

Alexander Thom and thoughts on the Megalithic Yard

By Peter Harris

Alex Thom had been Professor Emeritus of Engineering at Oxford. He was an expert in astro-navigation and surveying. In the preface to *Megalithic Sites in Britain (1967)* (Ref 4), Thom explained that the data contained in his book had been obtained by examining 600 sites in Britain. Of these 450 sites had been visited and about 300 surveyed. Thom proposed that the Megalithic builders used a length of 2.72 feet long, which he called the Megalithic Yard MY. He also concluded that when looking at stone circles that there were concentrations at the diameters of values 10 times the integer of MY and that circumferences occurred with multiples of 2.5 MY.

It is now over 60 years since Thom put forward his original proposals and much has been written about his methods of analysis, the validity of his claims and whether the MY existed. Some present day writers have used Thom's measurements to validate far more complex mathematical and cultural considerations (examples later).

Due to the sheer volume of written work available to the reader concerning Thom's MY and the limitations of space within this article, I will summarise the key points below.

Thom had justified his claims for a 2.72 feet Megalithic Yard due to his widespread surveys and knowledge of megalithic sites. At that time he received the support of two key statisticians (S.R. Broadbent and D.G. Kendall) and later a respected archaeologist (Richard JC Atkinson). Evidence is claimed to have been found of two 2.72 feet measuring rods marked in Megalithic inches as proposed by Thom, (Margaret Curtis). The Megalithic Yard is claimed to be similar in length to other European measurement values (R. Heath) and there does appear to be significant support for the use of the MY in recumbent stone circles in southern Scotland. (Barnatt and Moir).

In opposition to the existence of Thom's MY are numerous archaeologists, astronomers and statisticians, (for example Barnatt and Moir, C. Ruggles, D.Heggie, A. Burl, to name but a few). Some such as A. Burl have spoken against Thom's MY in very strident and forceful terms "[the MY] is a chimera, a grotesque statistical misconception." (Ref 5) Ironically Robin Heath, who supports Thom's MY, cites Douglas Heggie as having created a well written and unbiased book, (Ref 6) But in here Heggie states there is "little evidence for a highly accurate unit" (1971:58).

So what are the difficulties encountered when examining the claims of Thom for his proposed unit of length, the MY?

Thom had already concluded in 1955 that there was a standard unit of length being used by the megalithic designers. But with so many measurements in his possession, possibly in their hundreds, why did he submit the measurements for only 27 circles in England and Wales and 25 in Scotland? Was the data, and consequently all the later ongoing statistical analysis, based on selectively chosen evidence that supported Thom's already preconceived ideas?

Later evidence presented by Thom in 1967, 67 England and Wales circles, 82 from Scotland, still contained some of the previous possibly selective data. Even then the new data did not point to Thom's MY unit of length being used in England and Wales, in fact statistically it weakened his case.

Thom acknowledged that he "rounded" figures up to attain whole MY units.

Thom used only diameter measurements and not perimeter lengths. Thom states (Ref 7) "We have indicated here and elsewhere that the erectors evidently considered the circumference to be more important than the diameter. (Page 148) and yet on page 144 Thom states "obviously we did not measure the perimeters by tape, but calculated them from measured dimensions."

Even Thom's conviction re the validity of the 2.72 feet MY seemed questionable. His first results appeared to suggest 5.435 feet as the best unifying length with a standard error of diameter measurement from one-third foot to one full foot for larger circles. Seven years later than his 1955 paper he proposed that 2.72 feet could be accepted without hesitation. But he also proposed calling the double of this length the "megalithic fathom" and pointed out that a measurement of 1.36 feet may also have been used. Then at Mid-Clyth he found a new quantum of 7.743 feet which may have been 20 MY divided into 7 parts of 7.77 feet. At Carnac he proposed a somewhat different value, this time called the Megalithic Rod of 6.802+/- .002 feet! In 1976 at Avebury he revised the value of the MY to 2.722+/- .002 feet.

So how do we make sense of all this? Clearly pure numerical considerations will not by themselves be able to provide a 100% guaranteed solution to the specific question as to whether a standardised unit of length was used by megalithic builders. It is clear that we must draw more on a *variety* of objective megalithic site survey evidence to try and corroborate statistical or theoretical proposals. Let us look at Callanish as an example to compare my proposed HSMF measurement of 14.142 inches with Thom's 2.72 feet. I will use Thom's own measurements from "Megalithic Sites in Britain" 1967, page 72.

Thom's perimeters in his MY values for the sites are: 14.18, 75.39, 59.94, 32.75, and 42.5.
I have compared this with my HSMF measurements.

Callanish 1 Circumference = 34.662 (HSMF) Eclipse Year 346.62 days divided by 10
Callanish 2 Circumference = 173.31 (HSMF) Eclipse Year 346.62 days divided by 2
Callanish 3a Circumference = 138.6 (HSMF) Eclipse Year 346.62 days divided by 2.5
Callanish 3b Circumference = 74.4 (HSMF) Moon Cycle 18.6 years x 4
Callanish 4 Circumference = 99 (HSMF) Eclipse Year 346.62 days divided by 3.5
Callanish (5 ellipses) Circumference = 520 (HSMF) Eclipse Year 346.62 days x 1.5.

Thom's attempts to categorise the various ellipse shaped stone rings into "types" suggests to me that these were variations brought about when trying to integrate astronomical values into megalithic designs. For example Thom's Type A egg perimeter in relation to diameter appears very closely to be a multiple of the Anomalistic Month. Multiplying the ratio by 9 = 27.55, the number of days in the Anomalistic Month. Similarly the Type B egg ratio is 2.953. Multiplied by 10 this gives 29.53 the number of days in a Lunar Month and the Type D egg ratio multiplied by 6 gives 18.6, the Moon Cycle of 18.6 years.

In my view the megalithic designers were looking not just for functional measurements that could be used to plan the construction of monuments. I believe they were also attempting to incorporate these practical features with both symmetry (internal and external) and astronomical values. For example, the eclipses and the 18.6 moon cycle seem to be of enormous importance. Would it have been more logical when Thom had found significant statistical evidence pointing to the use of values around the integer of 22 feet that rather than conclude the use of a 2.72 feet unit it would have been the 14.142 inches measurement I propose?

Twenty two feet equals 8.088 MY (Thom's units) but twenty two feet (21.94 feet) equals 18.6 MF (Harris and Stockdale unit,) 18.6 being the number of years in the Moon Cycle. I should point out at this juncture that Professor Thom and his son, were both extremely supportive and approachable with my colleague Norman Stockdale. But it begs the question, if the Thoms, such knowledgeable, academic and professional men, had been so seriously doubted and criticised by academics and archaeologists, then what chance would I have as an amateur researcher/enthusiast in trying to validate our claims for the HSMF and the HSMi?

John Neal in his book "All done with Smoke and Mirrors" page 47 said: "Thom made a comparison of his Megalithic Yard with only one other known unit of measurement. This was the Spanish vara, the pre-metric measurement of Iberia, its value 2.7425 feet.....This is a good example of an intermediate measure being thought to be related because of similarity in length, and illustrates the importance of considering the sub-divisions when sourcing a measure.....Why he did not analyse the Megalithic Yard in terms of what was already well known of ancient metrology, must remain a mystery....The very simple fact of the matter is, that if as Thom claimed from the beginning, the Megalithic Yard has 40 sub-divisions, then it is not a "yard" but a double remen [1.25], or 2 and ½ feet, and the "megalithic inch" is a digit!.....16 of these digits are therefore one megalithic foot of 1.0909 English feet. This is a well-known measurement in ancient metrology, sometimes referred to as the Ptolemaic foot.....Then his "megalithic rod" [6.8 feet] is 6.25 Ptolemaic feet, which is also a measure known in antiquity as being 100th part of a furlong of 625 feet or 1/8th part of the 5,000ft mile. The megalithic measures are not, therefore, peculiar to what is accepted as the megalithic arena, but are perfectly integrated with measuring systems found throughout the ancient world." Therefore maybe I needed to look and see if there were any connections with other proposed measurements. Below are a few examples.

The "Beaker Yard" was identified by Aubrey Burl (2000:52) as 13.1 Metres long.

13.12 Metres = 36.525 (HSMF) (Solar year of 365.25 days divided by 10)

In Cumbria Burl (2000:106) felt a regional unit of 2 feet 7 inches was used.

2 feet 7 inches = 26.3 (HSMF)

26.3 (MF) x pi = 82.65 (HSMF)

82.65 (MF) = 27.55 (HSMF) Days in an Anomalistic Month x 3

This is of consequence because both the large stone circles of Cumbria are related to the 27.55 days Anomalistic month.

Castle Rigg circumference = 275.5 (HSMF) 27.55 x 10

Long Meg circumference = 303.1 (HSMF) 27.55 x 33

Michael Dames identifies key lengths in use around Avebury as approximately 65.25 and 400 feet.

65.76 feet = 55.8 (HSMF) = 18.6 X 3

400.69 feet = 340 (HSMF)

340 (HSMF) x 20 = 18.6 year Moon cycle days of 6800.

However, would it help to justify the validity of our proposed Megalithic Foot (HSMF) by proving its links to previous measurements such as the Roman Foot or the French Aune?

Here is one point of view, whose comments I have summarised below. It is from T. Benesh (Megalithic Portal. February 10th 2008))

The Spanish Vara = *33 inches

The French Aune = 46.66 inches

The Spanish Vara x 10/7 = The French Aune

The ratio of the English Pole to the French Pole = *the square root of 2*.

The argument being that the megalithic people modified the relationship with the French so that *the square root of 2* (1.4142) was substituted for 10/7 = 1.428

The square root of 2 = 1.4142

1.4142 x 10 = 14.142 inches (The length of our proposed Megalithic Foot (HSMF))

The Spanish Vara and the English Pole then related to the French Aune in multiples of 7. This allowed the use of the Pi ratio of 22/7 in the design of stone circles.

The French Aune of 47 inches = 186.1 Megalithic Inches (HSMi)

According to the "secretacademy.com" website, "The structure of ancient metrology was devised to express integers in designs. To this end, incommensurable ratios particularly pi and the square root of 2 are rationalised through close approximations... The commonly used approximation of the square root of 2 is 99/70 and 140/99. ...As both factors are common to the most often-used pi ratio of 22/7 it is not surprising that these two approximations prove to be related through the medium of measurement – squares and circles and how they are reconciled as being basic to metrology.

Additionally as so often happens, the *numbers* expressed in English feet and the number/length, 1.4142857 is the Sumerian 1.5ft cubit that stems from the foot of .9428571 ft." On the same Megalithic Portal blog mentioned previously (2008), is this very interesting comment by John Neal, the metrology expert.

"It is glaringly obvious that the measures that were used in Britain were not introduced by any invader, or have any known source within recorded history. The Roman Foot was in use in Britain in the Neolithic and the Bronze Age...*The Roman foot is known to have been in use from at least the third millennium BC, on the best of evidence.*" (Ref 9)

The Roman Foot is generally considered to be 11.66 inches long.

The square root of HSMF (14.142 inches) = 3.76 inches x 18.6 = 69.96 inches = (6 Roman Feet)

However, possibly even further back in time and prior to the Roman Foot was the Northern Foot of 13.2 inches.

The Roman general Nero Claudius Drusus campaigning in lower Germany 12BC, was forced to adopt the long established and deeply ingrained Northern Foot of the Germanic tribes in preference to the smaller Roman foot. The longer measure of these North European people, was 4800 Northern Feet to the 'mile'. This measure, the Northern Foot, was taken to wherever they migrated, so in that context the Northern Foot is known as the Saxon Foot. This unit measures 13.2 inches (335.3 mm).

Primarily a land measure, the Northern Foot is part of an interlinked system of measures. It is the base unit of the Rod, the Acre, the Furlong, and the Mile. The Northern Foot was deemed to be 36 Barley corns laid end to end, or 13.2 present inches. It can be traced back to 3000 BC to the pre-Aryan races of the Indus valley civilisation. The length is marked on Egyptian wooden cubit rods of 1900 BC., and on Royal cubits 1567-1320 BC.

The Sumerians were aware of it also, for their cubit was equivalent of $\frac{3}{4}$ of the Northern 'cubit' of 2 Northern feet and half of the Sumerian cubit was known as the Natural or Pythic foot which was preferred by the Celtic races. (*Skinner F.G. 'Weights and Measures', Science Museum, H.M.S.O. 1967*) For further details see "Earth, Pi, Miles and the Barleycorn" by Hugh Franklin, March 2000 and "Pagan Magic of the Northern Tradition: Customs, Rites and Ceremonies," by Nigel Pennick, Inner Traditions/Bear and Co, 2015).

The specific significance in regard to the Northern Foot of 13.2 inches and my proposed Megalithic Foot, HSMF, of 14.142 inches, is that 13.2 inches x 15 = 14.142 inches x 14. Therefore a direct connection and correlation of 15/14 could be made between the Northern Foot and the Megalithic Foot. (HSMF).

It is clear that if our proposed measurements the Megalithic Foot (HSMF) and the Megalithic Inch (HSMi) are to be accepted then a degree of *subjective* assessment has to take place. Numerology

and mathematical calculations can unify the most complex values and indeed, quite correctly, this ability in the right circumstances can be a positive thing.

For example is this coincidence? Were Imperial measures and the HSMF interlinked?

99 divided by 7 = 14.142 (Inches in the Megalithic Foot HSMF)

99 multiplied by 7 = 346.5 (Days in an Eclipse Year)

33 feet = 28HSMF

3 feet diameter = Circumference of 8HSMF

Richard Heath on his "Megalithic Science" website "Metrology of Arbor Low Part 2" states when discussing our proposed Megalithic Foot that: "The subsequent success of the authors in converting megalithic dimensions into time units gave them validation of their megalithic foot (HSMF), as being a unit actually employed within monuments which were deliberately dimensioned according to astronomical time periods.

Such a result could be interpreted as evidence of an earlier and less developed metrology, in use prior to the advent of the ancient metrology found worldwide (c.f. Neal) and historically considered to have emanated from the Ancient Near East."

Forty years of research, both primary and secondary, has established confidence that our proposed units of length fulfil both a practical and symbolic megalithic function. Deteriorating conditions on the ground have made our task so much more complex but when we draw together the various strands of our research and observe just how so many of the megalithic sites are situated and designed to perform practical astronomical functions, such as solar and lunar alignments, and how the circle perimeters have been designed and refined in various ways and types so as to more accurately determine their circumference lengths, and that these designs have also included complex but integrated internal geometrical construction and astronomical symbolic references, I would suggest that our accumulation of circumstantial and factual data confirms Chamberlain and Pearson's 2007 report (see below) conclusion that "different base units in use in the Stonehenge area may be co-ordinated elements of a common measurement system." Indeed as I write, further exciting research is now being pursued by Richard Bartosz, who in looking into the origins of sacred measurements and their practical usage, has identified the Imperial Foot, the Roman Foot, the square root of 2 and the Megalithic Foot, (MF), as component parts to a much more complex but integrated ancient system of measurement.

Similarly, David Kenworthy is researching and writing about the interaction between Thom's MY, the Imperial Foot and the HSMF. For example he points out that a 3 feet diameter gives a circumference of 8 HSMF. (Both Richard Bartosz and Dave Kenworthy have many posts on the Megalithic Portal thread dedicated to the HSMF and other "Mysteries Forum" threads re Stonehenge, measurements and speculate on purpose. Particularly of interest are the unifying possibilities re Thom's MY, the Imperial Foot, the Megalithic Foot (MF) and the Megalithic Roman Foot, that they are currently exploring.)

For example: 106 Imperial Feet = 90 HSMF = 110 MRF = 39 ATMY (1272 inches)

The Northern Earth magazine also carries related articles by Dave Kenworthy and Bill Wilkinson, the latter of whom is posting YouTube videos showing via google maps straight-line distances, some validating the proposed HSMF.

Geoff Bath, author of "Stone Circle Design and Measurement," 2016, Key Press, also points out on the Megalithic Portal HSMF thread, that if you divide a diameter expressed in MY by 4 and multiply by 29 that gives you the circumference in HSMF.

Harry Sivertsen, author of "Measurements of the Gods," 2009, Completely Novel Ltd, believes a very similar length unit to the HSMF has historical roots going back to the source of measurement and maths in the ancient world. In his updated paper on "Stonehenge Measures," August, 2016, he says, "Some unusual, but intuitive thinking has led to this (HSMF) value and all is revealed in the intriguing book researched by Harris and Stockdale, the measures certainly appear to be associated with Stonehenge and as we shall see, other elements well away from and much earlier than Stonehenge."

In an email sent to me including evidence Harry, one of the top 3% reviewed researchers on www.academia.edu, concluded that the "numerical connections to the HSMF can be found with the (Indian) Harappan bricks of both varieties, circa 2400 BC to 2000 BC." In previous correspondence Harry had concluded that the HSMF unit "can be seen as having connectivity to many diverse scenarios entailing the ancient canon of measure." (Much more information re the HSMF and its use at Stonehenge and its history has now been included in Harry Sivertsen's 2016 August update, "Stonehenge Measures.") Harry explains that what had really made an impression on him was that 560×14.142856 (HSMF = 14.142 inches) = 660, which in inches is 7920, representing the Earth's diameter. He also goes on to explain that: $33.333333 \times \text{HSMF} = 39.2857142 = 22/7 \times 12.5$ where $12.5/12 = 1.04166666$ which is $25/24$ and this with its reciprocal is the value to change back and fore between Roman, Greek, British and Saxon (Sumerian) values. Simpler is to multiply or divide by 0.96 ($24/25$).

Harry also proposes that the Stonehenge Aubrey Circle diameter divided by the Sarsen Circle diameter = $2.828571429 = 1.1412857142 \times 2$. Put another way the Aubrey radius/ Sarsen diameter = HSMF in inches.

Finally Harry Sivertsen put the following edited comments onto the www.Academia.edu website. (August 24th 2016).

"The measure proposed by Peter Harris and Norman Stockdale is one of considerable connectivity. This value connects with numerous of the measures of the ancient world as proposed not by Alexander Thom but by John Michell..... The megalithic foot of Harris and Stockdale is a further value that has a considerable number of correspondences, which it ought to as for circular measure the value most commonly in use was $22/7$ and the HSMF (Harris/Stockdale Megalithic Foot) is exactly $3/8$ or 0.375 Of 3.142185 etc or $22/7$(Measures within an inch) complies well with the HSMF as does the station stone rectangle and the outer ditch and bank.....Stonehenge has some beautiful connections to the HSMF.....it appears to have had a long history....."

Harry concludes that "As the author of Stonehenge Measures I feel honoured to have been involved with the evaluation of the HSMF in a much wider context than was originally contemplated. I now need to update (my) book Measurements of the Gods to include this gem of a measure and its associations."

Vladimir Belobrov, an independent researcher from Moscow, Russia, wrote on the www.Academia.edu website, 26.8.17, " I am very interested in your "Megalithic Foot". Its size is almost exactly the same as the size of the Russian half an archine.....The important thing is that so far I could not find metrological sources of this size (about 718mms) nor Russian, not even in world metrology. And now you've found its source."

Bill Wilkinson in an email sent to me on 7/7/16 said in relation to the 2.72 feet length of Thom's MY and my 14.142 inches Megalithic Foot (HSMF) that:

“The height of an equilateral triangle of sides pi is 2.72 and the diagonal of a square of sides 10 gives us 14.142. A right angled triangle with two sides of 56 gives a third side of 79.2. $79.2/56 = 14.142$. From the bulls-eye to bulls-eye of Sanctuary to Woodhenge measurement (over 15 miles) it’s hard to dismiss that 2.72 wasn’t being used. (But) all seems very interwoven. It’s easy to see how any of these figures might jump out in the statistics as a “universal” measurement.”

*Since this contact Bill Wilkinson has published an email book entitled, “Dartmoor’s Stone Circles Decoded.” This gives many new images from Google confirming the use of the HSMF.

Finally, whilst in the process of this research I came across a small paper entitled “Units of measurement in Late Neolithic Southern Britain” (Ref 3). In their introduction the authors, Professor Andrew Chamberlain and Mike Parker Pearson, state: “The abilities of the prehistoric peoples of Britain to construct large-scale yet intricate monumental architecture incorporating standardised constructional designs, accurate astronomical alignments and detailed patterns of symmetry are now widely recognised, but this raises questions concerning the techniques of measurement that were in use in the British Late Neolithic (third millennium BC). The regularities in the plans of circular earthworks and timber and stone settings suggests that, at least at the level of individual monuments, a system of measurement was used to set out the positions of banks, ditches and orthostats.”

Further, they state that this does not require a fixed unit of length and doubt the concept of there having been a standard unit of length that was in widespread use amongst the prehistoric peoples of Britain. They acknowledge that if such a standard or standards did exist there would be important implications for our understanding of prehistoric technology and society. They briefly mention Alexander Thom and his proposed Megalithic Yard and explain that Thom’s methods and results to find appropriate data for the Megalithic Yard failed to win widespread acceptance amongst prehistorians and statisticians.

Chamberlain and Pearson explain that many difficulties can frustrate the search for quanta in the dimensions of prehistoric monuments.

- 1) The level of precision data has to be high so as to eliminate errors in estimated dimensions.
- 2) Ancient measurements systems often made use of multiple values for their base units so that data from different built structures from different sites when combined in a single analysis can give a resulting pattern that is confused by the presence of multiple data.
- 3) Monuments can have taken place over different time phases and consequently do not correspond to the dimensions of the original plan of the monument.

In order to overcome these difficulties Chamberlain and Pearson proposed that the data best examined was where stone and post holes were more likely to have retained their original positions and hence reveal the metric principles upon which the monuments were constructed. They also focussed their analysis primarily on the regularities observable *within* complex multicircuit monuments rather than *between* separate monuments. This helps to isolate and circumvent the problem that may arise when the unit of measurement varies between different structures. In order to facilitate this method of analysis they chose the early phases of Stonehenge.

In Chamberlain and Pearson’s paper (2007) they pointed out an 11:10 ratio is found in some historically documented systems of linear measurement, including the British statute system, in which the modular lengths of chain, furlong and mile are based on multiples of 11 statute feet. Following the writing of this article I was lucky enough to make contact with Professor Andrew Chamberlain, the co-author of the original paper this article was based upon.

He commented that “As a footnote, we suggested in our article that the ratio of 1.1 (11 to 10) is particularly useful when setting out constructions in which the perimeters are intended to be in integer multiples of designated units, as it allows integer diameters of an odometer in the short unit to be transformed into linear measures on the ground in integer multiples of the long unit.”

“Your proposed megalithic foot is close to 1.1 times our proposed long foot of 12.672 statute inches, and the scaling of measurement units by a factor of 1.1 seems to be common in various measurement systems.”

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- * “Dartmoor: Stone circles Decoded.” Wilkinson, 2017, Kindle.

Note. The terms Megalithic Foot (MF) and Megalithic Inch (Mi) have had to be changed to more specific titles as there are other unrelated measurements with similar names. They are now referred to as the Harris and Stockdale Megalithic Foot (HSMF) and the Harris and Stockdale Megalithic Inch (HSMI).