the Charities Act 2011.

The British Sundial Society meets the definition of a public benefit entity under FRS 102. Assets and liabilities are initially recognised at historical cost or transaction value unless otherwise stated in the relevant accounting policy note(s).

Going concern

The financial statements are prepared, on a going concern basis, under the historical cost convention.

Change in accounting policy

There have been no changes to the accounting policies since last year or to policies used by the former charity British Sundial Society (registered charity number 1032536).

Incoming resources

Recognition of Incoming Resources

These are included in the Statement of Financial Activities (SOFA) when:

- the charity becomes entitled to the resources;
- the trustees are virtually certain they will receive the resources; and
- the monetary value can be measured with sufficient reliability.

Incoming Resources with Related Expenditure

Where incoming resources have related expenditure (as with fundraising or contract income) the incoming resource and related expenditure are reported gross in the SOFA.

Grants and Donations

Grants and Donations are only included in the SOFA when the charity has unconditional entitlement to the resources.

Tax reclaims on Donations and Gifts

Incoming resources from tax reclaims are included in the SOFA during the same period as the gift to which they relate.

Contractual Income and Performance Related Grants

This is only included in the SOFA once the related goods or services has been delivered.

Investment Income

This is included in the accounts when receivable.

Investment Gains and Losses

This includes any gain or loss on the sale of investments and any gain or loss resulting from revaluing investments to market value at the end of the period.

Donated goods, services and facilities

Gifts in Kind

Gifts in kind are accounted for at a reasonable estimate of their value to the charity or the amount actually realised. Gifts in kind for sale or distribution are included in the accounts as gifts only when sold or distributed by the charity. Gifts in kind for use by the charity are included in the SOFA as incoming resources when receivable.

Donated Services and Facilities

These are only included in incoming resources (with an equivalent amount in resources expended) where the benefit to the charity is reasonably quantifiable, measurable and material. The value placed on these resources is the estimated value to the charity of the service or facility received.

Volunteer Help

The value of any voluntary help received is not included in the accounts but is described in the trustees' report.

The British Sundial Society
Notes to the Financial Statements Continued
For the year ended 31 December 2022

Resources expended

Liabilities are recognised as resources expended when there is a legal or constructive obligation committing the Charity to the expenditure:

Governance Costs

Include costs of the preparation and examination of statutory accounts, the costs of the trustees' meetings and cost of any legal advice to trustees on governance or constitutional matters.

Annual Commitments

There are no annual commitments under non-cancelling operating leases and no capital commitments.

Investments

Investments quoted on a recognised stock exchange are valued at market value at the period end. Other investment assets are included at trustees' best estimate of market value.

Tangible fixed assets

The British Sundial Society Library is stated at valuation based on the 2014 value calculated by Rogers Turner Books.

2. Income from donations and legacies

	2022	2021
	£	£
Unrestricted funds		
Donations received	1,259	1,292
Legacies received	-	1,000
	1,259	2,292
	1,259	2,292

3. Income from charitable activities

	2022	2021
	£	£
Unrestricted funds		
<i>Promoting the Art and Science of Gnomonics</i>		
Day Meetings	230	270
Sales	442	596
Subscriptions	9,150	9,823
Events	13,307	-
	23,129	10,689
	23,129	10,689

The British Sundial Society
Notes to the Financial Statements Continued
For the year ended 31 December 2022

4. Investment income

	2022	2021
	£	£
Unrestricted funds		
Bank interest receivable	524	6
	524	6
	524	6

5. Costs of charitable activities by fund type

	Unrestricted funds	Restricted funds	2022	2021
	£	£	£	£
Promoting the Art and Science of Gnomonics				
Direct cost				
Bulletin/Publication	9,497	-	9,497	9,335
Day Meetings	180	-	180	291
Events	12,943	-	12,943	510
Postal Sales	137	-	137	172
Somerville Lecture	-	464	464	-
	22,757	464	23,221	10,308
Support costs				
Promoting the Art and Science of Gnomonics				
Governance costs				
Accountancy fees	720	-	720	720
Legal fees	35	-	35	35
	755	-	755	755
	23,512	464	23,976	11,063

6. Costs of charitable activities by activity type

	2022	2021
	£	£
Activities undertaken directly		
Promoting the Art and Science of Gnomonics	23,976	11,063

The British Sundial Society
Notes to the Financial Statements Continued
For the year ended 31 December 2022

7. Analysis of support costs

	2022	2021
	£	£
Governance costs		
Accountancy fees	720	720
Legal fees	35	35
	755	755

8. Net income/(expenditure) for the year

This is stated after charging/(crediting):

	2022	2021
	£	£
Accountancy fees	720	720
	720	720

10. Comparative for the Statement of Financial Activities

The comparative year values on the Statement of Financial Activities are for unrestricted funds.

11. Tangible fixed assets

		Library
Cost or valuation		£
At 01 January 2022		17,228
At 31 December 2022		17,228
Net book values		
At 31 December 2022		17,228
At 31 December 2021		17,228

The British Sundial Society
Notes to the Financial Statements Continued
For the year ended 31 December 2022

12. Debtors

	2022	2021
	£	£
Amounts due within one year:		
Trade debtors	1,157	1,156
Prepayments and accrued income	2,764	10,579
	3,921	11,735
	3,921	11,735

13. Creditors: amounts falling due within one year

	2022	2021
	£	£
Accruals and deferred income	1,403	1,226
	1,403	1,226
	1,403	1,226

14. Movement in funds

Unrestricted Funds

	Balance at 01/01/2022	Incoming resources	Outgoing resources	Balance at 31/12/2022
	£	£	£	£
<i>General</i>				
General Fund	76,155	24,912	(27,369)	73,698
	76,155	24,912	(27,369)	73,698
	76,155	24,912	(27,369)	73,698

Unrestricted Funds - Previous year

	Balance at 01/01/2021	Incoming resources	Outgoing resources	Balance at 31/12/2021
	£	£	£	£
<i>General</i>				
General Fund	77,303	12,987	(14,135)	76,155
	77,303	12,987	(14,135)	76,155
	77,303	12,987	(14,135)	76,155

Purpose of unrestricted Funds

General Fund

The purpose of this fund is for the general running of the charity

The British Sundial Society
Notes to the Financial Statements Continued
For the year ended 31 December 2022

Restricted Funds

	Balance at 01/01/2022	Outgoing resources	Balance at 31/12/2022
	£	£	£
Andrew Somerville Memorial Fund	5,998	(464)	5,534
St Katharine Cree Restoration Fund	1,148	-	1,148
	<u>7,146</u>	<u>(464)</u>	<u>6,682</u>

Restricted Funds - Previous year

	Balance at 01/01/2021	Outgoing resources	Balance at 31/12/2021
	£	£	£
Andrew Somerville Memorial Fund	5,998	-	5,998
St Katharine Cree Restoration Fund	1,148	-	1,148
	<u>7,146</u>	<u>-</u>	<u>7,146</u>

Purpose of restricted funds

Andrew Somerville Memorial Fund

The Andrew Somerville Memorial Fund is part of the general BSS Assets, but its use is restricted to funding the annual Andrew Somerville Lecture and restoration and education grants, should these be made.

St Katharine Cree Restoration Fund

The purpose of the fund is for the restoration of the sundial at St. Katharine Cree Church, Leadenhall Street, City of London.

15. Analysis of net assets between funds

	Tangible fixed assets	Net current assets / (liabilities)	Net Assets
	£	£	£
Unrestricted funds			
<i>General</i>			
General Fund	17,228	56,470	73,698
Restricted funds			
Andrew Somerville Memorial Fund	-	5,534	5,534
St Katharine Cree Restoration Fund	-	1,148	1,148
	<u>17,228</u>	<u>63,152</u>	<u>80,380</u>

The British Sundial Society
Notes to the Financial Statements Continued
For the year ended 31 December 2022

Previous year

	Tangible fixed assets	Net current assets / (liabilities)	Net Assets
	£	£	£
Unrestricted funds			
<i>General</i>			
General Fund	17,228	58,927	76,155
Restricted funds			
Andrew Somerville Memorial Fund	-	5,998	5,998
St Katharine Cree Restoration Fund	-	1,148	1,148
	17,228	66,073	83,301

BSS Conferences

Year and Location	Somerville Lecturer	Title
1990 Oxford	Dr Andrew Somerville	The “Symbolic” Renaissance Dials of Scotland
1991 Edinburgh	Christopher Daniel	English Polyhedral Dials
1992 Bath	Sir Francis Graham Smith	Pulsars as Clocks
1993 Manchester	Dr Allan Mills	Dividing the Day
1994 Urchfont	Dr Allan Chapman	Measuring the Sun and Stars
1995 Grantley	Prof. Philip Adams	Ulster – Sundials Old and New
1996 West Dean College	Fred Sawyer	Samuel Foster of Gresham College
1997 Penrith	Charles Aked	Meridian Lines
1998 Dunchurch	Sarah Symons	Ancient Egyptian Shadow Clocks and Sundials
1999 Dunchurch	Prof. David Waters	Sun, Moon and Stars: time measurement at sea
2000 Cirencester		<i>Postponed, owing to bereavement</i>
2001 York	Dr Jim Bennett	Learning from Objects: a study from 16C Florence
2002 Exeter	Dr Silke Ackermann	Folded Time Unfolded: a look at sophisticated astrolabic quadrants
2003 Yarnfield	Prof. John North	Chaucer, Holbein and the Shadow of Good Friday
2004 Oxford	Dr Ken MacKay	Sundials of Scotland
2005 Egham	Prof. D. Karl Hofbauer	“The Moon has Set and the Pleiades” – Sappho: time measurement in cultural history
2006 Durham	Prof. Rosemary Cramp	Anglo-Saxon Sculpture
2007 Cambridge	Dr Frank King	The Nodus and the Date – mission impossible
2008 Latimer	Dr Alison Morrison-Low	Scottish Sundials at National Museums Scotland
2009 Grange-over-Sands	Father Leo Maidlow Davis	Monks and Time
2010 Exeter	David Bryden	A Gallimaufry of Dial Makers and Designers
2011 Wyboston	Dr Rebekah Higgitt	Researching and Collecting Sundials in the Age of Precision Timekeeping
2012 Cheltenham	Prof. John Heilbron	The Meridian Line of S Maria degli Angeli
2013 Edinburgh	Tony Freeth	The Antikythera Mechanism
2014 Greenwich	Rory McEvoy	Supplying Time to the Royal Observatory in the Age of Enlightenment
2015 Nottingham	Dr Leofrank Holford-Strevens <i>(presented by Chris Lusby-Taylor)</i>	The Dates of Easter through the Ages
2016 Liverpool	Seb Falk	Instruments of Medieval Astronomy
2017 Oxford	Dr Allan Chapman	Instruments, Almanacks and Astrologers: the mathematical arts in the Tudor and Stuart age
2018 Norwich	Dr Sara Schechner	Sundials that Tell More than the Time
2019 Bath	Michael Davis	Adelard of Bath
2022 York	Dr Gloria Clifton	Professional Sundial Makers in the British Isles, from the late Sixteenth to the Twentieth Centuries
2023 Exeter	Dr Stephen Johnston	The Many Faces of Time: Polyhedral Dials in the Renaissance

Front cover: *Recently discovered horary quadrant by Oronce Fine, seen here inside its hand-carved leather case. For details and more illustrations, see the article by David Coffeen on pages 2–7.*

Back cover: *Sundial dated 1637 at Bodrhyddan Hall, one of a group of distinctive early stone horizontal dials in the former county of Flintshire, North Wales, described by Irene Brightmer on pages 24–27.*



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