Recent Research undertaken by Robin Heath at Le Manio, near Carnac, Brittany, France
JUNE 2009

THE DISCOVERY OF A SOLI-LUNAR CALENDAR DEVICE WITHIN AN ASTRONOMICAL RITUAL COMPLEX AT LE MANIO, MORBIHAN, BRITTANY

PRELUDE.

The Baie du Morbihan area of southern Brittany is the most densely populated area of megalithic activity in Europe. Despite centuries of mass destruction of thousands of standing stones, dolmens and cromlechs (stone rings in France), for quality building stone, enough surviving stones remain to provide mute evidence of a profoundly important cultural movement active in this area since at least 6000 BC. The Grand Menhir Brise in Locqmariaquer was once the highest standing stone in the world, its fallen remains weighing in at an estimated 340 tons.

From about 1720, contemporaneously with the rising interest in Stonehenge and Avebury in England, various people showed a similar and increasing interest in the Carnac monuments. Later, in 1796 d'Auvergne attributed them to druidic gatherings while in 1805 de Penhoët claimed they represented stars in the sky.

The first extensive excavations were undertaken in the 1860s by Scottish antiquary James Miln (1819–1881), who reported that fewer than 700 of the 3,000 stones in the three main alignments were still standing. Around 1875, Miln engaged a local boy, Zacharie Le Rouzic (1864–1939), as his assistant, and Zacharie began what was to become his arduous life work of re-erecting fallen menhirs and studying their archaeology. After Miln's death, he left the results of his excavations to the town of Carnac, and the James Miln Museum was established there by his brother Robert to house the artefacts. Zacharie became the director of the Museum and although self-taught, became an internationally recognised expert on megaliths in the region. He too left the results of his work to the town, and the museum is now named Le Musée de Préhistoire James Miln – Zacharie Le Rouzic in their honour.

From the late 1800s, the monuments increasingly were bought up by private individuals who donated them to the State in order to ensure their protection. Principal amongst these were Felix Gaillard, a Bordeaux merchant who married into a Breton family and subsequently owned a small hotel in nearby Plouharnel, at the entrance to the Quiberon peninsula. The hotel has now become the focus of a small museum housing Gaillard's excellent photographs and survey plans of the major monuments, now owned and run by Howard Crowhurst, an Englishman who has lived in France since the mid 1970s and more recently formed an association (ACEM - *Association pour la Connaissance les Etudes des Megalithes*) to promote study into the surviving monuments.

I first met Howard Crowhurst when I was invited to lecture and give workshops at the Solstice Festival in Plouharnel, in 2007. His book *Megalithes* (in French) greatly impressed me and our mutual interest in archaeoastronomy and ancient geometry and metrology led to an immediate friendship. I demonstrated to him the powerful advantages of using a theodolite on sites, after which he acquired two, plus a laser ranging device, and this has greatly improved the precision of his research.

In 2009 I returned to Plouharnel, again for the Solstice Festival, and undertook my own research both before and after the four day event. Howard had undertaken a great deal of theodolite and tape work at a well known site called *Le Manio*. This collection of surviving monuments forms an exceptionally rich group of astronomical alignments which together carry enormous ritual significance in that these sites hold information about human conception, the gestation period and ritual use of geometry and metrology. Howard understands the site to the point where his three hour workshop covered much of this material, and the implications of it were clearly understood by non-specialists. Those readers who have the chance to attend the Festival, and who speak either English or French, should regard this experience as a megalithic 'must'. Howard is an exceptionally good communicator of what are often seen as difficult areas of megalithic research, and he is astonishingly good at passing these ideas on to his audience with a great deal of clarity, enthusiasm and humour.

It was during Howard's seminar/workshop that he invited me to set up his theodolite within the Le Manio quadrilateral, a curious site near the 6.5 metre high 'Giant of Le Manio'. This done, I noticed something I had been searching for for twenty years. Read on...!

The focus of the whole site is the *Geant du Manio*, a 21 foot (6.5m) high standing stone whose estimated weight is over 70 tons. It stands towards the southern end of the complex. In the nearby woodland may be discovered two further large stones, whose shape suggests that they were both deliberately sited as recumbent stones. The smaller stone (pierre carre F on plan) has almost a square cross section, while the larger stone resembles a dome centrally placed within an elliptic base or platform. It is hard not to see a heavily pregnant woman or goddess in the shape of this stone. Indeed, the stone is known locally as *la Dame du Manio*.The photographs and plan (*below*) show all of these stones.

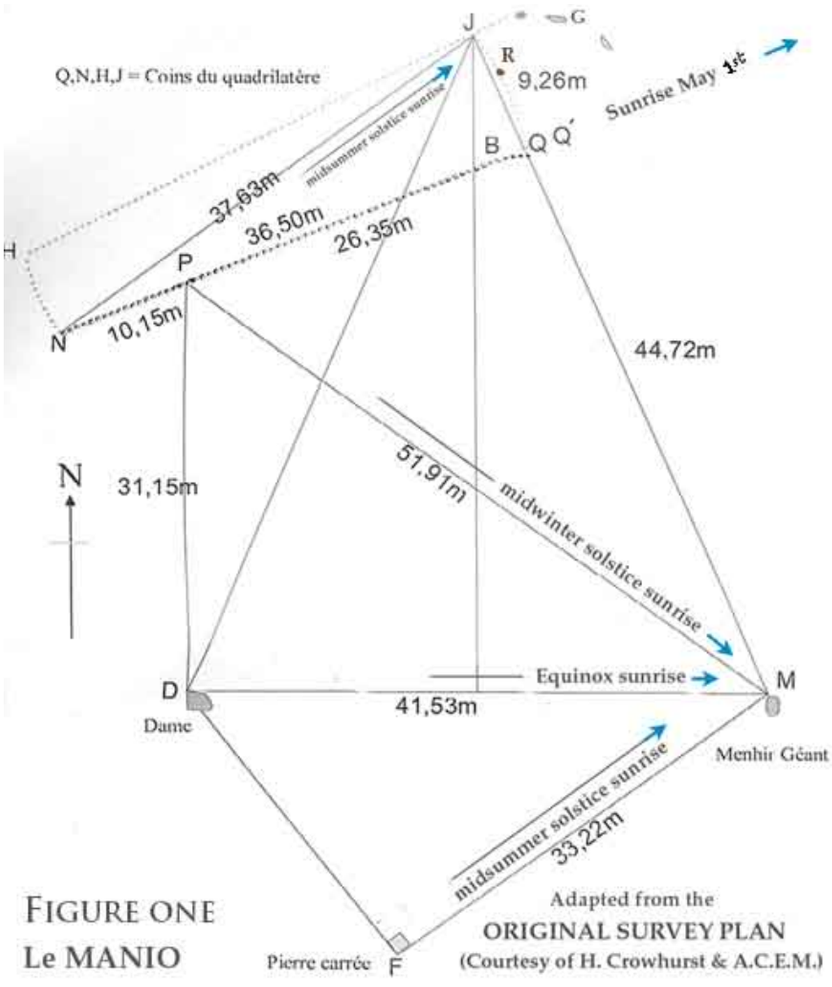


FIGURE ONE
Le MANIO

Adapted from the
ORIGINAL SURVEY PLAN
(Courtesy of H. Crowhurst & A.C.E.M.)

Theodolite work undertaken by Crowhurst and members of ACEM has recently established that the three stones formed the corners of an accurate 3-4-5 right triangle, and that the 5 side was aligned very precisely along the cardinal east-west line. The side lengths were measured as 24.915m, 33.22m and 41.53m respectively. The small rectangular stone forms the right angle.

Work undertaken between 1970 and 1974 by Alexander Thom and various members of his family showed that, only at the latitude of Plouharnel, such a 3-4-5 arrangement marks the extreme sunrises and sunsets. In 1970 Thom surveyed an identically dimensioned 3-4 rectangular stone 'ring' at Crucuno in order to arrive at this conclusion, the four sides of the rectangle he discovered to be precisely aligned to the cardinal points, and the two diagonals from the corners provided an orientation to the solstice rises and sets. He also suggested that the original dimensions of the rectangle were intended to be 30 by 40 Megalithic yards of 0.829m (2.72 feet), with the diagonals then being 50 of the same units.

Crowhurst then noted that the two largest and tallest stones (by a long way) in the le Manio quadrilateral formed the apex of a second 3-4-5 triangle. The '5' side of the former triangle becomes the 4 side of this second triangle (DMP). The dimensions he obtained during the survey were 31.15m, 41.53m and 51.91m.

Having established the accuracy of these two 3-4-5 triangles, it became rapidly evident that the site responded to the astronomical truths of the solar year at this site in the following ways:

1. At Winter solstice sunrise, the shadow of the *Geant* falls in the vulva shaped gap between the two tallest stones within the quadrilateral - point P on the plan.

2. At Summer solstice sunrise, the shadow of the *Geant* falls on the rectangular stone that appropriately forms the right angle of the smaller 3-4-5 triangle.

3. At the Spring and Autumn equinox the shadow of the *Geant* falls across the belly of the pregnant 'goddess' stone at sunrise. The Autumn equinox is, of course, nine months after the preceding Winter solstice, one human gestation period later.

The accuracy of the geometry and the astronomical alignments of that geometry to the appropriate sunrises approach the limits of a modern surveying theodolite. During my own work at the site I was able to independently confirm many of ACEM's figures. ACEM's work represents a major breakthrough in confirming the integration of Pythagorean geometry with solstitial and equinoctial solar orientation at a very early date, perhaps prior to 4000 BC.

Combining the astronomical with the clearly evident symbolism of the site, it would be a rare anthropologist who would not agree that the site is indicative of the creative act of reproduction within the interplay of death and rebirth of the sun. It may appear strange that such things are 'worked' via the medium of Pythagorean triangles, but I have found, as did Thom, that such is to be found throughout the megalithic period in northern Europe. The question I asked myself was "*Where is the moon in all of this?*"

THE LE MANIO SITE COMPLEX

A plan of the site together with the principal measurements obtained from the theodolite survey is given above (*figure 1 previous page*). This plan was produced by Crowhurst and ACEM, using accurate theodolite surveying, tapes and laser ranging devices. Two 3-4-5 and two 5-12-13 triangles can be identified, together with the quadrilateral in the northwestern corner, to which I will return later. The smaller 3-4-5 triangle has a perimeter of 99.665 metres, which when divided by 12 (the sum of the 3,4 and 5 sides), gives a unit length for the triangle of 8.3054 metres. The larger 3-4-5 triangle has a perimeter of 124.59 metres, whence using similar techniques, the unit length becomes 10.3825 metres.

Similar analysis on the identical pair of 5-12-13 triangles yields a perimeter of 124.569 metres and thus a unit length (divide by 30) of 4.1523 metres. The photographs on page two are of points D,F and M.

THE METROLOGY OF THE TRIANGLES

In solving metrological problems, it is normal to reduce the measurement units to Imperial feet or Greek feet (1.01376 feet). To convert metre lengths to feet it is necessary to multiply the figures in metres by 3.2808. Thom's Megalithic yard is 2.72 feet, or 0.829 metres, so to ascertain the lengths in megalithic yards one must divide length given in metres by 0.829, or given in feet by 2.72. In Megalithic yards of 2.72 feet, we discover the following:-

(1) The smaller 3-4-5 triangle is constructed in units of 10 Megalithic yards. (actual 10.018 MY)

(2) The larger 3-4-5 triangle is constructed in units of 12.5 Megalithic yards. (actual 12.524 MY)

(3) The two 5-12-13 triangles are constructed in units of 5 Megalithic yards. (actual 5.008 MY)

Thom's proposed unit of length emerges clearly from these measurements, and Thom also suggested that perimeters were normally expressed in Megalithic rods of 2.5MY, which they are seen to here. One 3-4-5 triangle (DMF) is even *congruent* to those found in the Crucuno rectangle and therefore partakes of the same astronomical, metrological and geometrical functions.

THE LE MANIO QUADRILATERAL

The plan shows this curious structure as a tapered kerbed quadrilateral. The photographs (*below*) show this kerbed structure and its right angle corner (Q on plan) in detail. At its eastern end, and outside of the quadrilateral, there is an assemblage of more widely spaced stones forming a sweeping curve from the northernmost corner towards the south and the *Geant du Manio* stone.

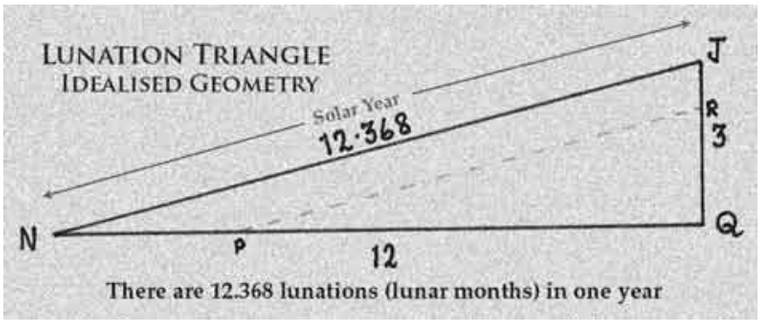
The right angle at point Q (*see left hand photograph below*) is emphasised, with the stones forming a cruciform arrangement, and one stone has been dressed to further emphasize the intent of the right angle, which is provided by the only gap between the two intersecting lines of contiguous stones.

Crowhurst and the ACEM team had previously measured the orientation and dimensions of the quadrilateral (*seen on the plan in figure one*). The orientation of the southern side of the quadrilateral was determined by theodolite as being 67.38 degrees and this is the larger angle of a 5-12-13 triangle.

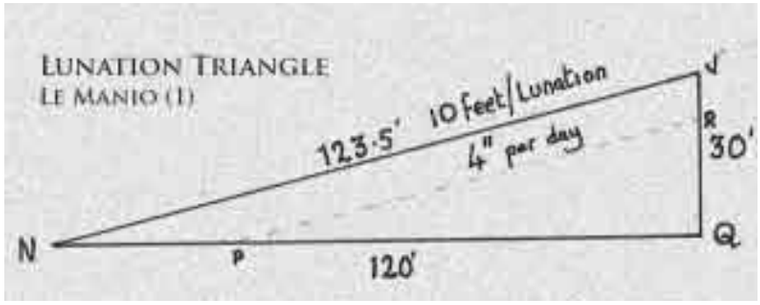
Using the diagonal (NJ) the resulting right angled triangle has a perimeter of 9.26 + 36.50 + 37.63 metres, which equals 83.39 metres. The geometry is clearly one that I recognised immediately from my previous research at prehistoric sites, being that of the 3-12-12.369 lunation triangle (*see illustration on following page*). An almost Pythagorean (whole number sides) equivalent is the 8-32-33 triangle. The lunation triangle uses the identical geometry in order to integrate solar and lunar cycles within the calendar device - it automatically calibrates the solar year into lunar months along the 12.369 side, there being 12.36826 lunations (each averaging 29.53059 days) in a solar year.

Using the dimensional information above it is possible to assess the unit of length being used in its construction. The lunation triangle's perimeter *must* be 27.369 units long, a figure which when divided into the combined tape readings for the perimeter (83.39 metres) gives 3.0469 metres for the unit utilised by the builders.

This unit translates to 3.675 MY which is 10 feet (to 99.97%). The 'solar year' hypotenuse of this triangle appears to have been built to be 123.369 feet in length, 10 feet representing one lunation period. Here we find the moon's presence within the Le Manio complex! The device is calibrated such each day/night period is represented by a third of one foot - four inches. There is numerical resonance.



There are 12.368 lunations (lunar months) in one year

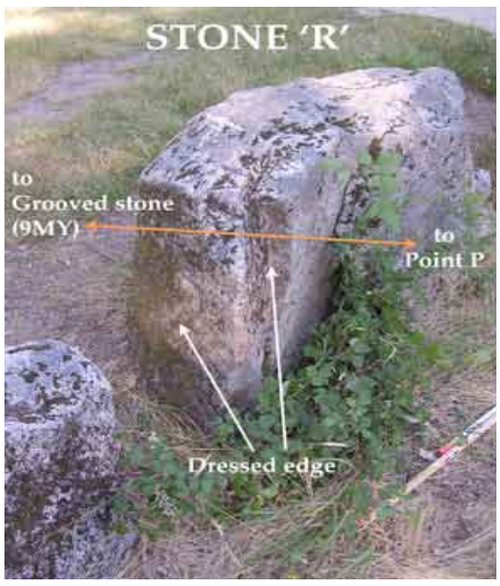


We can now summarize. The 'working part' of this calendrical device at Le Manio is aligned to the Summer solstice sunrise, and is calibrated in units of length directly related to the structure of the principal solar and lunar cycles - i.e. using feet and megalithic yards, as detailed elsewhere. In this technology, the 10.875 day 'gap between the end of the lunar year (354.367 days) and the end of the solar year (365.2422 days) is represented by the foot, while the megalithic yard normally represents one lunation cycle of 29.53059 days, of which there are 12.368 in one solar year. To a metrologist, it should not be at all surprising that time cycles became transduced into space cycles or 'lengths of time', as Livio Stecchini indicated thus in the 1970s. But precise and before 4000 BC?!

The Le Manio quadrilateral site therefore offers a total vindication of earlier work derived from research on the Stonehenge lunation triangle. It is no longer possible to dismiss either the reality of the Megalithic yard, nor its derivation, with the foot, from calendraic and lunar cycles. At Le Manio the foot and the megalithic yard are found within devices that structure the primary time cycles that define the calendar. To find such a device in good condition at Le Manio gives affirmation that prehistoric cultures were fully aware of these sun and moon cycles and had worked out the primary relationships between the two luminaries to high precision using geometrical techniques, of which the lunation triangle is one very extraordinarily good one.

A SECOND LUNATION TRIANGLE

In the process of measuring the quadrilateral it became clear to me that a second functional lunation triangle existed at the site. Along the easterly short end of the structure may be found one single stone with a vertical side which has been dressed flat. I have nominally marked this as Point R on the plan. The photographs below indicate the process being described, and were taken during the original survey to investigate this second lunation device. From point P on the ACEM plan a rope stretched to this flattened edge runs parallel to JN, retaining the similarity of shape of the larger lunation triangle. Using a fibreglass tape (Imperial units) of known accuracy, the three sides of the second triangle measured as follows:-

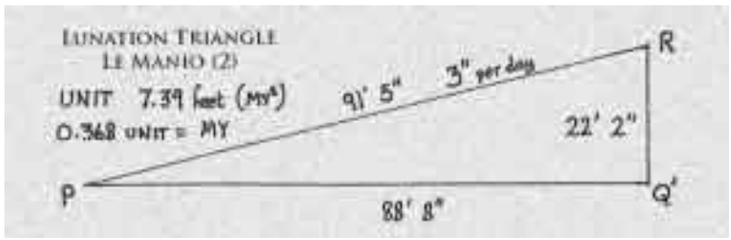


(1) The '3' side -from the right angle to the dressed edge of stone R - 22 feet 2.1 inches

(2) the '12' side - Length PQ' on the ACEM plan - 88 feet 8.36 inches

(3) The '12.369' side - Point P to the dressed edge of stone (point R) - 91 feet 6 inches

(4) In units of one quarter of a foot (3 inches), the '12.369' side is 366 units in length (3 inches).



[*NB Q' is the marked and dressed edge stone beyond Q and outside of the quadrilateral that enables a right angle to form from Q' to stone R. The site plan shows that line JQ is slightly curved, and the photograph at the bottom pf page 4 shows the dressed stone]*

Applying the earlier analysis on this triangle, the perimeter is 202 feet 4.45 inches. The unit of length used is this length divided by 27.369 which is 7.395 feet, which is 2.72 Megalithic yards, *the square of the unit*. This unexpected result confirms the value of the unit and results in the over-run between the end of the lunar year (12 lunar months or lunations), and that of the solar year (10.875 days or 0.368 lunations), normally one foot in length, becoming 2.72 feet, or exactly one Megalithic yard. The device is calibrated to 3 inches per day.

AN EXTENSION ALONG THE MIDSUMMER SUNRISE AXIS

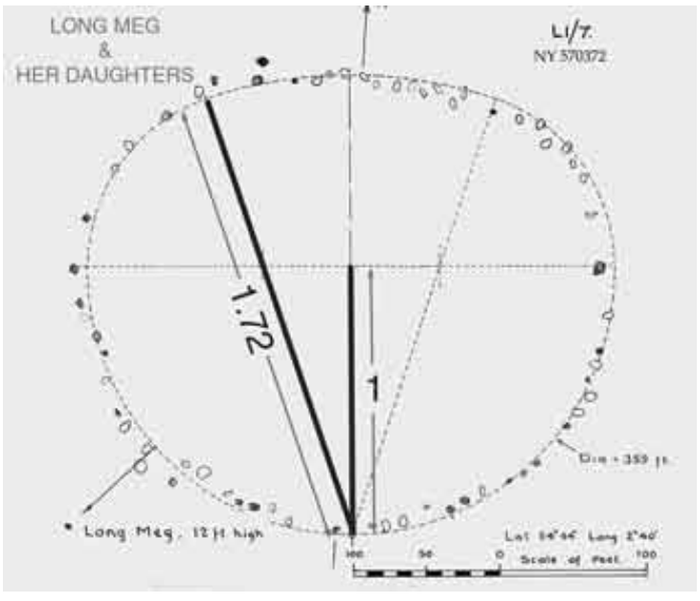
While stretching a tape from point P to the dressed edge stone (along the midsummer solstice sunrise angle) it became apparent that it was also accurately aligned to the centre of one of the stones forming a curved extension to the quadrilateral on its eastern side. The tape was then run out along the extra distance to the stone, a distance which measured out at exactly nine Megalithic yards. A semi-circular groove about one inch (2.5 cm) in radius was found carved into the top of this stone and oriented in the same direction, that of the midsummer sunrise. The photographs below show this measurement.

CONCLUSIONS

From the evidence discovered by Crowhurst and the ACEM team, the le Manio site is clearly built to indicate the key times of the solar year, solstices and equinoxes, within a ritually significant monument that presents the cycle of the year within an analogue of human life - conception to birth and, one might surmise, rebirth. The site operates astronomically in precisely the same way as the well known rectangle at Crucuno, by utilising the unique properties of the *latitude* of the region where the geometry of a 3-4-5 triangle whose smaller sides are aligned to the cardinal points of the compass is then seen to accurately align its longest ('5') side to two solstitial sunrises and sunsets. The Crucuno rectangle, comprising two diagonal '5' sides, presents all four solstitial events, midsummer and midwinter rises and sets.

The Le Manio quadrilateral site goes much further than this. The moon is responsible for the cycles of human conception and gestation, and in the quadrilateral the moon's lunation cycle is integrated within those of the sun. While the lengths of the alignments are insufficiently long to enable precision assessment of the exact time of the solstices, the Carnac area contains many examples where foresights and backsights are sufficiently distant from each other to offer precision to the day. The solstices are not the best time to obtain such precision because the change in angle of the surise or set varies so little from day to day, while around the equinox, there is a daily change on the horizon of more than the angle of the sun's disc (about half a degree), which is easily observable. For example, at St Barbe, the alignment from Tumulus St Michel offers a precision alignment to May 8th - St Michael's Day.

The Le Manio site offers something that is much more important than solstitial markers. The placement of 5-12-13 triangles together with the lunation triangle derivative - the 3-12-12.369, indicates that the processes of drawing down to earth the cycles of the sun and moon had been fully developed at Le Manio at an earlier date than at Stonehenge. As I have discovered at Stonehenge and elsewhere, the nature of the cycles is such that one should always expect to find the ratio 1:2.72 or 1:1.72 where this has been realised by the megalithic astronomers, as this is the fundamental ratio that enables the sun and moon to be placed within a meaningful soli-lunar calendar.



What has proved to be extraordinary is that these *ratios*, where they are found, are normally expressed as *lengths* within the main geometrical features of monuments as expressions of the foot and the Megalithic yard, usually as integer multiples of these units. I have shown that this occurs in a variety of stone rings, most notably Thom's type B flattened circles (e.g. *Long Meg shown illustrated right*) where it is to be found as the main defining radii of the shape, the radius of the semicircle and that of the flattened arc (1:1.72). In addition, at Stonehenge, the ratio of the two principal circles, the Aubrey circle and the Sarsen circle are arranged such that the latter circle is sized to the former circle as 1 is to 2.72. The Sarsen circle is thus 52 feet in radius while the Aubrey circle is 52 MY, confirming the ratio. As a fraction this is almost exactly 7/19ths, the solar year comprising twelve and 7/19ths lunations. Astronomically we know this is true today, for the Metonic soli-lunar repeat cycle of nineteen years occurs after 235 lunations, and 235/19 is simply the vulgar fraction of twelve and 7/19ths.

However, the reader needs to recognise that while the astronomy remains as days and ratios, whoever conceived of the megalithic monuments here and at Stonehenge had to express these lengths of time and their ratios as fixed units of length in order to incorporate these within their temples to the sun and moon. My work over the past twenty years has clearly demonstrated that they chose the foot, the root of all metrology and the most ancient of metrological units, (perhaps because one degree of arc around the equatorial circumference is 365.24 feet), together with Thom's Megalithic yard. These two units are incontrovertibly the earthly counterparts of the time cycles that determine the calendar and the dance of life on Earth.

In a rough coppice in southern Brittany lies the earliest known surviving example of a lunation triangle within a site which Howard Crowhurst has already demonstrated was dedicated to indicating the nature and human relevance of solar cycles. This paper shows how the moon was integrated within the Le Manio site.

The two lunation triangle 'devices' are shown to be aligned along the summer solstice axis and their units of length expressed in integer values of megalithic yards or feet. It has been shown that the same design processes and understanding at Le Manio were later identical with those built into Stonehenge, perhaps over 1000 years later.

Those archaeologists that marginalised Thom's research and ignored the mounting evidence since his death now face something akin to a dark night of the soul. They were not qualified to meet the challenges, nor was the profession fit for purpose in identifying what has been shown here to have been an important cultural development - a megalithic science - fully up and running prior to 4000 BC. The evidence in this paper is therefore much more relevant to the History of Science than it is to the present practices and attitudes held within Archaeology.

Is that pipe smoke I can smell, and do I hear a gentle Scottish accent and a wry laugh?

Robin Heath, June 2009
St Dogmaels

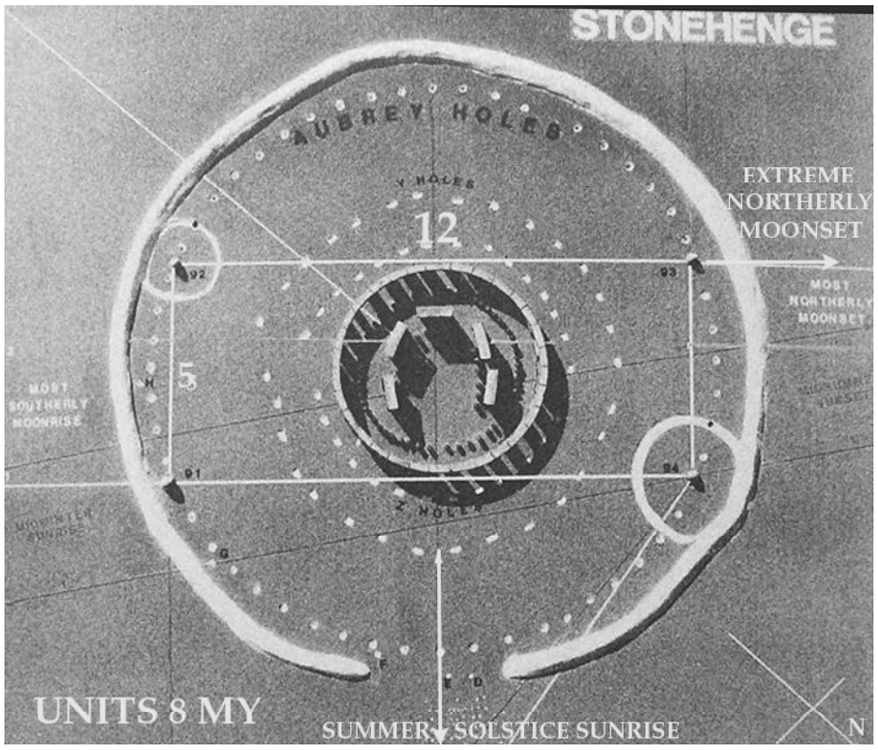
ACKNOWLEDGEMENTS

I would like to express my sincere thanks to Howard Crowhurst and those members of ACEM who took part in the initial survey of the le Manio site. Without their work it is unlikely that this paper would ever have been written. Also to Trish Osborne, Gabriele Trso and Paul Broadhurst for assistance with the tape measurements on an extremely hot afternoon.
I also apologise for changing all ACEM's metre lengths into Megalithic yards or Feet - but that's the metrology of the lunation triangle! I trust that this will not dent the *entente cordiale* too much.

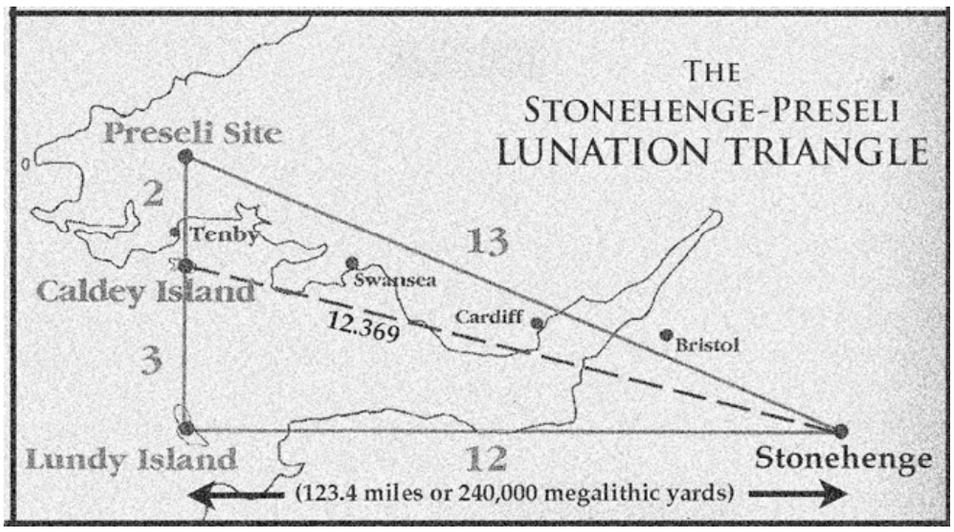
NOTES

Within the ditch and bank that defines the Stonehenge site can be found a 5:12 rectangle, described by the greatest living authority on stone circles, Dr Aubrey Burl as, 'near-perfect'. This rectangle, is called the Station Stone Rectangle'. A 5:12 rectangle has a diagonal of thirteen of the same units. At Stonehenge these units are 6.6 metres, although in the ancient units of measure identified by Alexander Thom, this becomes a simpler 8 Megalithic yards (A Megalithic yard is 0.829m or 2.72 feet). This makes the diagonal, which also forms the diameter of the Aubrey circle at Stonehenge 104 Megalithic yards (13 x 8 MY), which has been measured by Atkinson, Thom, North and myself during surveys.

Just as for Crucuno, Stonehenge is built at a latitude where the right angle plays a significant role in the astronomy and the geometry of the site - in this case that between the extreme sunrises and moonrises. The unit of length is the same - Thom's megalithic yard of 2.72 feet (0.829m). At Le Manio one discovers other commonalities of design with Stonehenge, such as the incorporation of the ratio 1:1.72 in the principal dimensions, and the evident use of the lunation triangle device, suggested at Stonehenge, in order to provide an accurate calendar and eclipse predictor.



The Stonehenge site and the Bluestone site reproduce the 5-12-13 geometry on a scale 2500 times larger. This is alternative real *evidence* connecting the Bluestone site with Stonehenge *geometrically*, in comparison with the speculative evidence currently being proposed



by Wainwright and Darvill. The additional fact that the sides of the rectangle at Stonehenge are aligned to the extreme northerly positions of *both* the sun and the moon imbue this geometric discovery with important *astronomical* meanings. Lundy Island provides a third corner for the giant 5:12 rectangle and the right angle for a 3-12-12.369 lunation triangle to Caldey island. This geodetic construction is again aligned with the cardinal points. The prehistoric cultural importance of having discovered *Cosmos* - a geometrical order in the apparently disconnected orbital cycles of the sun and moon had been discovered - suggests why such an astonishing project was undertaken.

FURTHER INFORMATION

In my first published book, *A Key to Stonehenge* (Bluestone Press 1993 and 1995), the geometric link between the Bluestone site and Stonehenge was explored, but it took a further ten years to explore the full implications of that initial discovery. More complete treatments may be found in *Sun, Moon & Stonehenge* (Bluestone, 1998) and in *The Measure of Albion* (co-written with John Michell, 2004). The diminutive *Stonehenge* (Wooden Books, 2000), distils the main essences of this material and is also freely available at the Stonehenge site shop. The included pictures here should whet the appetite of those people who want some more objective data about Stonehenge's purpose and why it was built and why the bluestones were so essential to its construction.

For a complete account of prehistoric astronomy in Britain, with most of this material embedded within a richly illustrated biographic account of Thom's life, try *Alexander Thom: Cracking the Stone Age Code* (Bluestone Press, 2007).

Finally, much of the material discussed within this article has been filmed by a TV company, and a link will shortly be found on the websites - **www.skyandlandscape.com** and **www.astro-archaeology.org**

Further information on books by Robin Heath may be found elsewhere on the website
www.skyandlandscape.com