

RESTORATION OF THE DRUMMOND CASTLE OBELISK SUNDIAL

Part 1: History and Reinstatement Ceremony

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Introduction

The sundial obelisk at Drummond Castle in Perthshire has a long and distinguished history not only for its place in the architecture of the ancient castles and houses in Scotland, and for its connection with the very earliest days of the British Sundial Society (BSS), but also for its importance among the free-standing multiple dials of the early 1600s across the British Isles, Fig. 1. In 2017 after almost four hundred years outdoors the sundial was showing serious signs of the stone deteriorating and the whole structure was feared to be unsound, Fig. 2. Making it safe had become urgent. In the early months of that year the sundial was completely dismantled and removed to specialist workshops in Edinburgh. A programme of total restoration and conservation treatment was approved.

As work progressed significant gnomonic features of the sundial became apparent, which had not been recognised before. And misconceptions about the function of the sundial, which had probably circulated for 150 years or more, were properly corrected. The sundial is in fact a compendium of mathematical delineations of its era, in particular including Babylonian, Italian and seasonal hours on a large minority of the dials, together with common hours and declination lines. None of the dials shows the time of world cities as was always believed. The key to all of the gnomonic features is the inscription carved on a scroll in Latin which identifies them and explains how they were coloured.

Once the intricacies of this sundial were understood it was decided 'it must be got working again', in addition to doing the major work of conserving the fabric of the stone against future deterioration. All the gnomons were to be new and correct and the whole rebuild aligned and accurate. This was a considerable step-up in the restoration work. The story of the sundial is introduced in this article, from its original date of 1630 through to the reinstatement ceremony held in the gardens at Drummond Castle in June 2019. There is much greater detail in the story still to be told, which will follow in later parts of the article over a period of time.

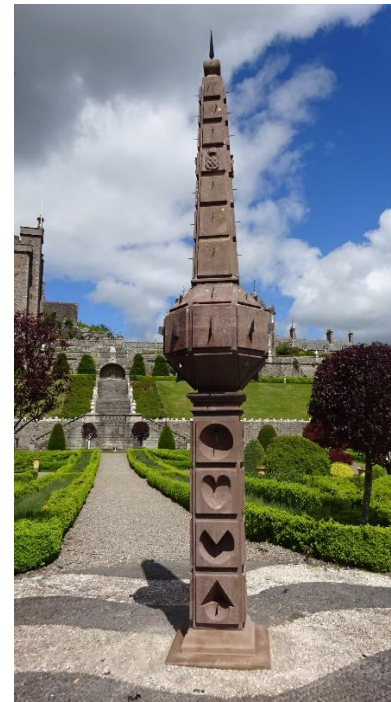


Fig. 1. The Drummond Castle obelisk sundial after restoration. Photo at Summer Solstice, June 2019.



Fig. 2. Poor condition of the lower part of the shaft and the moulded base in early 2017.

*Photo: Graciela Ainsworth
Sculpture Conservation Ltd*

History of Drummond Castle and the sundial

The Drummond family have a long history dating back to the 1300s. Around 1490 the 1st Lord Drummond was granted permission by King James IV of Scotland to build a great stronghold on the rocky outcrop south of Crieff in the lands of Strathearn where Drummond Castle now stands. The original castle was a fortified tower, or keep.¹

In 1605 the 4th Lord Drummond was created 1st Earl of Perth after giving service to James (VI of Scotland) I of England on a mission to secure peace with Spain. He modified the keep and had it extended. John Drummond 2nd Earl of Perth succeeded his brother on his death in 1612. John was a Privy Councillor under both James I and Charles I. His education was in France and he knew mathematics. Between 1630 and 1636, he developed the range of buildings further at the castle and laid out new gardens below, Fig. 3.



Fig. 3. "One of the finest formal gardens in Europe," view from the castle, September 2019.

The 2nd Earl engaged master mason John Mylne III of Perth for the building work. The Mylne family were master masons over the course of eleven generations up to the 19th century. They are credited with raising architecture to the status of a profession in Scotland, and had commissions for public works and grand mansion houses in Scotland and England. In 1631 John Mylne III was appointed principal master mason in Scotland to Charles I. The Drummond obelisk and the magnificent sundial at Holyrood Palace in Edinburgh are both his works, assisted by his sons John and Alexander. The Holyrood dial was a gift to Queen Henrietta Maria from the King on the occasion of his Scottish coronation in 1633, Fig. 4.²

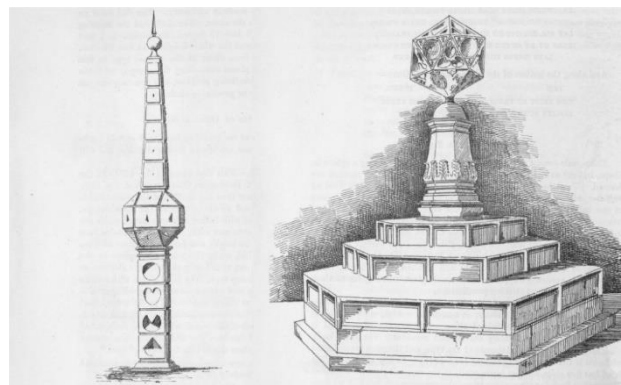


Fig. 4. Drummond and Holyrood sundials sketched by Ross (1892).

It is presumed that John Drummond and John Mylne III worked together on the design and realisation of the sundial obelisk for the new gardens at Drummond Castle. Carved in a hard sandstone it displays the unequivocal date 1630, which is three years earlier than the Holyrood dial, Fig. 5. The two are in contrasting forms for their respective clients. The Drummond dial is restrained and geometric, while the Holyrood dial is elaborate and richly carved. These prestigious sundial commissions seem to have established the great tradition of fine stone sundials in Scotland, which flourished for 150 years.



Fig. 5. Date shield 1630.

The castle and gardens were redesigned, rebuilt and extended over the centuries, starting with the aftermath of destruction by Cromwell's troops in the 1650s, and interrupted at different times by war and politics both at home and abroad. In the late 1700s romantic landscapes were in fashion but by the 1800s interest in formal gardens had revived. Queen Victoria and Prince Albert visited Drummond Castle in 1842 and walked in the gardens. Although the planting schemes have altered since the time of their visit, the layout of a St Andrew's Cross with the sundial obelisk at its centre is unchanged. It is still 'one of the finest formal gardens in Europe.'³

Connections with BSS

David Drummond 17th Earl of Perth accepted the invitation to become Patron of the British Sundial Society at its foundation in 1989. He had a keen interest in sundials and at his home Stobhall Castle, on the banks of the River Tay just north of Perth, there was a historic pillar dial also by Mylne. His ancestral family continued to own Drummond Castle and its gardens. No doubt he and Andrew Somerville first Chairman of the BSS had had an association of interests during the period of Andrew's deep studies into the ancient sundials of Scotland. His research was published in 1987 as a paper in the Proceedings of the Society of Antiquaries of Scotland, of which Lord Perth was already a Fellow.^{4 5}

Andrew and his wife Anne and another original member of the BSS, George Higgs, made many trips together to examine sundials in Scotland. George was skilled at restoring damaged and missing metal gnomons. An archive of photographs, notes, correspondence and calculations of theirs is lodged with Historic Environment Scotland in Edinburgh.⁶ George had made preliminary calculations for the gnomon of one sunken dial on the Drummond Castle obelisk. Andrew identified the Babylonian, Italian and seasonal hours, and lines of declination present on the dials, while Anne transcribed the complete text from the carved Latin scroll and corresponded about its translation with another early BSS member, Dr Philip Pattenden, Fig. 6. More recently Dennis Cowan in Part 7 of his series describes the obelisk as one of Scotland's grandest sundials.⁷

It is unclear whether the delineation and functional operation of all the dials on the Drummond obelisk were fully defined in the 1980s. Probably they were not, for good reasons—outdoors the growth of moss and lichen on the stone obscures detail, lines are eroded by the weather, dials that are high up are hard to see from the ground, and lastly the task is big. Andrew did specify the design for a new obelisk sundial made in bronze for Dunphail House in Morayshire. It includes facet dials and hollow dials and is probably the first in Scotland since 1630 to include hour lines for other than common hours. It is smaller and simpler in concept than the one at Drummond Castle.⁸

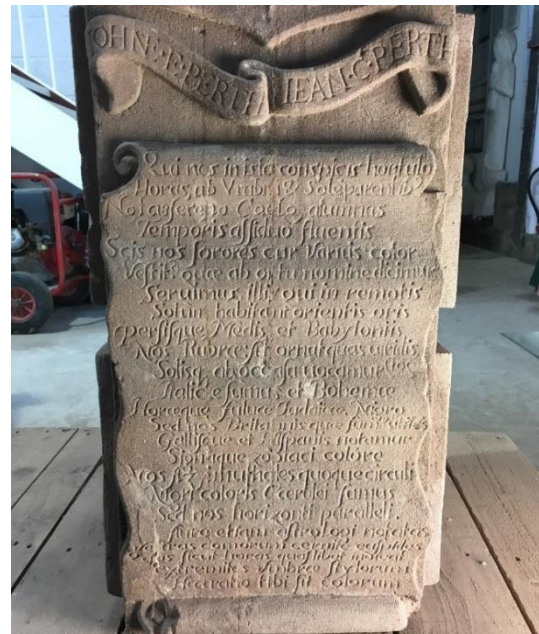


Fig. 6. The carved Latin scroll on the lower north side of the shaft. Interpretation of the scroll is fascinating and will require a separate written article.

Photo: Graciela Ainsworth Sculpture Conservation Ltd

The recent detailed examinations indoors in dry conditions have revealed that the Drummond sundial is extremely complex. It is possibly the most important multiple sundial from the 17th century in the British Isles in working condition today.

Description of the obelisk and the multiple dials

The sundial is a tall stone column standing some 4.5 m (15') high. There are four principal sections. The square shaft supports a massive polyhedral boss or capital. The tapering finial has a lower and upper section. The whole rests on a moulded base and it is finished with a ball and spike on top. The facets are cut in relief forming individual dial panels. The result is a clean and pleasing geometric form.

The lower shaft has dials on three sides, east, south, and west. These dials are carved as sunken hollows in varied geometric shapes. They are in four tiers making twelve dials on the three sides. Six of these, three on the east and three on the west, are compound types incorporating sub-dials. Several dials have complex delineation with sets of lines overlaid on each other. The dial orientations are vertical, polar, and equinoctial. One dial on each of the three sides is a full hemisphere. On the north side there is a single dial, which is a sunken pyramid at the level of the top tier. A coat of arms and the Latin scroll are placed below it.

The polyhedron boss stone has twenty-four dials. Its proper name is a rhombicuboctahedron, which is one of the figures of Archimedes. Again the facets are panels cut in relief, Fig. 7. Unlike the shaft none of the dials are sunken and none are compound. The eight dials around the middle are vertical and decline towards eight compass points. The eight upper dials are reclining and the lower eight proclining. Ten of the 24 have complex delineation with sets of lines overlaid. Every dial is delineated and none are redundant. Each one is fully illuminated by the sun at the proper times. The sun is high in summer, sunrise is early and evenings are long at the northern latitude of Drummond Castle, but the sun is very low in winter.

The sixteen panels above the boss stone, on the lower section of the finial, have four heraldic crests in the top tier leaving twelve dials on the three tiers below it. Each one has single delineation as a simple dial for Babylonian, Italian, or seasonal hours. They decline towards the four cardinal points and recline to the taper angle of the finial. All four sides of the finial are occupied. The upper section of the finial has a further twelve dials in three tiers. Each one is for common hours, and the dials are arranged in association so they display as long a period of hours through the day as possible.

To sum up, there are 13 compound and complex dials on the shaft, 24 simple dials on the polyhedron but 10 of them with complex delineation, 12 simple dials on the lower finial and a further 12 on the upper finial. This is a total of 61 principal dials on the obelisk. To include sub-dials,



Fig. 7. The polyhedron stone in poor condition. The gnomons proved to be an irregular set, not uniform in thickness or metal composition. Some were damaged, incorrect, or missing. Photo: Historic Environment Scotland

declination lines, Babylonian, Italian, seasonal, and common hours, and associated dial declination and inclination angles, there are 131 systems of time measurement on this sundial.

Distinctive features of the Drummond sundial

The sundial at Drummond Castle is a free-standing stone monument. This in itself does not distinguish it from others of its day. In the first years of BSS there was considerable effort on researching monumental sundials. As well as working on Scottish dials, Andrew Somerville and other founding members delved into sundials of the 16th and 17th centuries in England. The grandest ones were made for royal palace gardens like Whitehall and Hampton Court.^{9 10}

These were massive stone blocks with multiple dials, even 117 dials are mentioned. Instruction manuscripts and tables of data were supplied for an entire compendium of horological, astronomical and calendrical information that could be determined. Generally the mathematicians and horologists designed their own dials, no doubt referring back to the texts of scholars like Sebastian Munster in 1531. The typical design pattern was the massive cube with polar and equinoctial carvings. Chris Daniel shows examples that have survived in 'Sundials' his illustrated book, Fig. 8.¹¹

The obelisk sundial at Drummond Castle is distinctive because it departs from this design pattern. While it retains all the precise and complex detail of the mathematician, it is a work designed by the mason architect for aesthetic form. This is creative design imagined for a particular outdoor space. The whole rises towards the sky and each section is conceived as a complete multiple dial. It was a distinctive new approach for 17th century sundials. In fact John Mylne's obelisk in Drummond Castle gardens pioneered a whole sundial class unique to Scotland and unknown in the rest of Britain.

Two more features make this sundial distinctive. The sunken or scaphe dials on the shaft are more intricate than others known. They are visually intriguing and the sub-dials show great mathematical ingenuity, Fig. 9. There has been the suggestion that the shapes are associated with freemasonry but this is not evident, they have specific gnomonic functions. The second feature is the delineation of Babylonian, Italian, and seasonal hours on all parts of the dial, with the explanatory scroll in Latin. This must be rare. Without examining every surviving monumental sundial in Scotland and England in very close detail



Fig. 8. The massive cube dial at Madeley Court in Shropshire, thought to resemble the sundial at Whitehall designed for James I in 1622 by mathematician Edmund Gunter.

Photo: British Listed Buildings



Fig. 9. Compound Drummond dial facing west with four sub-dials. The half-cylinder lies on a polar axis, its two long edges acting as gnomon styles for hours before and after 6 pm.

it is impossible to say this is the only one, but it could be. It is likely this was the Earl of Perth's unique specification derived from his years living abroad.

Finally the whole 61 dials, a majority of them declining from south, and 38 also reclining or proclining, represent a long and difficult work of graphical construction followed by realisation in stone. This must have been fully intended and necessary in order to create such a masterful display of sundial mathematics. The fact that this sundial in all its detail survives practically unaltered nearly 400 years later still standing in its own garden is perhaps the most distinctive feature of all.

Purposes of the restoration work

By 2017 sections of stone were deteriorating. Cracks and splits were visible, Fig. 10. Critically the moulded stone base, on which the whole weight of the sundial was resting, had disintegrated. The entire structure was unsafe and was removed for restoration to the workshops of Graciela Ainsworth Sculpture Conservation Ltd in Edinburgh.¹² Previous restoration work was in the 1980s, and presumably at earlier times, but there is little information.

Dr Jim Tate was in charge of local initiatives and management of the restoration programme on behalf of the Grimsthorpe and Drummond Castle Trust, who have the castle and gardens in their care. Jim, formerly of the National Museums of Scotland, is an adviser to the Trust. The structure of all the stone was consolidated first. The bronze material of the gnomons was analysed. A laser scan of the whole sundial was commissioned, which provided a 3-D data record. This could feed into a future hologram display for the public. Jim also invited his wife Claudine who is a classics scholar to translate the Latin scroll. Meanwhile Graciela recommended that Alastair Hunter should join the team for his knowledge of gnomonics.

A number of points were clear. The laser scan would not resolve fine detail of the gnomonics, Fig. 11. The Latin translation however opened an entirely new window. At a stroke it swept away all the preconceptions about the sundial of the past. The key words that stand out in the text are 'Babylonian' and 'Italian.' These words evaporate all the myths about the dials showing time at different cities, and indicate instead that this is about hours since sunrise and sunset.

The scroll fully explains the dial delineation and the line colours. It is a set of instructions for distinguishing the lines and reading the shadows of the gnomons—albeit in poetic language



Fig. 10. Repairing a fissure in the stone.

*Photo: Graciela Ainsworth
Sculpture Conservation Ltd*



Fig. 11. Three complex dials on the Drummond polyhedron after restoration. The direct south vertical dial has delineations for common hours, and Babylonian and Italian hours. The south-west dial has the same, while the south-east dial carries common hours and Zodiac declination lines.

confusing for modern readers. The whole sundial is a gnomonic triumph almost certainly designed as an exhibition piece for the Earl of Perth to display to his friends.

This was a revelation to the team and to the Trust, who were then undecided whether to complete the conservation work in the sundial's present condition, or to reinstate it as a fully functioning object. After instructing a preliminary gnomonic examination, and a review of this sundial's apparent place in the context of sundial history, the Trust decided to proceed. It was to be restored to working order: in the words of the Managing Trustee, "this sundial has to be got working!" The work would not require re-incising dial lines, but it did need all metal gnomons to be replaced with new ones, Fig. 12.

Replacement of gnomons

There are 61 dials with gnomons. On the shaft the compound dials with sub-dials need more than one, some are already carved in stone and some are metal. On the polyhedron the dials with overlaid delineation need both gnomon style and nodus. On the finial the gnomons are pins with the tip acting as nodus. Repairing and replacing all of these was a long process which effectively was the reverse of doing the original design.

The first task was defining the lines. This was not so easy when lines were faint, delineations were overlaid, and dials were at compound angles. The next step was measuring dial dimensions, line spacings, and angles. This supplied the necessary data for computations determining gnomon style and nodus height and sub-style angle. Designing new gnomons followed, which must match existing socket positions to fix the gnomons in the stone. The gnomons were manufactured in bronze, patinated, and carefully fitted on the dials. Some of the stone gnomons were eroded and needed to be built up again at the nodus point.



Fig. 12. Direct south vertical hemisphere. This is a complex equinoctial Drummond dial inscribed with common and seasonal hour lines, and Zodiac declination lines. The new gnomon has a polar style edge and a nodus point. The shadow of the hemisphere rim is not significant. Photo at Noon, Autumn Equinox, September 2019.

Rebuilding the sundial

When stone repairs and conservation work were complete, and new gnomons were in place, the sundial was ready for rebuilding. Alignment with true north was measured by the sun on site in the garden and fixed with markers. Previously the sundial had been in line with the axis of the garden, which was not true north. The new base stone was then aligned and set in its position. It was a replacement for the old stone that was broken. Its edge would be the datum for lining up all the sundial stones above.



Fig. 13. The process of hoisting the heavy stone shaft and transferring it onto the base stone in a vertical position.

A scaffold tower and hoists were erected to raise the sundial stones and set them in turn into position, a process that took three days, Fig. 13. Because of the angular profiles of the stones, especially with protruding gnomons, measuring their exact alignment was difficult. Much depended on judgement by eye. The stones were built up with mortar joints, which were finished with pointing. On the fourth day the scaffold was taken down. When all work was done the whole sundial was wrapped in wet hessian to prevent the mortar drying out.

Work was finished on Friday 21st June 2019, the day of summer solstice. This date had been pre-planned but it turned out to be a day of brilliant sunshine, perfect for admiring the newly restored sundial and taking photos. The dial shadows were very accurate. The whole sequence of restoration, gnomon replacement, and rebuilding had been a success.

Reinstatement ceremony

A Sundial Reinstatement Ceremony was held two days later at 11.00 am on Sunday 23rd June. Members of the family and guests, and the restoration team, were kindly invited by the Trust to attend. Head of the family Lady Willoughby de Eresby was present.

Graciela and Alastair each gave a talk describing the restoration and conservation process and explaining the historical context and how this sundial worked. Everyone was fascinated by the obelisk brought back to life once again. No one doubted that everything about the sundial must be on record for the future.

A visual guide to the sundial had been prepared in advance and printed. This gives a broad story plus a detailed description of some of the most intriguing dials.¹³ The booklet will serve as information for visitors to the castle and gardens for many years. An indoor exhibition is also in hand. The gardens are open to the public at Easter each year and from May to October, Fig. 14.

Postscript

The aim of this article has been to describe the history of the sundial through to the present day. There is much more still to explain. Future parts to the article are planned—conservation and restoration techniques, interpretation of the Latin scroll, definition of all dials, sundial simulation in 3D.



Fig. 14. The obelisk sundial standing tall in Drummond Castle gardens at Autumn Equinox, September 2019.

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