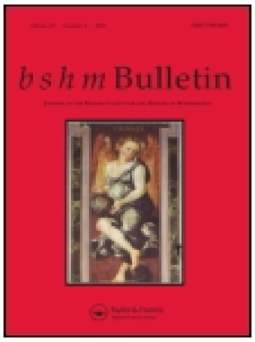

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Gregory's meridian line of 1673–74: a St Andrews detective story

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In 1668, James Gregory arrived in St Andrews University following his two-year sojourn at Padua University. He planned to create the first purpose-built astronomical observatory in Britain to take celestial measurements to a new level of accuracy superior to anything else in Europe. In 1673 he had assembled an enviable collection of astronomical instruments and time-keepers of unusually high quality and precision. By the following year he had converted the upper floor of the Old Library into his observatory and constructed the first ever non-ecclesiastical astronomical meridian line in Europe, the longest and most accurate of its kind for many years to come. Recent site surveys and computations by the author show that 'Gregory's pillar', the south mark for his meridian line, is less than 1 metre to the side of the terrestrial geodetic meridian through the telescope bracket in the window of Upper Parliament Hall 2.4 kilometres to the north. What technical methods did Gregory use to achieve what he did? What depths of academic prejudice destroyed his hopes? The author outlines the little that is known and takes the first steps towards unravelling a three-centuries old mystery.

Hidden beneath a bland carpet held down by bookcases and tables in the Upper Parliament Hall of St Andrews University in South Street, a delicate strip of wood is inlaid in the wooden floorboards (Figure 1). It runs under the carpet from the north side of the room to beneath a window on the south side. Outside the window a curious metal bracket is bolted to the stonework, camouflaged to the point of invisibility in greyish paint (Figure 2). The outlook from the window shows the blank, emptywall of a University building erected in the 1890s. From the next window to the right some nondescript trees on the Scoonie Hill skyline can be seen two miles away (Figures 3 and 4). Amongst the trees, should one care to see for oneself, is a washing-line post: a pillar made of stone with a sad, bent, wrought-iron trident atop of it (Figures 6 and 7).

The precise geographical positions of the bracket in the window of Upper Parliament Hall and the Scoonie Hill pillar are:

	Latitude	Longitude
Bracket	56 20 21.374 N	2 47 38.185 W
Pillar	56 19 03.437 N	2 47 38.182 W

These figures are based on large scale centimetric accuracy Ordnance Survey grid co-ordinates and the author's personal site survey, converted with precision numerical software into geodetic latitude/longitude (European Terrestrial Reference System 1989) co-ordinates.

What is remarkable is that the two Longitudes, of the bracket and the pillar, are almost exactly the same. The difference in the last decimal place translates into an east–west difference on the ground of under one metre, at that latitude. To all intents

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the two points have the same longitude. They lie on the same geographical meridian line running from the north pole to the south pole, and are separated by a north–south horizontal distance of 2.410 kilometres.

An inlaid wooden strip in a floor, a window bracket, a trident on a stone pillar two miles away due south: these are all we have left to remember one of the most amazing scientific achievements in an age of great scientific advances over three centuries ago—the conception and laying-out in the 1670s of an astronomical meridian line by James Gregory.

Gregory (or Gregorie, as he himself spelt his own name), the first Regius Professor of Mathematics in St Andrews University, has been described by the historian Ronald Cant as 'one of the greatest geniuses of his age, fully abreast with the swiftly advancing tide of scientific discovery in Europe, a friend and in much the precursor of Newton himself'.

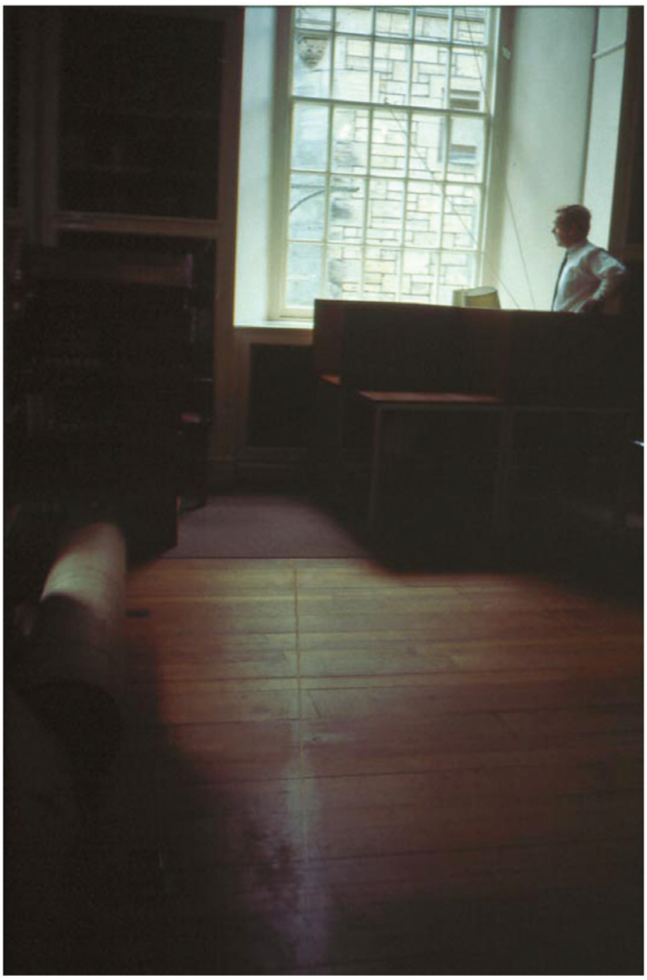

Figure 1. The emblematic meridian line inlaid in 1748 in the wooden floor of the 'new' Upper Parliament Hall, pointing towards the original (?) metal bracket for telescope (or astrolabe?) visible outside the window on the left, half way up the lower sash. The inlaid strip points to the left hand (stone) jamb of the window opening, and not to the outer end of the bracket's arm

Figure 2. Gregory's telescope bracket placed in one of the southern windows of the rebuilt Upper Parliament Hall as seen from the Quadrangle of St Mary's College. The bracket head is 6.75 metres above ground level

We do not know when Gregory actually laid out his line. The best we can say is that it was during his six year stay in St Andrews, from his arrival towards the end of 1668 to his departure for Edinburgh, in frustration at the hostility lately shown to him by his academic colleagues, in 1674. Most likely it was in the winter of 1673–74. We do not know by what practical methods he surveyed and located the position for the southern end of his 'virtual' meridian line. We do not know if the bracket attached to the window in Upper Parliament Hall to support his telescope or astrolabe is original or a later, better preserved, substitute. We do not know for sure to which window Gregory attached his bracket. We may reasonably conjecture that it was the one from which he scratched the north-running line in the floor of the Old Library. And we do know that in 1748 the Edinburgh instrument maker James Short laid down the (still extant) inlaid wooden strip in the floorboards of what was still the University Library. Curiously, the wooden strip is not aligned with the outer end of the bracket but with the actual stone jamb of the window. Is this in itself significant? We do not know. It is plausible to assume that Short replicated the position of Gregory's scratched line, and that it would start from the same window-opening with the telescope bracket, but there is no reassuring, confirmatory evidence.

Figure 3. Upper Parliament Hall in 2002, looking east, with the embrasure of the 'bracket window' (third arch) visible on the right

Figure 4. The view of the woodland that today obscures Gregory's pillar on Scoonie Hill ridge, taken from the window next to the one with the bracket (to avoid staring uselessly at the blank, frustrating, 1890 gable of the present Psychology Building)

The Old Library was on the upper floor of Archbishop-Chancellor George Gledstane's 'library house', started in 1612 and perfected by Alexander Henderson in 1643. It sat beside St Mary's College in South Street. The building itself was enlarged vertically in 1765 to accommodate the ever expanding collection of books following the University's being entitled in 1710 to receive a copy of every book published in Great Britain. As Cant says, 'this was done by raising the walls of the old upper hall and inserting a gallery to form a stately room which can take its place beside any of the library interiors of the period'. We have to assume that the horizontal locations of the four south-facing windows remained unaltered by this vertical re-building.

Quality meridian lines do not come cheaply. Why should Gregory think that it would be a good thing to establish his meridian line, both as an 'artificial' line scratched across the floor of his 'observing room' and as a 'virtual' line in space marked by its two end points, the northern end by his telescope bracket and the southern end by a pillar on the then bare skyline of Scoonie Hill? To begin to attempt to answer for Gregory perhaps we should look at the provenance of meridian lines in a more general context.

True, there had been other meridian lines in Europe before Gregory, and many more after him. Nearly all of them were indoors, inside Roman Catholic churches. Before Gregory's time, most meridian lines were constructed for 'ecclesiastical purposes'. Easter is a movable feast in the Christian religion; it has to be on the Sunday following the first full moon after the vernal equinox. Determining the correct date each year for Easter was a troublesome and opinionative task. Throughout the Holy Roman Empire each geographically located or sectarian branch of the Catholic church had its own opinions and methods for predicting the coming dates of Easter; which led to endless argument and confrontation.

The historian Faith Wallis, in her introduction to her translation of that remarkable, comprehensive and detailed book, *The reckoning of time*, written in 725 AD by Bede, the great Northumbrian scholar and monk, says that his book 'is about measuring time and constructing a Christian calendar, or what later medieval writers called a *computus*' (Wallis 1999, xvi). The Church, either through the use of pre-written paschal tables, or by the direct application of the rules and procedures (in effect computer algorithms based on the movements of the moon and sun) in a computus, could provide future dates for Easter on which it was expected that most would agree. It became obvious that certain astronomical features needed to be known as accurately as possible to avoid confusing the faithful with different paschal calculations: features such as the tilt between the earth's polar axis and the plane of the ecliptic in which the earth and the sun co-existed (the angle of 'obliquity'), and the all-important date of spring, the vernal equinox, also known astronomically and astrologically as the first point of Aries.

Few but the most skilled could master the intricacies of the great brass astrolabes and wall-mounted quadrants used by the keenest astronomical observers to measure these desirable numbers. But sundials were ubiquitous and everyone knew how to use these instruments. The only difficulty was accuracy. The shadow cast by the upright blade or gnomon of an ordinary sundial is not sharp. The sun is not a point of light. The shadows cast by the disc of the sun are blurred. Making the sundial a hundred times bigger simply makes the shadow a hundred times more blurred. But if you have a building with a large empty hall and you pierce a small hole in its roof, then the sun casts a more visible image whose centre is easier to detect on the floor of the hall. All you have to do now is to mark out a line on the floor of the hall, running north and south, as accurately as you can with the means available, with its starting point directly beneath the hole in the roof—a meridian line. The observer can then accurately judge when the sun's image has advanced to the point where it straddles the line, the instant of local noon. Being safe indoors, the line can have other cross lines marked along its length. By noting the various places where the image of the winter sun straddles the line each day, the observer can tell the date of the winter solstice when the sun is at its lowest point in the sky in the year. This is the place where the sun's recurrent noon image stops moving southwards each day and stands (*sol stice*) before beginning the climb back up to the highest place, at the summer solstice. The angle subtended between the two solstices is twice the ecliptic's obliquity. On the way up and down between the two solstices the image will pass the halfway points of the spring and autumn equinoxes. And all these can then be accurately observed.

Big churches and cathedrals are ideally suited to these internal sundials with their meridian lines—their so-called *meridianae*. Some were big enough to have the sun hole as high as 90 metres above the floor. In sundial terms, this is a virtual gnomon of nearly 300 feet. They are usually reliably stable and not given to subsidence, so the continuation of records over many years can provide good scientific information. From this information the clerics and scholars could extract the information so essential to getting the best dates for many Easters to come. And also for the correction of the ever increasing errors in the inadequate calendar ordained long ago by Julius Caesar, which resulted in the introduction in 1582 of the Gregorian calendar (Pope Gregory XIII, not James Gregory) and the sacrifice of ten or eleven days. Some of the meridian lines so constructed in Europe have the most beautiful embellishments and decorative features. They were prized objects and respected; at least until their original purposes became forgotten and the feet of tourists began to erode their earlier perfections. John Heilbron, the historian of science, has eloquently described both their practical construction and their scientific and cultural importance during the Renaissance and its aftermath in his aptly named study *The sun in the church: cathedrals as solar observatories* (Heilbron 1999).

The important ecclesiastical meridian lines that Gregory could well have known about are in Santa Sophia in Constantinople (1437), Santa Maria del Fiore in Florence (1468), and especially the Basilica of San Petronio in Bologna (1576). Gregory had travelled to Italy in 1664 and returned to London in Easter 1668. He spent most of his Italian time in Galileo's University of Padua, which is not far from the oldest university in Italy in Bologna. The problems over the Bologna meridian line may well have become familiar to Gregory during his stay with his fellow Scot, Professor Caddenhead, Professor of Philosophy in Padua University. As the sundial historian Charles Aked has described it:

> Egnazio Danti, in 1576, installed the first meridian line in the Basilica of San Petronio, Bologna, with a gnomon aperture height of 25 metres. Again this was not entirely satisfactory: the results obtained were not accurate enough. However this meridian line was put out of action when the enlargement of the church resulted in the removal of the wall containing the gnomon aperture. In 1653, the growing anxieties of the Catholic Church caused the Pope to commission Giovanni Domenico Cassini to restore Danti's meridian line. Cassini soon came to the conclusion that it was impractical to do so and instead determined on an entirely new instrument. He found the plan of the enlarged cathedral an almost insurmountable barrier to a meridian line because of the great pillars separating the main nave from the side naves containing chapels. The majority of the scientists of the day declared it to be impossible; Cassini carried out his calculations and decreed otherwise. (Aked 1997, 24–28)

In passing, we may note that the Cassini here is the same Giovanni Cassini who was professor of mathematics and astronomy at Bologna from 1650, where he taught when not undertaking papal duties, and who in 1664 (the year that Gregory arrived in nearby Padua) used a new and powerful telescope to measure the rotation speed of Jupiter, observed its bands, and saw that it was flattened at its poles. Two years later Cassini had measured very accurately the rotation speed of Mars on its axis, and in 1668 when Gregory was arriving in St Andrews, Cassini had published detailed series of observations of the moons of Jupiter. Cassini was also in correspondence with the self-taught astronomer John Flamsteed in London, as was Gregory. That same year Louis XIV had invited Cassini to the Observatory being built in Paris. Here he continued to make important observations and discoveries with his powerful refracting telescope, and planned the immense project to construct a virtual meridian line across all of France. The plan was to measure with great accuracy not only its total length but also the changes in length between each fixed point of geographical latitude. This would allow the true non-spherical shape of the Earth to be established for the first time. Finance caused delays and it was eight years after Gregory had died before the survey could start.

James Gregory would surely have kept himself fully informed of the scientific endeavours and aspirations of nearby Cassini. Bologna is only as far from Padua as Aberdeen is from St Andrews. The great breadth of Gregory's own scientific and mathematical thinking and discovery makes it certain that Gregory was fully in touch with all that was new and exciting in the eruption of scientific knowledge of those times. It is more than likely that he was also fully aware of the activities of the emerging group of English astronomers who were pioneering observational astronomy in England, a group that had begun with the short-lived Liverpool astronomer Jeremiah Horrocks and later included the English mathematician and astronomer Richard Townsley who was to invent the micrometer and design the clocks for the eventual Observatory at Greenwich.

In St Andrews, in 1668, Gregory arrives to set in motion the boldly original plan to establish a professorship of mathematics independent from any of its colleges in the two hundred year old university, a plan made possible by the patronage of the restored monarch Charles II and the academic insight and innovation of the soon to be assassinated Archbishop-Chancellor Sharp. The talents and hopes of the newly arrived incumbent are boundless. He is friendly with many significant members of the eight year old Royal Society of London and corresponds with these inventive intellectuals and discusses with them many mathematical topics. He has published two revelationary books on geometry during his stay in Padua. He has invented a new kind of telescope (known to all today as the 'Gregorian' reflecting telescope) ten years before Newton invented his (the 'Newtonian'). He is laying down developments in mathematics that only his modesty prevents from becoming named for him in perpetuity, developments that include the independent discovery of what is essentially the 'differential and integral calculus' ahead of both Newton and Leibniz. The list goes on and on. The magisterial panegyric by Professor Turnbull (1939, 5–11), delivered in Upper Parliament Hall on the occasion of the University's celebration in 1938 of the tercentenary of Gregory's birthday, lets us briefly glimpse the giant who once worked there awhile. Whether the mathematical technicalities are understandable outside their context is immaterial to the general consensus that, in James Gregory, St Andrews had one of the most remarkable geniuses of his age. Yet he felt driven to leave after just six years.

Of course the newly arrived Gregory, fresh from the intellectual hotbed of Padua in Italy and fully aware of the value of a meridian line to observational astronomy, would certainly wish to provide himself, and the University, with just such a definitive scientific instrument, when the opportunity arose. After establishing himself as a stimulating teacher of mathematics and astronomy he set in motion his innovative plans for his Observatory. He returns briefly to his roots in Aberdeen and holds a church-door collection to raise money to help finance the alterations of the University's Old Library to create his observing room and instrument stores.

Encouraged by the University '[so that...] we may be enabled to keep correspondence with learned and inquisitive persons in solid philosophy everywhere' he is despatched on a spending spree, by the excited University '...to goe for London, and there to provide, so far as the money already received from our benefactors will reach, such instruments and utensils as he with advice of other skilful persons shall judge most necessary and useful for the above mentioned designe'.

He comes back to St Andrews with a large suite of expensive scientific clocks and observational instruments, including the Great Planispheric Astrolabe by the Elizabethan engraver Humphrey Cole in 1575 (with a new 'tympan' plate especially engraved for the latitude of St Andrews), the mariner's astrolabe by Elias Allen, and the three Joseph Knibb Clocks (see Lee 1963, 154–157; Smart 1991, 11–12). Two of the latter are matching 'regulators' of great accuracy, to be used to monitor the performance of the third, smaller, wall clock, the first of its kind, the first ever pendulum clock to 'split the second' for the greater precision of the many timed observations he hoped to make in the years to come. The author has very recently uncovered evidence (Amson 2008) that suggests that the split-second precision of the clock supplied by Knibb is almost three times poorer than requested by Gregory. This could well have had serious consequences for the prosecution of his ambitious star-cataloguing programme. It may even have contributed to Gregory's later frustration during the last year of his stay in St Andrews, and his increasing unease as the University unexpectedly began to thwart him on every hand in his teaching and his running of his Observatory. All three clocks still beat their lonely witness in today's Senate Room.

To set out his meridian line, Gregory has the old puzzle of solving the problem 'Where is true north, where true south'? True north is the direction in which the north pole lies on the axis of the Earth. But which direction is that from the Old Library? A magnetic compass would be no help at all. Its needle points to the north magnetic pole, which slowly wanders, often many thousands of kilometres from the Earth's north pole. You first need to know where true north lies in order to tell where magnetic north is: in that order.

Gregory was making detailed enquiries in London. During his stay there he corresponded with Flamsteed (see Forbes 1995, letters 150 and 155). Some of the original letters are in St Andrews University archives. Gregory shares his plans with Flamsteed and described how he intended to take over and completely rebuild the top room of the Old Library as his new Observatory.

But Flamsteed had never yet set out any meridian line. He only gained the practical experience of setting out his own meridian line at Greenwich after the King had commanded the Observatory to be built in the Royal Park in Greenwich, and by then Gregory has been a year dead. So Gregory laid out the St Andrews meridian line by himself many years before the first of the four Greenwich meridian lines. Had Gregory survived his short stay, and prospered in St Andrews, who knows? The prime meridian might have been chosen to pass through St Andrews and not Greenwich, and all the world today might be using St Andrews Mean Time—'STAMT' rather than 'GMT'.

But Gregory did not stay. In what should have been the year in which observational astronomy in Scotland, indeed in Britain, established the most fundamentally novel facilities for its accommodation and enhancement, he accepted a counter offer from the University of Edinburgh of their Chair of Mathematics, and removed himself and his family from St Andrews. Writing in 1674 in Edinburgh shortly before his early death of a stroke, he sadly recalls how his students had revelled in the clarity and innovation of his mathematical teaching in contrast to the dull repetitions of the older St Andrews system under which each Regent himself taught all subjects in the triumvirate to his own group of students throughout all their four years, with no cross ventilation to illuminate the aspiring mind. He records the hostility of the other masters of the University and how

> [. . .] the servants of the colleges got orders not to wait on me at my observations: my salary was also kept back from me, and scholars of most eminent rank were violently kept from me, contrary to their own and their parents wills, the masters persuading them that their brains were not able to endure it. These, and many other discouragements, obliged me to accept a call here to the College of Edinburgh, where my salary is nearly double, and my encouragements otherwise much greater.

Though but an incidental allusion amidst a damning plaint of disappointment, it is obvious from this lament that Gregory was actually ‘at his observations’ in 1674. Since there still seems to be no extant contemporary records we can only conjecture at what these ‘observations’ were. Nor, apparently, have we any information about the actual techniques used by Gregory to achieve high accuracy in the directions of his meridian lines with the means available in the 1670s. Perhaps, as Flamsteed advised, he used his great Cole Astrolabe and his quality clocks to note the times when the sun reached a certain altitude in the morning and again in the afternoon, and ‘split the difference’ to gauge the time when the sun was due south. Repeating the task day after day for many days would help to get the best average ‘south’. Perhaps he used the bright star Sirius during the long nights of his 1673–74 winter of observations to avoid importing errors from the, as yet, imprecisely known changes throughout the run of the day in the sun’s declinations and right ascensions. This is thought to have been the technique used some years later by Flamsteed for his first Greenwich meridian line—though even that is still, very surprisingly, somewhat speculative. But how Gregory could have extrapolated that short, internal direction in the Old Library room out to Scoonie Hill two miles away with such apparent accuracy in the 1670s is unknown. The problem is far, far subtler than it appears. As anyone who has since tried with seventeenth-century techniques knows all too well.

By whatever means to hand, Gregory is said to have planted a wooden post to mark the southern end of his virtual meridian line (Figure 5). Did it carry a metal trident for a sighting mark? Who knows? Nor does anyone today have any idea what Gregory actually did with his meridian line, neither with the virtual line from the old Library up to Scoonie Hill, nor with the emblematic one scratched in his floor.

St Andrews being emphatically a post-Reformation University, oscillating in a century of cruel conflicts between those for whom Easter was either celebrated or abominated, it is most unlikely that Gregory would have regarded his meridian line as an ‘ecclesiastical meridian’ in the manner so popular with the ‘Easter fixers’ in European Catholic churches. And being emphatically scientific, Gregory would surely have had more practical and astronomical purposes in mind for his entirely novel and extensive external line. It was known that Flamsteed regarded the best star position catalogue of the day, by the Danish astronomer Tycho Brahe, as being too

Figure 5. The view from what might have been the site of the original wooden pillar (or pillars?) on the northern fore-slope of Scoonie Hill Ridge. The tower of St Salvator's college is prominent just left of the centre, and the (invisible) Upper Library window is located about six 'tower-widths' to its right

full of errors to advance science. There was a pressing need for months and years of more accurate observations. And Gregory had high hopes for a Great Observatory with telescopes with very long focal lengths of forty or more feet in length. Where else in Europe at that time was there such an accurate and very long meridian line pegged across the land to inspire such an ambitious project? He was an original thinker and doer.

In the fullness of time Gregory's wooden post rotted, as wood does. It was replaced with a stone pillar by the fifth Regius Professor of Mathematics, David Gregory, grand-nephew of James. Ronald Cant (Cant 1949, 1992) says that this was done in 1757 'though not on the same site' (Figures 6 and 7). We cannot now ask Cant how he knew this. Local gossip has it that the stone pillar was either never put back where the wooden pillar was planted or was since moved. The University Minutes of 17 March 1775, eighteen years later, say that

> [. . .] the two poles that were set up on the top of a hill south from the town for the meridians of the telescope and transit instrument are fail'd and frequently beat down by the wind

and that

> [. . .] two stone pillars should be set up in their place.

Later the accounts show that a local mason, William Neish, was paid two pounds

> [. . .] for the meridian marks.

From one line to two meridian lines: the mystery deepens. One is sufficient; two is a careless hostage to observational confusion.

Which pillar is the present one? Why were there two of them? Were there two northern marks as well? In 1910 John H Wilson the creator of the University Botanic Gardens wrote in his *Nature study rambles around St Andrews*:

> [. . .] The shaft of the pillar is 9 feet 3 inches long and 12 inches square at the base, and it is fixed into the centre of a slab of very coarse conglomerate, shaped like a

Figure 6. Gregory's 1757 (or 1775?) replacement stone pillar and trident today, well inside the Scooniehill Farm Cottage yard

> millstone. The slab rests on a brick base 14 inches deep. A three-pronged iron bracket, 3 feet high, is fixed to the top of the shaft, and each prong is terminated by a circular eye. The present bracket was preceded by one of similar pattern, and my recollection is that its lateral arms ended in crescentic hooks. [. . .] Grierson, in *Delineations of St. Andrews* (first ed., 1807), states that the meridian line was 'determined toward the south by one of two large stone pillars of a conical form, erected on the height of Scoonie-hill, within view of the town, and on the north, by a small iron cross, to be seen on the west end of the house at present possessed by the principal of the United College'. [. . ..] The present pillar was quite visible from the town before the shelter-belt of trees was planted at Scoonie-hill. (Wilson 1910, 213–221)

Here we are told the two pillars were of *conical* form—not our present single long square shaft; that the trident arms ended in crescents—not our present circular rings; and that the north point was a small iron cross on a house on the other side of South Street from Gregory's observing room atop of the Old Library—not the iron telescope bracket in one of its window openings; and also that the pillar was visible from the town. The plot thickens.

Figure 7. The wrought-iron trident ‘south-aiming-point’ atop of the stone pillar inside the Scooniehill Farm Cottage yard

What the author has now noticed is that it is impossible to see the northern telescope bracket from the pillar’s present site (Figure 9). And not just because the University later erected fine stone buildings just in front of Gregory’s Observatory window. Through the old trees and undergrowth for a few metres north of the present stone pillar the land rises a little before leaving the wood and reaches the low crest of Scoonie Hill Ridge and then begins to fall more steeply before running out towards the town. The author’s recent, detailed levelling-survey of the hill’s vertical profile shows that the lower third of the pillar is hidden from the view from the Old Library window by this shoulder of land in front of the pillar. Indeed, the Upper Library window comes into view only as you move northwards from the fence between the woodland close to the pillar into the arable field to its north. Plausibly, was that more northerly crest the site of the original wooden pillar?

The woodland is not old (Figure 8). An earlier large scale 1855 Ordnance Survey map shows a field running right up to the northern wall of the cottage back-yard and the map marks the pillar inside the yard where it is today. Could this pillar itself be either David Gregory’s 1757 pillar, or one of William Neish’s two 1775 pillars—or none of these? It is a single stone, 2.8 metres long, dressed, tapered and chamfered, weighs half a ton, and has a 1.4 metre high wrought-iron trident crowning its head.

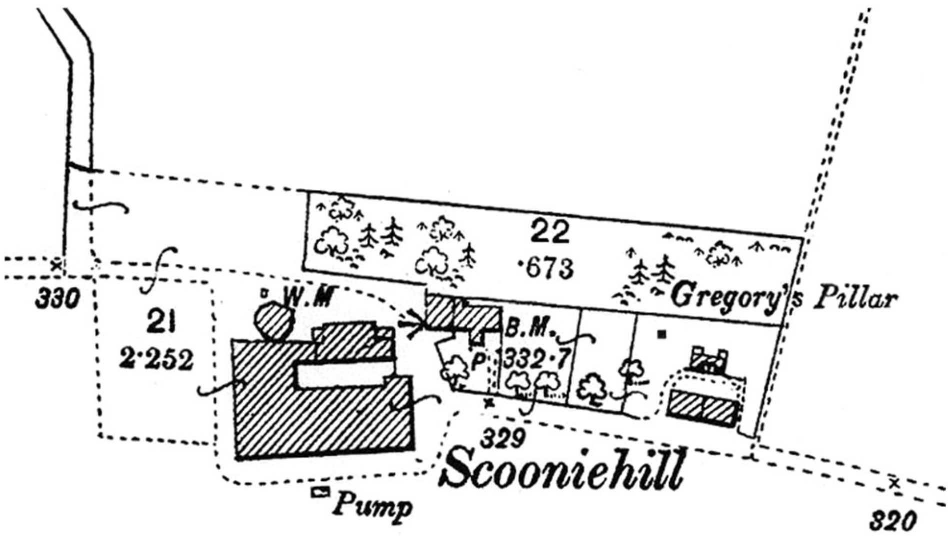

Figure 8. The location of Gregory's pillar in the back-yard of the Scooniehill Farm Cottage, as shown on the 1893 Ordnance Survey large scale map (1 : 2500) (25.344 inches to the mile). The tree plantation (field no. 22) north of the pillar does not appear on the earlier 1855 (6 inches to the mile) OS map. The distance between the SpotHeight 330 (left) and the SpotHeight 320 (right) is 219 metres (718 feet) and North is straight up. Enlarged aerial views of the site (showing Gregory's pillar and its shadow) can be found on the internet using, for example, 'www.flashearth.com'

Figure 9. The view north standing beside Gregory's pillar in its present location in the back-yard of the Scooniehill Farm Cottage, looking through the wood to the (now invisible) town of St Andrews beyond and below the crest of Scooniehill

Faced with a choice of erecting it in place or moving from the open field site of the original wooden pillar into the greater protection from farming activities inside the curtilage of the cottage yard, perhaps the latter option was taken at that time? It would not be difficult for well supervised tradesmen to extend, with care, the true direction of the meridian line backwards for 40 metres over Scoonie Hill Ridge with the help of surveying poles and sight lines. The accuracy of the chosen resting place, where it is today, suggests either that great care was taken with this responsibility, or that it was remarkably—perhaps incredibly—fortuitous.

What is not uncertain, however, is the all too obvious subsequent neglect and lack of conservation of one of the most important jewels in the University of St Andrews' scientific crown. Of course Gregory's original wooden pillar on the fore-slope of Scoonie Hill was never going to survive into an age of scientific heritage awareness. Its carefully crafted stone and iron replacement is struggling to be allowed to survive into these heritage conscious days. Even his telescope bracket in his Observatory window still leads a perilous existence. Only a year or so ago workmen removed his bracket from the wall and threw it into a skip from which by happen-chance it was rescued by a knowledgeable passer-by and restored to its former position.

Three hundred and thirty three or more years ago the first ever secular astronomical meridian line in Europe, the longest and most accurate of its kind for many years to come was created by James Gregory.

It was surpassed only when James Bradley, third Astronomer Royal, created his own eleven-mile long Greenwich meridian line from the Transit Room at Greenwich to his Obelisk in Essex in the 1750s, the one still used by the Ordnance Survey rather than the even later one erected in the mid-1800s by George Airy, seventh Astronomer Royal, for determining GMT.

All that is left to us today of Gregory's line is its neglected south aiming point pillar and its precarious northern telescope bracket. Neither of which can now see, nor be seen from, its companion.

Why not mark the present, accurate location of the pillar on Scoonie Hill with a carefully crafted substitute with all the necessary touristy information panels to which we are now becoming so accustomed? Bring home that remarkable eighteenth-century replacement stone pillar and its battered but still triumphant trident. Plant it in St Mary's quadrangle as a reminder of what Gregory's meridian line was, and as a token to what it might have become in the annals of science had Gregory not been driven, deeply disappointed, out of St Andrews by smaller academics, only to go blind and die a year later, aged but 37. There is no other comparable historical scientific artefact of that epoch, of that scale, and of that precision anywhere else in the world. James Gregory, today largely unnoticed in Scotland and elsewhere, and forgotten outside mathematical circles, deserves nothing less.

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The photographs inside Upper Parliament Hall were taken by the author and reproduced with the permission of Professor Ian Carradice, Keeper of the University's Museum Collections. All other photographs were taken by the author in his own right.

The extract from the old Ordnance Survey map is reproduced courtesy of the Map Collection of the National Library of Scotland.

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For digital images of ecclesiastical meridian lines on the web see, for example: 'Astronomical Instruments of the 16th and 17th Centuries' at http://nfo.edu/italy/meridiana.html

'*1655–2005: 350 Years of the Great Meridian Line*' at http://www.bo.astro.it/universo/cassini/meridian_ing.htm