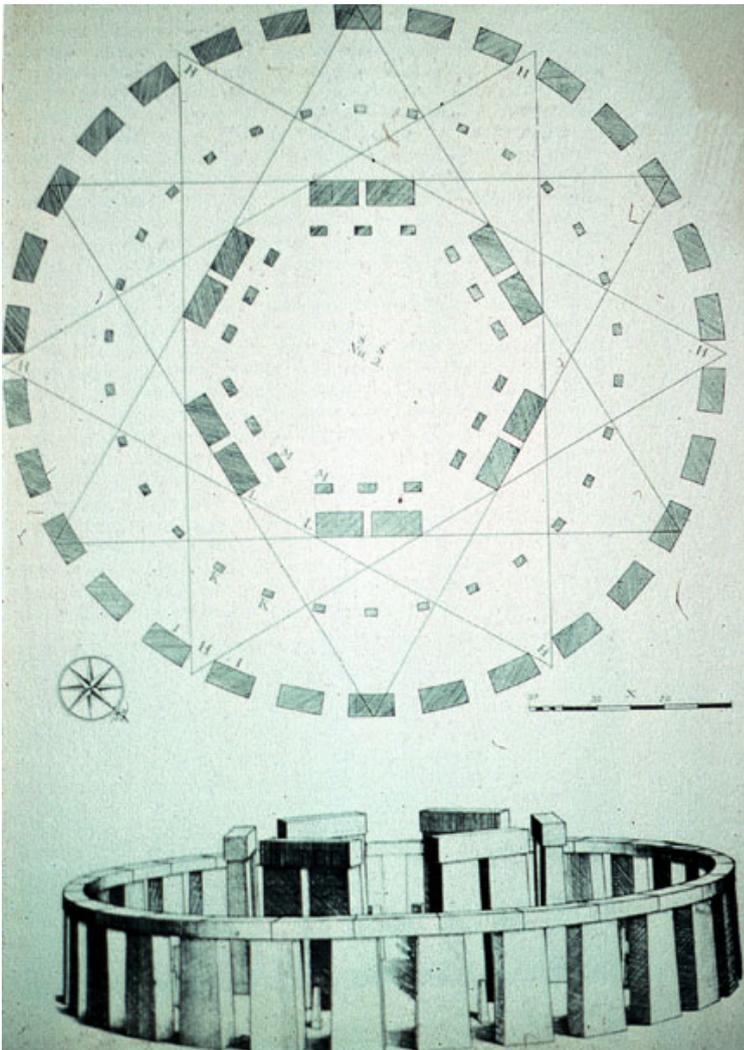


PASCAS PARK



'Stonehenge'



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Namaste



STONEHENGE ECLIPSE CALCULATOR:

<http://www.eclipse-chasers.com/henge1.html>

Bill Kramer

Some years ago I learned that someone had put forth the notion that Stonehenge, the famous archeological site in England, could have been used to predict eclipse events. As an eclipse chaser, I was naturally intrigued by this concept and wanted to learn more.



During a visit to Stonehenge in 2001 the tour guide said that Stonehenge might have been used as an astronomical calculator. He mentioned that it was said to predict eclipses however he did not know the specifics when I questioned him. This led me to begin researching the subject deeper in order to learn more about Stonehenge and how it could have been used as an observatory. The gift shop at the Stonehenge monument site contained several small booklets that assisted greatly in this quest. I've supplied a list of good references at the end of the article.

The following article is a summary of what I've learned along with an analysis of a simple numeric method for eclipse prediction. References are provided at the end for those wanting to learn more about this fascinating subject.

The fact that many of the large stones line up to mark the solstice and equinox as well as other astronomical timings related to the seasons is well known. However, this knowledge alone cannot help in eclipse prediction unless it is done to a much higher degree of precision than can be accomplished with

large rocks and wooden posts. And the degree of sophistication needed to conduct a long term experiment into the repeating cycles of the Sun, Moon, and Earth would have resulted in more than just a ring a well placed stones. Archaeological studies have found evidence of holes that once held wood posts that mark the positions of the moonrise relative to other stones. This leads one to wonder just how much the ancients who built Stonehenge were researching the cycles of the heavens.

Several clever explanations for the stone configurations related to solar system objects have been proposed along with the sun and moon tracking. Other stone circles from the same archaeological time period do not have the same configurations thus making Stonehenge somewhat unique in that regard. A lack of written records from the time period in question means that we can only guess. Some of the guesses have been interesting while others can only be considered preposterous given what is known these days about the civilization and times through archaeological study. But then, archaeology is a science of based on the scientific method with little opportunity for definitive proof. This means that sometimes there are breakthroughs that prove previous conceptions incorrect. Perhaps the builders of Stonehenge were astronomical geniuses and their work is only preserved in our spirit to understand.

Stonehenge Eclipse Calculator Origins

So where did this story that Stonehenge could be used as an eclipse calculator come from? Turns out that the stones themselves are not the source of the story. The story stems from a ring of holes around the outside of the circle.

Surrounding the famous ring of stones are the remains of some small holes, also in a ring. The holes, known as the Aubrey holes, were discovered during an exploration of the site in the mid 1600's. Aubrey discovered the remains of 56 virtually even spaced holes that appeared to have been dug up and refilled many times over. The remains of cremated humans have been discovered in most of the holes. And analysis of the dirt at the base of the holes indicates that they did not serve as post holes or holes for stones (the dirt showed no evidence of compacting as typically found at the bottom of an ancient post hole). The physical dimensions of the Aubrey holes places them approximately 16 feet apart around a circle 284.5 feet in diameter. The holes themselves range in size with an average diameter of 3.5 feet and a depth of 2.5 feet. The holes are not in a perfect circle. Some are almost two feet off of the proper diameter or distance along the circle for an exact even spacing.

What were the original purposes of the pits? They do not have the same characteristics as pits dug to hold posts nor those dug to support the stones. Perhaps they were instrumental during the construction or they were built for other symbolic purposes. Without any form of written records it is guesswork.

A Stonehenge investigator, or more properly an astro-archeologist, named Gerald Hawkins was the first to associate the 56 Aubrey holes with a procedure for predicting eclipses. Working with astronomer Fred Hoyle they devised a method by which one could predict the likelihood of an eclipse event. This method is not perfect and requires that one reset the "calculator" every so often, nor does it predict the location of an eclipse on the globe - it merely predicts when the circumstances for an eclipse are right.

First we will take a look at the method, then an explanation of why it works. You can build your own

eclipse prediction engine based on this simple procedure or do like I did and write a computer program that performs the operations.

Set Up

The elements required are simple.

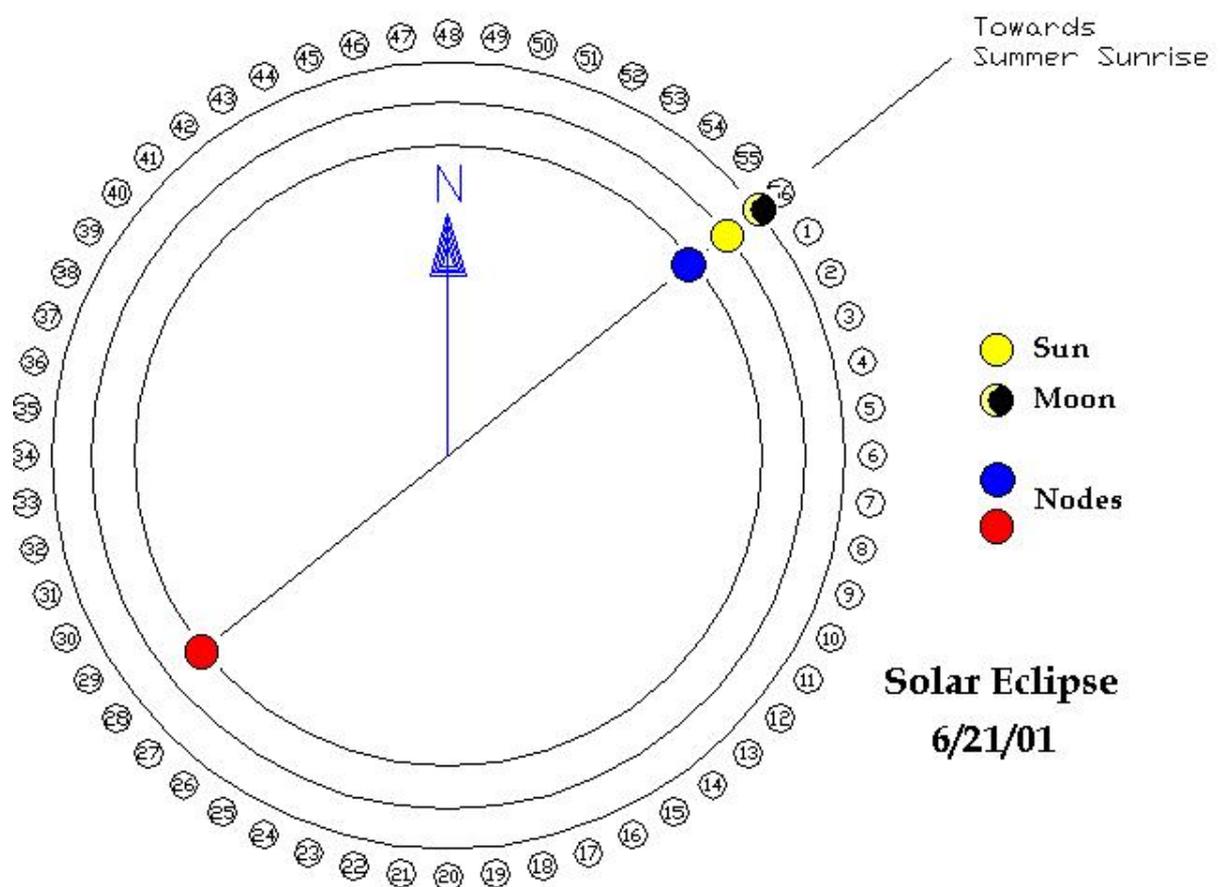
56 holes

4 markers

Two of the markers are for the Sun and Moon respectively.

The other two markers are for the eclipse nodes. Nodes are the places where the orbit of the Moon about the Earth intersects the Ecliptic.

Label the holes as 1 through 56. It does not matter where you start but the sake of our model, label the holes in a clockwise manner. (You could match the Stonehenge numbering system for the Aubrey holes - number 56 is the hole in line from the centre to the heel stone.)



**Sta
rt Up**

On the day of the summer solstice, place the Sun marker in hole #56.

On the evening of a full moon, place the Moon marker in hole #56.

Begin advancing the Sun and Moon marker every day.

The Node markers are added with the observation of a lunar or solar eclipse. Place one of the Node markers in the same hole as the Sun marker. The other Node marker should be placed in the hole exactly opposite.

- If you observed a solar eclipse, the Moon and a Node marker are in the same hole as the Sun.
- If you observed a lunar eclipse, the Moon marker is opposite the Sun marker and each have one of the Node markers included with them.

You can now begin the regular ritual of advancing the markers.

(Note, the solar eclipse of June 21st, 2001 was a unique opportunity to set up a Stonehenge style calculator base. Summer Solstice plus the Solar eclipse on the same day.)

Predicting an Eclipse

Once the markers have been placed you can use the model to predict the next eclipse. The markers are moved from one hole to the next according to the following schedule.

Moon marker - move twice a day, once in the morning and again in the evening.

Sun marker - move every six and one half days. Alternate mornings and evenings.

Node markers - move every four months (moved in opposite direction)

The Moon and Sun markers are moved in the plus direction (hole 1 to 2, 2 to 3, and so on) while the nodes are moved in the minus direction (hole 3 to 2, 2 to 1, 1 to 56, and so on).

When the Node markers are one away from both the Sun and Moon markers, then an eclipse will occur. If the Sun is near one node and the Moon near the opposite, it will be a lunar eclipse. If both the Sun and Moon are near the same marker then there is a chance of a solar eclipse. Whether the eclipse is visible for your location requires a much more precise calculation. This calculation will only tell us the likelihood of an eclipse event occurring.

The Moon and Sun markers can be "corrected" at standard alignment times. The Moon during the Full Moon each month and the Sun during the Solstice. The nodes would be recalibrated each time an actual eclipse was observed.

If the model is maintained in real time then you will be able to tell that an eclipse is coming a few days before as the Moon's marker advances into position. The model might be used in a simulation by accelerating the clock. Using a computer program based on this simple model the dates of upcoming eclipse events were predicted five years in advance.

The method is not 100% accurate but it is close and can be refined even further. We can refine the model by understanding more about why it works.

Refining the method

The orbits of the Sun, Earth, and Moon are cyclical. When counting days the cycles do not divide into nice neat integer numbers. But that does not mean integer numbers (also known as whole numbers) cannot be used. The key to using integer numbers is to use a common multiplier result. It just so happens that the number 56 works pretty well.

The Sun: Multiply 6.5 by 56 and the answer is 364. This is just 1.25 days short of a proper year. Thus moving the Sun marker every six and one half days is "pretty close". Every six months the Sun marker can be corrected during a Solstice (Northern most or Southern most travel of the Sun during a year). The maximum error would be just over half a day with regularly applied corrections. When doing a simulation of the calculator sequence you must take into account the extra day and add yet another every four years just like a leap year.

The Moon: Divide 56 by 2 and you have 28, just about the number of days required for the Moon to orbit the Earth and return to the same position relative to the background stars. The actual value is 27.322 days thus requiring regular corrections to be applied based on actual observations. To apply the corrections in a simulation of the calculator for future eclipse prediction skip one hole each orbit about the circle. This would allow the Moon marker to complete a circuit in 27.5 days. If another hole is skipped every third circuit then the average cycle over three lunar orbits is 27.33 days. The result of $(27.5+27.5+27)/3$ is 27.333 and that will keep the simulated future position of the Moon very close to reality.

The Nodes: The nodes movement, three times a year, means that 18.66 years are needed for a complete circuit. The actual orbit of the nodes is 18.61 years. Every 18 years, the node values will be off by about one month. Thus four cycles (4 x 18 years) are needed before the nodes are off by one position in the circle. Corrections applied by direct observation will allow the Stonehenge calculator to keep an accurate eye on upcoming eclipse events. As for simulations, 72 years before the nodes are off one position is not too bad.

Refined Method Description:

- The Sun advances one position every 6-1/2 days. Twice a year, the interval will be 7 days (adding a half day before the advance of the marker).
- The Moon marker advances twice a day. It skips one hole on each orbit of the circle. Every third orbit an additional hole is skipped.
- The Nodes are advanced in the opposite direction three times a year.

Using the refined method a simulation was able correctly predict eclipse event dates up to ten years before and after a known eclipse date.

Such knowledge may have been useful to the builders of Stonehenge. We can never know however it is fun to speculate.

Reference material

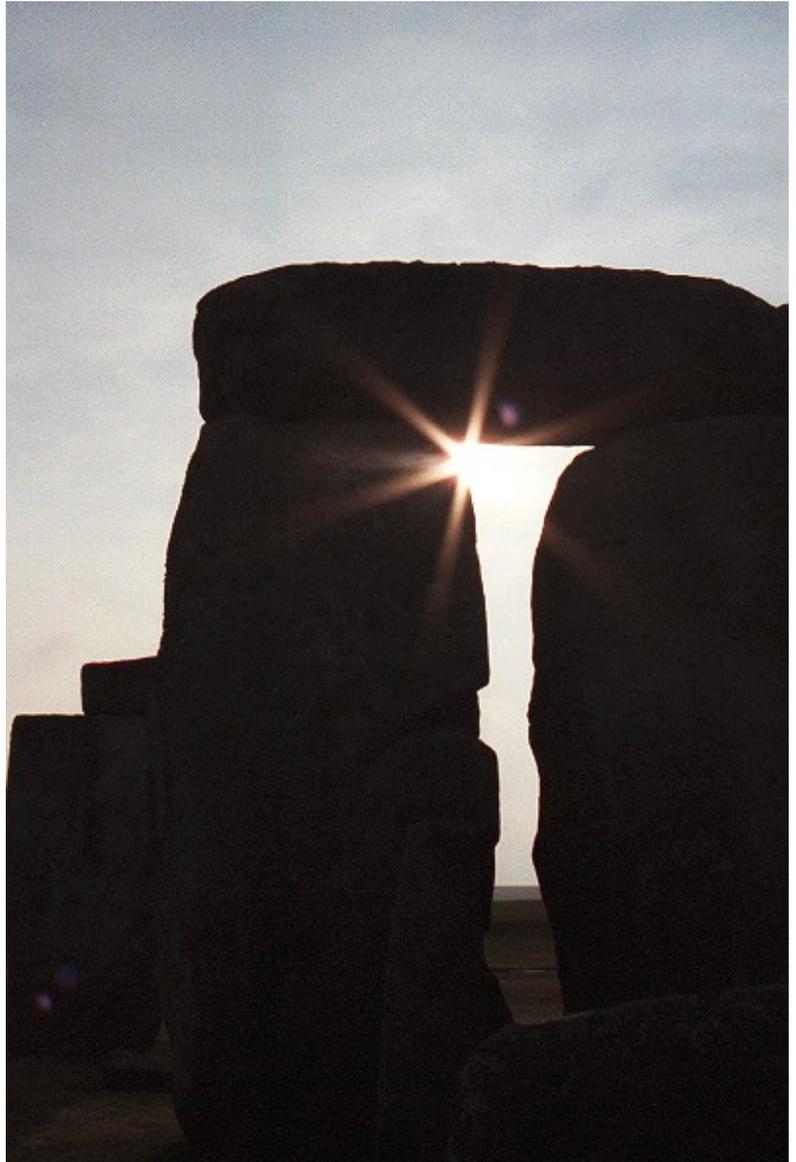
The following publications and web sites contain useful references to Stonehenge and how it could have been used in ancient times. There are also numerous pictures and details of excavations that have been done over the past centuries.

Written works -

- The Astronomical Significance of Stonehenge - C.A.Newham (Coates & Parker LTD (2000 edition), first published 1972)
- Stonehenge Sun, Moon, Wandering Stars - M.W.Postins (Malthouse lane, Kenilworth, Warwickshire)
- Stonehenge Decoded - G.S. Hawkins (Souvenir Press 1965)
- Beyond Stonehenge - G.S. Hawkins (Hutchinson 1973)
- Sun, Moon, and Stonehenge - Robin Heath (Bluestone Press 1998)
- Megalithic Lunar Observatories - A. Thom (Oxford University Press 1971)

Web Sites -

www.stonehengepostcards.com - collection of visual images over past century and more
www.english-heritage.org.uk/stonehenge/ - official Stonehenge site, visitor information
www.earthview.com/ages/stonehenge.htm - Stonehenge eclipse calculator article
www.world-mysteries.com/mpl_4.htm - Stonehenge eclipse calculator detailed article



STONEHENGE:

<http://www.britainexpress.com/History/Stonehenge.htm>

Early building. There was a henge at the Stonehenge site before the Bronze Age, built sometime around 2800 B.C. (First constructed prior to 6300BC but after 6400BC. Designers were descendants of those who designed the Great Pyramids of Egypt.) It was really nothing more than a ditch and bank enclosing an open space. The stone now called the Heel Stone lay outside the ditch. There may at some point have been a circle of wood or a hut inside the enclosure; there certainly was a tradition of wooden henges in the area. Inside the henge a ring of 56 holes were dug, called today "Aubrey Holes" after a 17th century "discoverer" of the site. These holes were filled with cremation materials.



The Bluestones. About 2200 B.C. the [Beaker People](#) swung into action. Perhaps to impress their superiority on the local population, they began the process of building a double ring of stones inside the henge. These "bluestones" were transported all the way from southern Wales, a distance of several hundred miles. Why go to Wales when there were stones as close as twenty miles to the north on the Marlborough Downs?

Well for one thing, it seems that the Beaker People had an established trade route from Wessex to Ireland in their search for copper and gold, so southern Wales was on their way home. Also, it is possible that there may have been friction between the Beaker People and the natives of the Marlborough Downs which prevented them from accessing the nearer stones.

Transporting the stones was an enormously impressive achievement. Over 80 of these bluestones, most weighing over four tons, were painstakingly carried to Salisbury Plain by boat and sledge, a process that took over a hundred years to complete. This was not a weekend project by a team of do-it-yourselfers. In later years the transport of these stones was attributed to magic, even the wizard Merlin was supposed to have taken part.

The sarsen circle. Impressive it may have been, but the stones were barely in position before they were torn down. They may even have been hauled off to another building site. Speculation (there's that word again) among archaeologists is that there was a shift in the power balance of the area, and the Beaker People were ousted by a local revolt. A new circle was erected, this time using more easily obtainable "sarsen" stones from the Marlborough Downs, to form an inner horseshoe surrounded by a circle. The interesting thing to note is that the linteled horseshoe was built using mortise and tenon joints, pegs and holes, as would be expected of people skilled in woodworking. This is the circle that is so famous today. It is really the third phase of building, incorporating the other two, for the "bluestones" were brought back from exile and re-erected around the inner horseshoe.

What is Stonehenge? Is it an astronomical observatory? Probably not, though there are certainly solar and lunar alignments to be found in the final arrangement of stones. Was it a Druid temple, complete with sacrifices and blood curdling ceremonies? Sorry, no. The Druids were Celtic priests, not due for another 1,500 years at least. What on earth was it then?

It was probably a multipurpose ceremonial centre, like other early circles, relating to fertility, death, and rebirth. There are remains of quite a few cremations and other burials nearby and inside the circle. It was obviously an important site in the religious observances of the Bronze Age culture, but precisely what those observances were it isn't possible for us to say. In other words, we don't know, but half the fun of Stonehenge is the speculation.



STONEHENGE:

<http://witcombe.sbc.edu/earthmysteries/EMStonehenge-aerial.html>

***An Aerial View of Stonehenge***

The view includes the circular bank, ditch, and counterscarp bank.

A number of the **Aubrey holes** are also visible. The **Heel Stone** can be seen in the lower right.

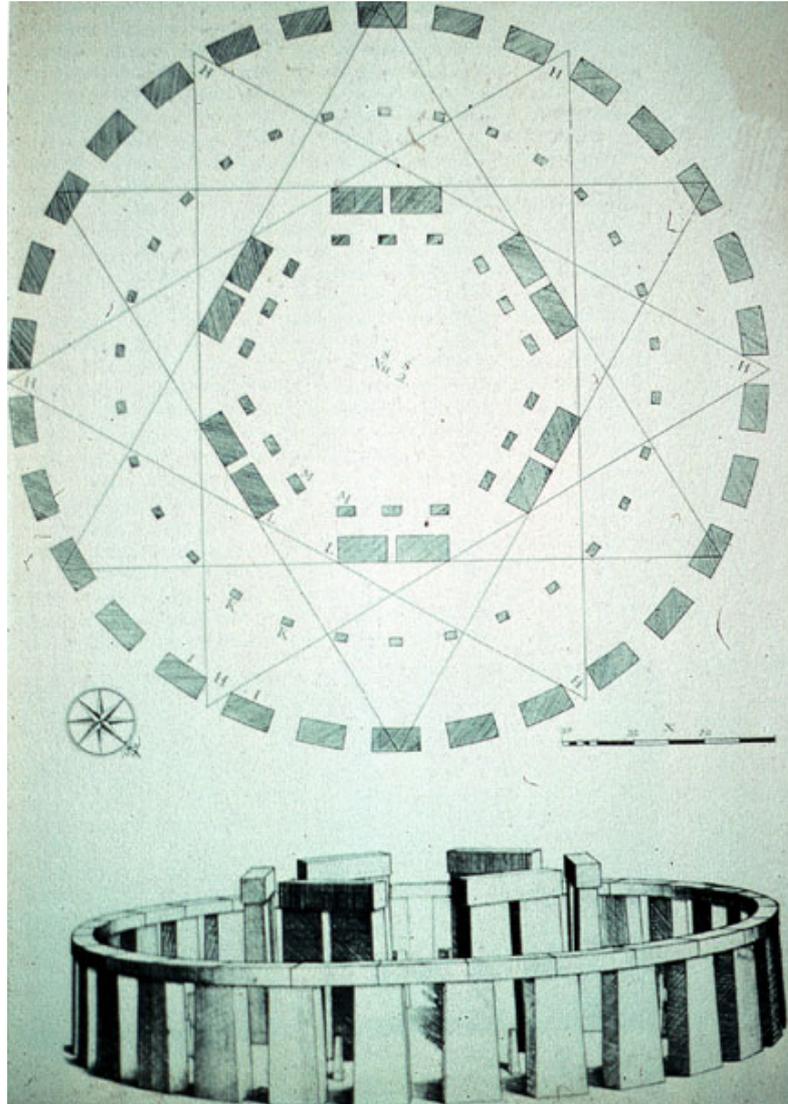
Stonehenge Restorations

Over the centuries, various attempts have been made to show how Stonehenge may have looked originally. Most of these have been accomplished only on paper. One of the earliest dates to the sixteenth century.



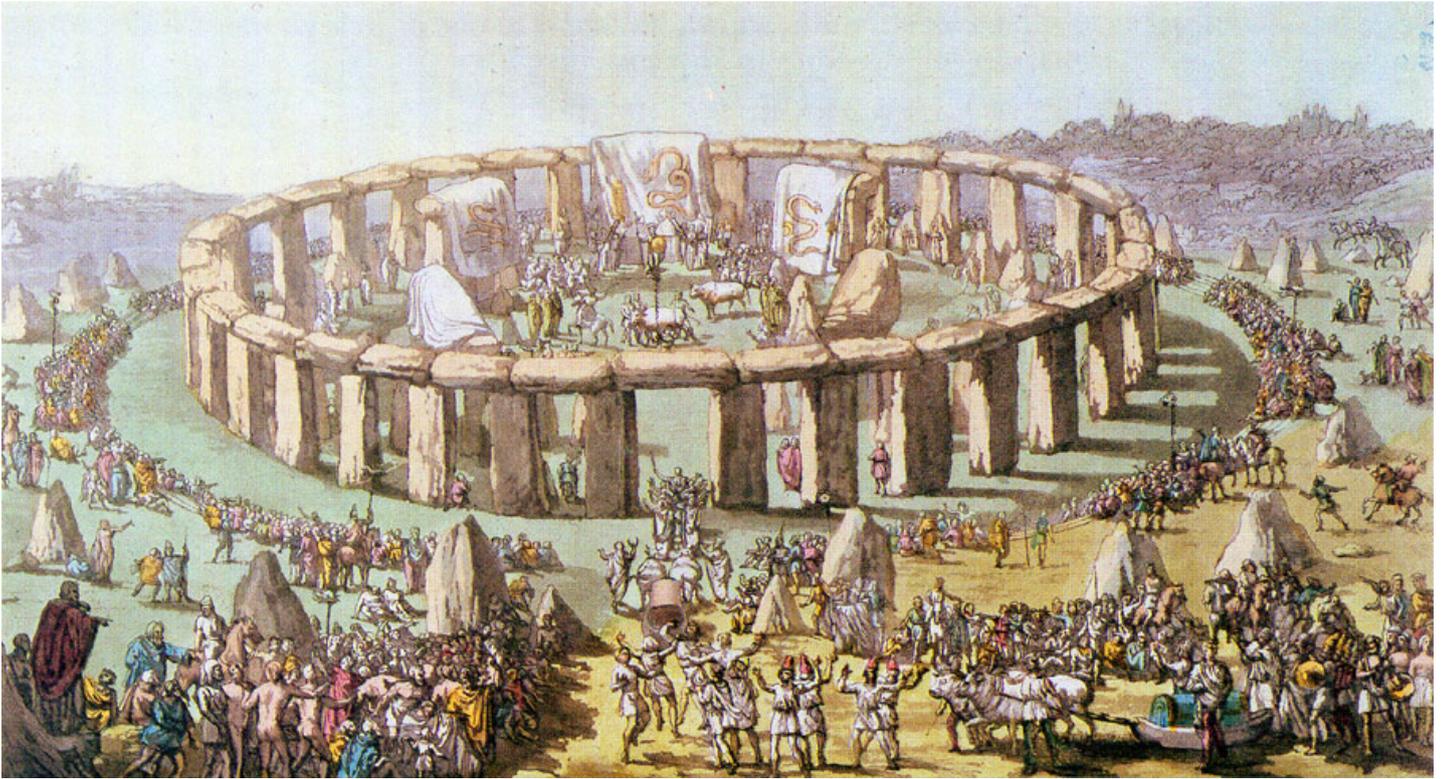
'STONHING', 1575 (print by "R.F.")

The rustic quality of the 16th-century restoration, was transformed by the architect Inigo Jones in the 17th century into a model of order and precision. Incapable of thinking that [Druids](#) could have been responsible for such an imposing structure, Jones identified Stonehenge as a Roman Temple and 'restored' it accordingly.



Inigo Jones, 'Stonehenge Restored' (1655)

Later in the 17th century, [John Aubrey](#) argued that Stonehenge had indeed been built by the [Druids](#), an opinion supported in the 18th century by [William Stukeley](#). Stukeley's description of Stonehenge, and [Avebury](#) as Druidic Temples, caught the popular imagination.



Druidic Festival at Stonehenge (coloured Italian engraving, 1820)

Stonehenge and the Druids

After centuries of neglect in the wake of first Roman and then Christian suppression, the [Druids](#) were rediscovered during the Renaissance when the revival of interest in ancient Greek and Latin writers brought attention to the works of Pliny, Tacitus, and Julius Caesar and their descriptions of the Celtic world. First in France in the sixteenth century, and then in England, the ancient Celts (or Gauls as they were known in France) and Druids were claimed as historical ancestors. By the seventeenth century, a new romantic image of Druids began to emerge in French and English literature.

In England as early as 1624 the Celtic warrior queen Boudicca is credited by Edmond Bolton with building [Stonehenge](#) as her monument. Although other English writers at this time refused to acknowledge anything worthwhile in Celtic culture, and the architect Inigo Jones (1573-1652), in his *The Most Remarkable Antiquity of Great Britain, vulgarly called Stone-Henge, Restored*, compiled from his notes by his son-in-law John Webb and published in 1655, would conclude that "Stonehenge was no work of the Druids" (he claimed instead that it had been built by the Romans, see "[Stonehenge Restorations](#)"), the link between the Druids and Stonehenge had nonetheless been forged in the popular imagination.



Druids celebrating the summer solstice at Stonehenge

Already by 1649, [John Aubrey](#) had suggested that the Druids were probably responsible for building Stonehenge, a theme he developed into a book originally to be titled 'Templa Druidum' but which ultimately formed a chapter in his *Monumenta Britannica*. In the early 18th century, Aubrey's views became known to [William Stukeley](#) who not only declared Stonehenge (and [Avebury](#)) to be a temple of the Druids, but, according to some, was instrumental in initiating in 1717 the first Order of Druids on

Primrose Hill, London. Some scholars, however, have found no evidence for this, and recognize instead the earliest revived Druidic order as being the Ancient Order of Druids founded in 1781 by Henry Hurle who organized it on the lines of Freemasonry. By 1839, however, conflicts between members led to the formation of a breakaway movement named the United Order of Druids, lodges for which were also established in the United States and Australia. The United Order of Druids still flourishes today as an international charitable organization.

The more mystical Ancient Order of Druids also continued through the 19th century and into the 20th, claiming among its many members Winston Churchill (1874-1965), who was initiated into the Albion Lodge at Oxford.

Archaeoastronomy at Stonehenge



Already in the 18th century the British antiquarian [William Stukeley](#) had noticed that the horseshoe of great trilithons and the horseshoe of 19 bluestones at [Stonehenge](#) opened up in the direction of the midsummer sunrise. It was quickly surmised that the monument must have been deliberately oriented and planned so that on midsummer's morning the sun rose directly over the **Heel Stone** and the first rays shone into the centre of the monument between the open arms of the horseshoe arrangement.



View from the centre of Stonehenge towards the **Heel Stone**, and a photograph of the sun rising over the **Heel Stone**

This discovery has had tremendous impact on how Stonehenge has been interpreted. For Stukeley in the 18th century and [Sir Norman Lockyer](#) in the first years of the 20th century, this alignment implied a ritualistic connection with sun worship and it was generally concluded that Stonehenge was constructed as a temple to the sun. More recently, though, the astronomer [Gerald Hawkins](#) has argued that Stonehenge is not merely aligned with solar and lunar astronomical events, but can be used to predict other events such as eclipses. In other words, Stonehenge was more than a temple, it was an astronomical calculator.

It was argued that the summer solstice alignment cannot be accidental. The sun rises in different directions in different geographical latitudes. For the alignment to be correct, it must have been calculated precisely for Stonehenge's latitude of $51^{\circ} 11'$. The alignment, therefore, must have been fundamental to the design and placement of Stonehenge. As if corroborating the claims made by Hawkins for Stonehenge, [Alexander Thom](#), a professor of engineering and a mathematician, has shown that many other megalithic sites throughout Britain are also oriented towards the sun and the moon.

The alignment also made it clear that whoever built Stonehenge had precise astronomical knowledge of the path of the sun and, moreover, must have known before construction began precisely where the sun rose at dawn on midsummer's morning while standing on the future site of the monument. This point needs to be made because, as I suspect, with Stonehenge and many other such monuments, it was the site, a particular place within the landscape, that was important; only later were these sites marked in some more permanent manner by the digging of ditches and banks and (or instead) the erection of wood or stone structures.

For reasons we shall never know, this particular spot in the landscape was so important that not only were ditches and banks dug and, later, stone circles and horseshoe arrangements constructed to mark it, but that some of the stones were deliberately transported there with considerable effort from a great distance away.

Contrary to expectations, the great stone circles and horseshoe arrangements for which Stonehenge is famous are later additions to the monument (mostly Stonehenge III) and are not essential to the lunar and solar calculations.



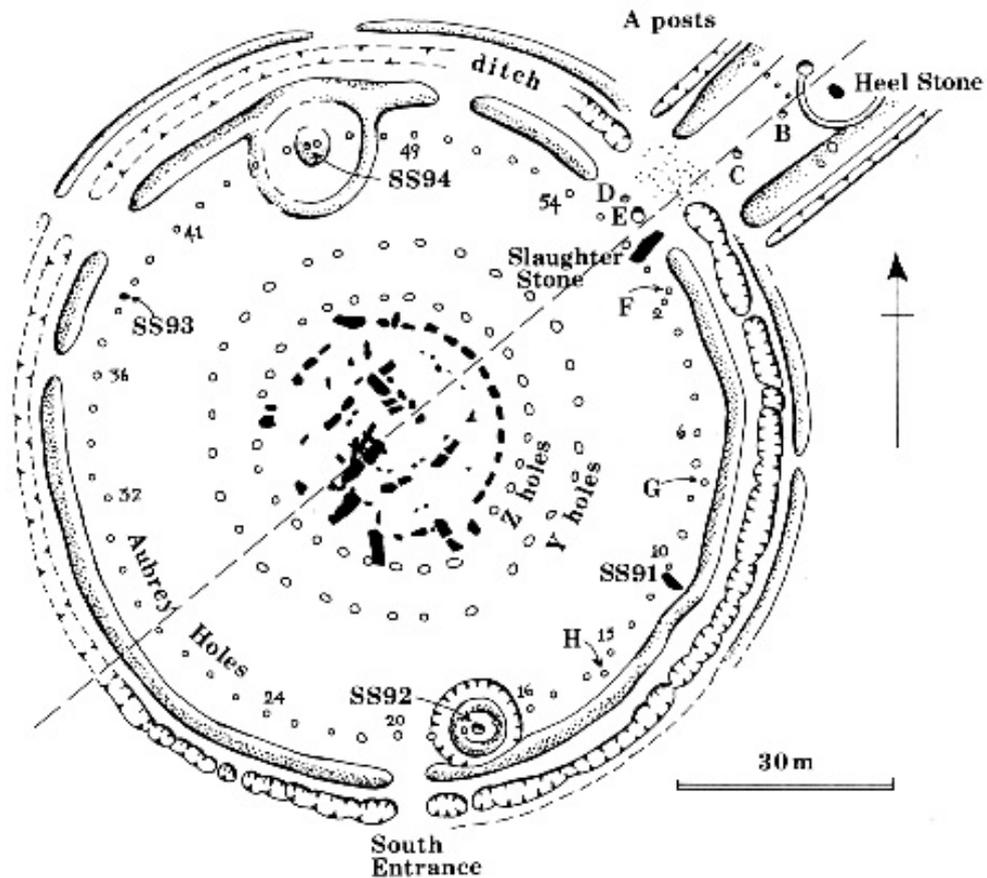
Stonehenge: Phase I (image from [Mohen](#), p. 30)

Today Stonehenge I is barely noticed by visitors. Standing far outside the massed standing stones of Stonehenge III, the remains are comprised of a circular ditch inside of which was erected a bank. The bank is now eroded down to about a foot or so but can still plainly be seen. There is little agreement on how high it was originally. The diameter of the bank is 320 feet and it has at least one major break in it in the northeast, presumably to allow an uninterrupted view in the direction of the **Heel Stone** and the midsummer sun. At least one other break is a noticeable, and perhaps also a third. It should be noted that the break in the northeast is not quite aligned with the later horseshoe structures; nor is it quite aligned with the causeway beyond, or with the **Heel Stone**.



The **Heel Stone**

Inside the bank were dug 56 holes -- discovered by [John Aubrey](#), and known as the **Aubrey Holes** -- placed at precisely regular intervals around a concentric circle of about 285 feet in diameter. Archaeological investigations have shown that these holes were not dug to hold upright stones or wooden posts. Besides the **Aubrey Holes**, of crucial importance are the four **Station Stones** marked at positions 91, 92, 93, and 94, to form a rectangle that stands in a precise relationship with the centre of the monument and with the **Heel Stone**. Only two of the **Station Stones** survive, and one of those may not be original.



Plan of Stonehenge with the **Aubrey holes**, the **Heel Stone**, and the **Station Stones** 91, 92, 93, 94 marked (image from [Castleden](#), p. 30)

For the archaeoastronomists, the **Aubrey Holes** served as fixed reference points along a circle, and their number was essential to astronomical calculations. The cycle of the moon, for example, which takes 27.3 days, can be tracked by moving a marker by two holes each day to complete a circuit in 28 days.

A much longer calculation is to move the marker by three holes per year to complete a full circuit in 18.67 years. In this way, it is argued, it would be possible to keep track of the *nodes*, points where the paths of the sun and the moon apparently intersect to produce an eclipse. Because the moon slews around in its path, the two *nodes* move along the path of the sun, a complete circuit of which takes 18.61 years. By means of the markers in the **Aubrey Holes** and keeping track of the directions of the sun and the moon, the astronomer at Stonehenge could calculate nodal points ahead of time and thus predict both lunar and solar eclipses.

Whether this was in fact the intended use of the **Aubrey Holes** is highly debatable. In recent years astronomical interpretations have been taken up in support of more fanciful notions about the cosmic "New Age" significance of Stonehenge and contemporary "secular Druidism" (see [Stonehenge and the Druids](#)).

THOSE OTHER CIRCLES AT STONEHENGE.

<http://www.celticnz.co.nz/US11.html>

"Most of what has been written about Stonehenge is nonsense or speculation," said R.J.C. Atkinson, archaeologist from University College, Cardiff. "No one will ever have a clue what its significance was."

The fact is that our enlightened ancestors did all in their power to show us the profound meanings of the Megalithic or Bronze Age monuments and left glaringly clear indicators of purpose and function. It is an indictment on our scholars that they have been unable to unlock the simple mathematical codes, which are encrypted into the Stonehenge observatory or its pyramid predecessors. It is admitted that the process of code extraction can be rather involved, as our forebears used layer upon layer of astronomical / navigational numbers in their worldwide explorations and astronomical endeavours.

We will now sift through the more obscure component positions of Stonehenge, one by one and subject the individual parts or features of the site to mathematical scrutiny for identification of repetitive formulas.

The Stonehenge observatory, in its most apparent overall circle diameter, was built to $1/2$ the length value of the Great Pyramid of Egypt.

Professor Alexander Thom said the following concerning the, sometimes, elliptical nature of standing stone observatory circles: *'builders occasionally distorted circular monuments, to make the relationship perfect and that this is at the root of the custom of creating oval rings'* (see Stonehenge, Neolithic Man and the Cosmos, by John North, pg. 302).

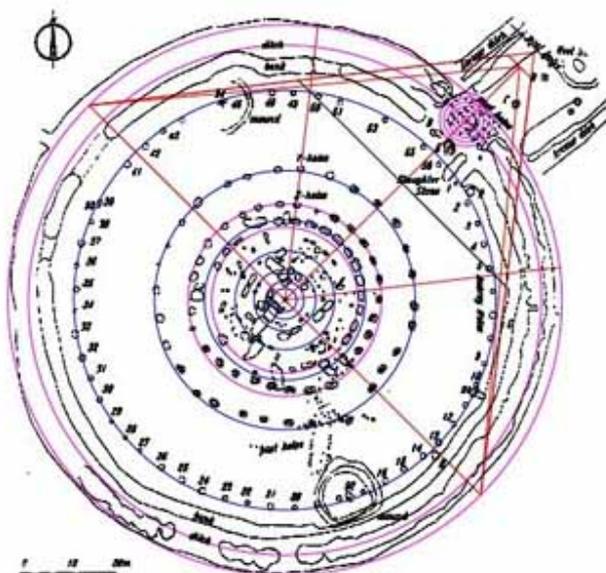


Figure 10: The outermost circle shown (magenta coloured) has a diameter of 378 feet and this value is $1/2$ the base length of the Great Pyramid. Note how the circle relates perfectly with the majority of the Stonehenge site, especially at the azimuths of 45-degrees and 225-degrees. There are slight

discrepancies at 135-degrees and 315-degrees, but the best overall description of an encasing circle for the Stonehenge site would be one of 378 feet diameter.

When an exact 1/2 scale geometric representation of the Great Pyramid is incorporated into the Stonehenge monument's dimensions, a number of excellent relationships are seen to occur. Lines extending from both sides of the baseline and set to an angle of 51.84-degrees (The Great Pyramid's side diagonal angle) converge upon and precisely touch a post marker on the Avenue. The post was obviously placed to record this relationship to the Great Pyramid. Alternatively, lines from the base, which brush the PHI limits of the Aubrey Circle, converge upon a point consistent with the Pyramid's circumnavigating terrace or altar top (set to heights of 450 feet for the terrace or 453.049492 for the altar top). These values are halved to fit the Stonehenge ratio. All factors point to Stonehenge's extremity circle dimensions being indelibly linked to the measurement codes of the Great Pyramid and many added relationships continue to occur in circle sizes or component positions throughout the site.

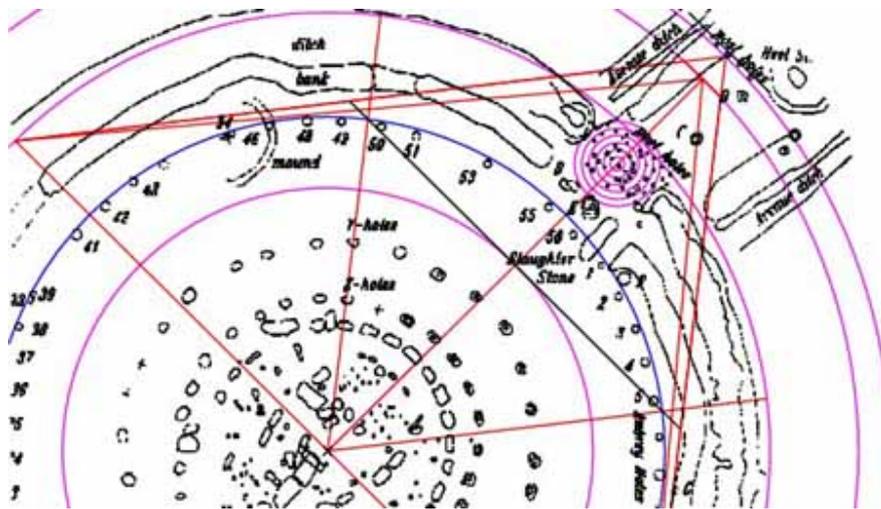


Figure 11: Let's now consider the pyramid geometry in slightly more expanded detail. Starting at the outermost magenta coloured circle, a precisely placed post designates the apex position of a "capstone included" Great Pyramid. The same circle, which brushes the pyramid apex, is also clearly marked by a post or stone component adjacent to the Avenue ditch. This circle would code, essentially, 480 feet of height on the Great Pyramid, from ground level to the theoretical apex of its symbolic capstone. It is here shown as 240.4 feet in radius, as the true value of the pyramid's vertical height would have gone to about 480.8 feet.

The 2nd inward magenta circle designates the true height of the Great Pyramid.

The 3rd inward magenta circle has a diameter of 378 feet and contains Stonehenge.

The 4th inward magenta circle (113.262373 feet radius) extends to a line running between posts 5 and 50 of the Aubrey Circle. This renders 1/4th the height value of the Great Pyramid (453.049492 feet true or 168 Megalithic Yards). This circle can also be interpreted to mean 113.4 feet radius and relate, in a dynamic, way to a major lunar cycle code.

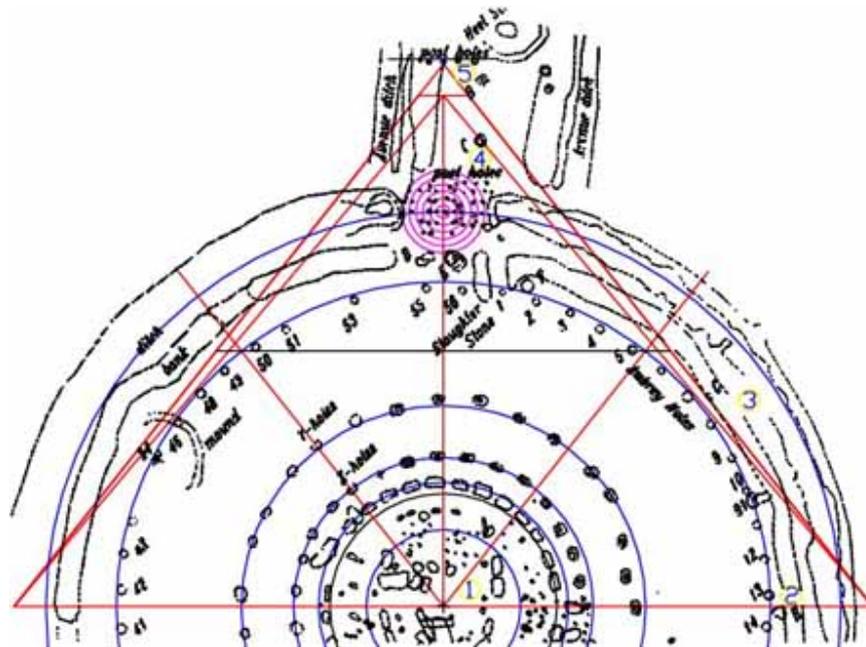


Figure 12: The Great Pyramid's half ratio, two dimensional, flat plane geometry in the Stonehenge layout. Note the numbered positions to the right-hand side of the site:

- (1).** This designates site centre, which position is found by crossing lines between Stonehenge's 4 "Station Stones".
- (2).** A stone marker adjacent to but just outside the Aubrey Circle clearly designates the "pyramid" baseline at 135-degrees azimuth from site centre to the north-eastern edge of the stone. The stone itself carries the official designation of component "H" on the Stonehenge site plan. It would be interesting to find out if a marker, slightly beyond the ditch, once marked the intersection of pyramid baseline and diagonal side (hypotenuse).
- (3).** This region of the site seems to lend itself to indicating both the Great Pyramid's face angle and the height of the altar floor, in the way that lines relate to site contours or brush the Aubrey posts, then carry on to positions of the Avenue.
- (4).** The stone or post position, officially designated as "C", appears to mark the line from the pyramid's 135-degree azimuth base extremity to the altar top or altar path, with the Aubrey post 7's exterior providing an interim part of that line.
- (5).** The post at the end of the Avenue, which precisely marks the symbolic apex position of the 1/2 scale Great Pyramid on site. The side angle of this Great Pyramid, two-dimensional replica is 51.84-degrees.

It is quite obvious from post and stone positions, plus the diameter of the Stonehenge encasing circle, that the Great Pyramid provided the measurement inspiration for the creation of Stonehenge. There are too

many precise hits between adjacent, opposite and hypotenuse positions, of a perfectly 1/2 scaled Great Pyramid, to doubt Stonehenge's affiliation to the Great Pyramid's geometry.

51.84-DEGREES, 25,920 YEARS (PRECESSION) & THE SOLAR YEAR.

The Heel Stone provides the most extended known position of the Stonehenge site and its purpose has never, quite, been fully resolved. It is precisely located to indicate primary codes. Let's explore the probabilities:

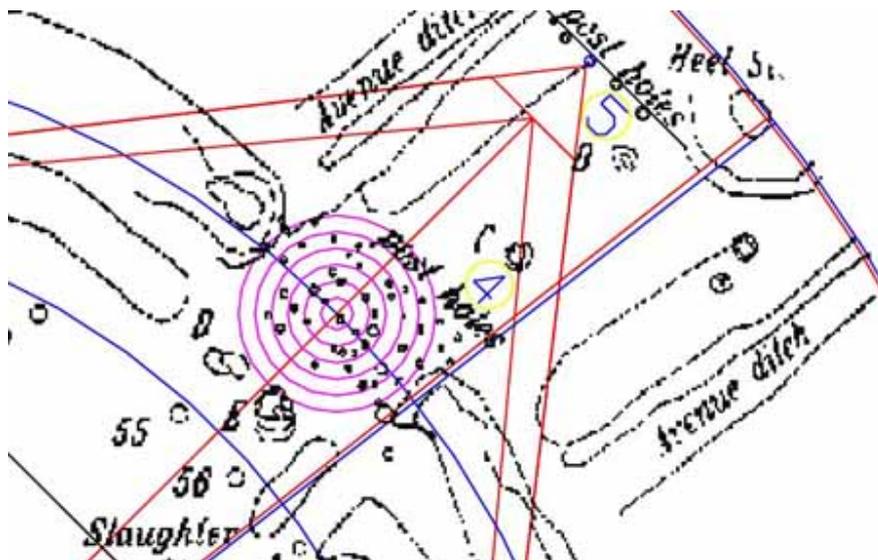


Figure 13: The Heel Stone is shown in the upper right-hand corner of this picture and its south-western side, as well as exterior face, allude very strongly to known, repetitive codes. It's difficult to know whether the Heel Stone has slumped marginally in the thousands of years since it was precisely erected and positioned, but indications are that its relative position is still excellent as a code bearing repository.

Two lines, one red and one blue, originating at the epicentre of Stonehenge, are seen to traverse and terminate on the Heel Stone. Simultaneously, two circles, one red and one blue, originating at the site's epicentre, brush positions of the outmost face of the Heel stone. Further inward on the Avenue, a post sitting adjacent to the Avenue set of circles (marked by post positions and coloured magenta) relates to the out-flowing lines that run from site centre to the Heel Stone. Here are the several codes indicated by the Heel Stone's position:

(1). The red line originating at site centre is at an azimuth angle of 51.84 degrees and extends for 259.2 feet. The 51.84-figure relates to the angle of the Great Pyramid. It is also 1/500th of 25,920, which was the number used by the ancient astronomer / mathematicians to describe the duration, in years, of the Precession of the Equinoxes.

(2). The red circle has a diameter of 518.4 feet and a radius value of 259.2 feet. Note how closely it relates to the extremity face of the Heel Stone. It's very probable that there was some tapering or

modification to the Heel stone, such that the 51.84-angle and the 259.20 feet distance occurred at a marked position of the Heel Stone.

(3) Whenever 259.20 was anciently present in a distance or length, it also inferred a 2nd coded value of 260. This occurred in the diagonal side length value of Silbury Hill (259.20 feet or 260 feet). It also occurred in the length value of the Stone of Destiny (the Stone of Scone), upon which Irish, then Scottish, then English Monarchs received their coronations over a period in excess of two thousand years. The carefully fashioned length of the Stone of Scone was designed to be slightly less than 26 inches (25.92"). The "26" number relates to the Sabbatical Calendar system and the duration of the Solar Year (52 weeks...26 X 2). The blue circle brushing the outer face of the Heel Stone has a diameter of 520 feet or a radius of 260 feet.

(4). The blue line extends 260 feet from site centre and brushes the south-western face of the Heel Stone. It has an azimuth angle of 52.17857143-degrees and this is 1/7th of 365.25 days...the duration of the true Solar year. Under the Sabbatical Calendar system, the passage of time was counted in increments of 7-days, 14-biweeks, 28-day months and 52-weeks annually, as well as 13-months per year or 26-weeks from equinox to equinox.

The most precise coded relationship, visually, would seem to relate to the 260 feet distance from site centre and the 52.17857143-azimuth angle (1/7th of 365.25). We can see, however, from the position of the post marker adjacent to the Avenue set of concentric resolving circles that the 259.20 feet code was equally important.

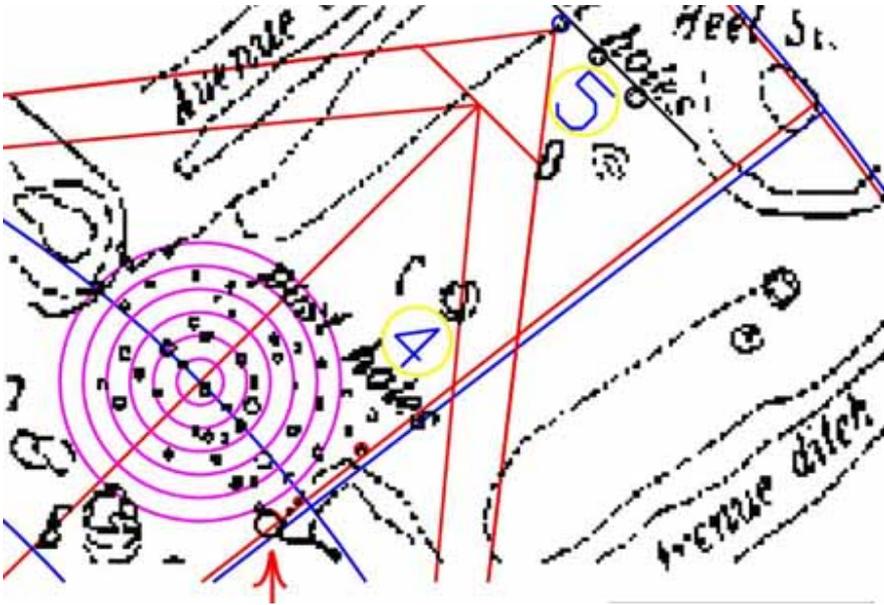


Figure 14: A red arrow points toward a significant post marker, sitting adjacent to the Avenue circles. The position of this post verifies the 52.17857143-degree angle (blue line) to the side of the Heel Stone and 3 further post markers indicate the 51.84-degree angle (red line). The large post marker's centre was coded to reside 169.2 feet from site centre or 90 feet back from the Heel Stone to provide a sought after ratio value...169.2 (90 = 2.88. This is the same ratio value that exists between the inner Sarsen Circle (100 feet) and the Aubrey Circle (288 feet)...1: 2.88.

MULTIPLE CIRCULAR & LINEAR CODES.

We will now begin to identify the purpose behind placing individual component stones and posts in the Avenue section of the site and extract anew the intended codes relative to positions. Features of the embankment or mounds, etc, mark some of the more inward codes. Let's return to the Heel Stone and work inward from that most extreme position.

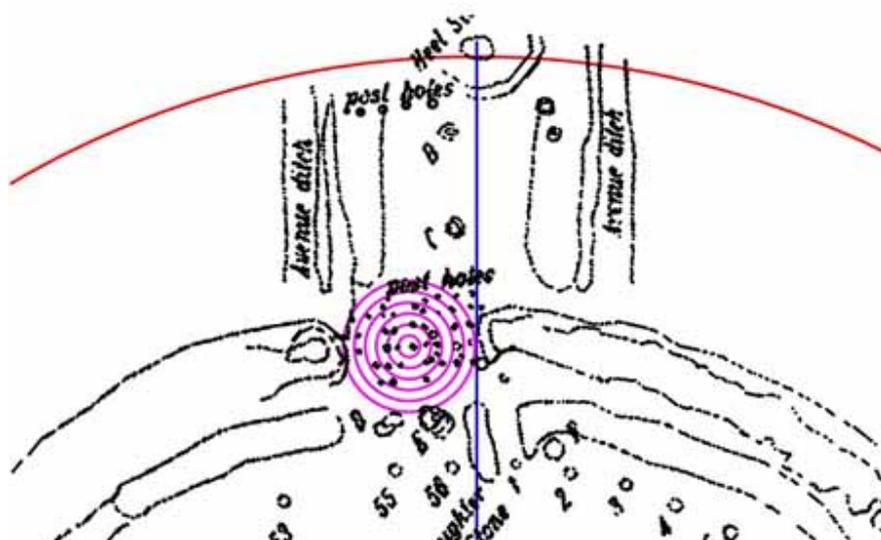


Figure 15: The likeliest code for the inner side of the Heel Stone relates to a circle (red) of 254.8403393 feet radius or 509.6806786 feet diameter. This circle diameter is exactly 189 Megalithic Yards of 32.360678 inches each. One quarter of the base length of the Great Pyramid of Egypt was 189 feet and the 3 main pyramid structures of the Giza Plateau are built within the confines of a "grid" with each grid square measuring 189 X 189 feet.

Also, this diameter (509.6806786 feet) carries a code for the side diagonal length (assuming a symbolic capstone and pointed apex) of the Great Pyramid in feet...in accordance with the PHI method for calculating that length.

There were two ways of calculating the side diagonal length of the Great Pyramid to the theoretical point where lines rising from each base-side, up the face, would converge and meet 27 feet above the Pyramid's flat altar floor. The first method was by trigonometry, using 1/2 the base length (378 feet) of the pyramid (adjacent) and a side angle of 51.84 degrees. This rendered a diagonal side length value of 611.7894615 feet.

Alternatively, the ancient mathematicians also coded this length to work to PHI...which meant 378 feet X 1.6180339 (PHI) = 611.6168142 feet (2 inches shorter than by the trig method) or 226.8 MY (which is 1/2 of 453.6... note the Pyramid's height in feet to the top of its altar floor was 453.6 feet under its sexagesimal assignment).

The inner face of the Heel stone, as shown, complies closely to a circle of 509.6806786 feet diameter. In inches this represents 6116.168142"...producing the same set of numbers (X 10) as the Great

Pyramid's PHI rendered length in feet (611.6168142 feet). Therefore, the ratio relationship between this Stonehenge diameter and the PHI generated diagonal side length of the (capstone included) Great Pyramid was 1 to 1.2.

THE LATITUDE OF STONEHENGE

In the foregoing picture a line (blue) originating at Stonehenge's centre, dissects the centre of the Heel stone. The azimuth angle of this line, off North, is 51.18333333-degrees, which equates to 51 degrees, 11 minutes. This is the official latitude designation for Stonehenge (51 deg. 11 minutes).

Note how the line relates to the Avenue set of circles (magenta) and brushes the northern side of the large post marker adjacent to the Avenue circles. A nearby line of posts extends toward the Heel Stone, as if to indicate this "latitude" line.

It is normal carpentry or surveying practice to have "sighting-lines" run to the "side" of pegs or posts, rather than to the centres, as far greater accuracy is achieved and the surveyor is able to visually verify the accuracy of the full alignment. When a line runs to the centre of a stone, the stone itself will generally have a peaked or pointed top to finitely indicate the refined intended position of the alignment.

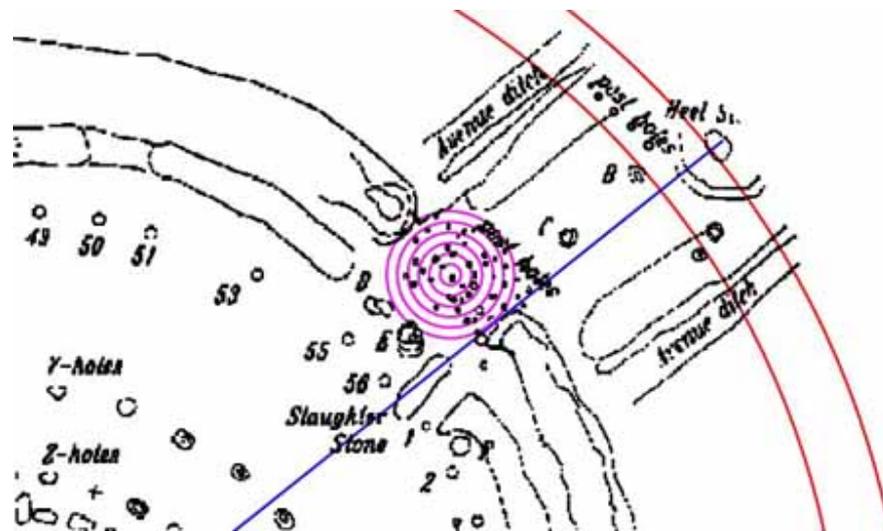


Figure 16: Another circle of immense importance, which links Stonehenge to the Lunar codes of the Khafre Pyramid of Egypt. It will be noted that this circle (2nd inward red) brushes two component positions on the Avenue, one of which has the official designation "B". The diameter of this circle is 472.5 feet, which is exactly the intended vertical height of the Khafre Pyramid of Egypt. The base measurement of Khafre was 15/16ths that of the Great Pyramid or 708.75 feet. It was also built to a 3,4,5 triangulation code, with 1/2 the base length acting as the adjacent (354.375 feet), the vertical height acting as the opposite (472.5 feet) and the diagonal face acting as the hypotenuse (590.625 feet).

Each of these values was in deference to the lunar month and lunar year (based upon 29.53125 days per lunar month or 345.375 days per lunar year).

The diameter of this Stonehenge circle is, therefore, coding the height of the Khafre Pyramid in increments of 16 X 29.53125-days/ feet. This value of 472.5 days was also integral to the ancient method of measuring the 18.613-year lunar nutation cycle, which was calibrated to endure for

6,804-days (230.4 lunar months of 29.53125-days or 14.4 time periods of 472.5-days duration). Note also that 230.4 is an expression of the very important ancient number 11.52.

For a full account related to the importance of this Stonehenge circle value, review the section dedicated to the Khafre Pyramid lunar codes.

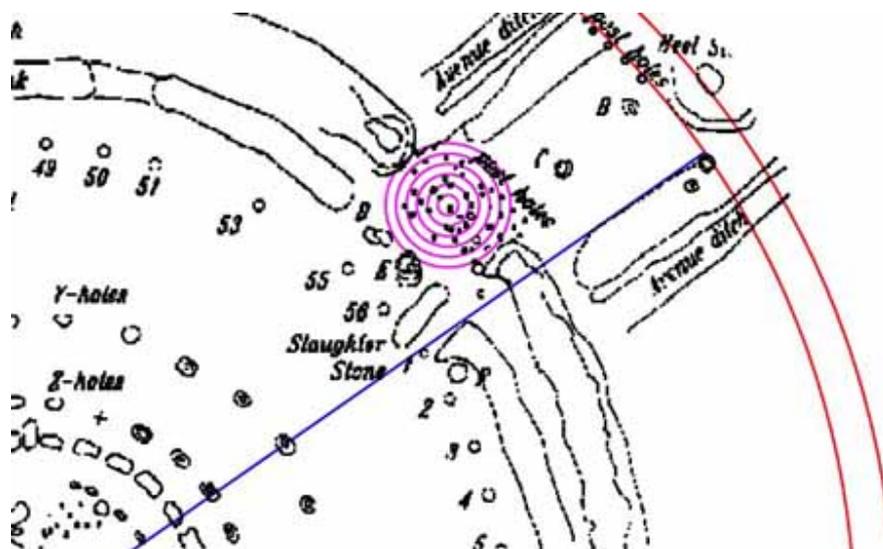


Figure 17: Another circle and angle vector, each containing dynamic codes. The blue line, originating at site centre, is on an azimuth angle of exactly 55-degrees. Note how it brushes the earth-works features adjacent to the Slaughter Stone and then the embankment line near the Avenue ditch. The 55-number was the basis of an 11-series of numbers used in navigation. The league, mile, furlong, chain, rod / perch, fathom and link were all included in this 11 and 55 series. The linear distance generated by these "11 and 55" increments would convert smoothly to a sexagesimal circumference, which would produce accurate degree angles toward point of departure or plotted destination.

The circle (red) has a radius of 243 feet (486 feet diameter). There were 243 X 28-days (Sabbatical Months) in the ancient 6,804-day lunar nutation cycle (18.613-years). This radius or diameter number also ties Stonehenge to the Khafre Pyramid's lunar codes, as Khafre coded the 6,804-day nutation cycle into its base perimeter (34,020 inches...68,040 (2). Each 5" of Khafre's base would have inferred 1 day in the 18.613-year lunar cycle.

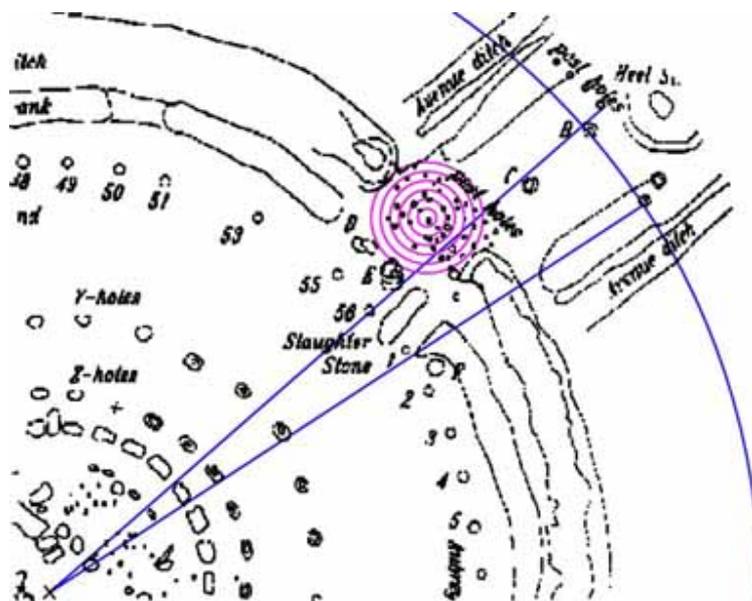


Figure 18: This picture shows a blue circle and two vectors, originating at site centre, which brush and resolve onto Avenue component positions. The blue circle is a PHI circle (466 feet diameter...a PHI ratio increase on the diameter of the Aubrey Circle)..

The two vectors comply to degree angles of 48.6 and 56.7-degrees respectively. The 48.6-degree vector resolves to the edge of an earlier shown circle of 486 feet diameter. This number is an important "lunar" value encrypted into the Khafre Pyramid. The period of 486 days was 1/14th (septimal) of the assigned calibration (6,804-days) used anciently to describe the 18.613 lunar nutation cycle. This angle (48.6-degrees) appears to align onto the "first glint" position of the summer sunrise (as seen on the north-eastern horizon, which was .6 of a degree higher than Stonehenge). The evidence would suggest that this chosen "first glint" position of the summer solstice sun was the "benchmark" surveying position upon which the site layout was conceived. The "station stones" positions appear to be mathematically configured by and locked onto a 48.6-degrees azimuth...90 degrees opposed. This will be discussed at length as we proceed.

The 56.7-degree vector was also used as a part of the numerical method for lunar determinations. It is 1/120th (sexagesimal) of the 6804-day (18.613-year) lunar cycle. The time-span of 5,670 days was the ancient calibration for 16 lunar years (@ 354.375 days per lunar year). The half value for 5,670 is 2,835 and the Khafre Pyramid (Egypt's pyramid of the moon) had a base perimeter value of 2,835 feet (708.75 feet X 4). The coding of 56.7 feet (doubled out to 113.4 feet) will arise again in a dynamic way between the "station stones" of Stonehenge (to be discussed shortly). Note also that 56.7 feet is exactly 1/8th of the height of the Great Pyramid, under its sexagesimal assignment (453.6 feet).

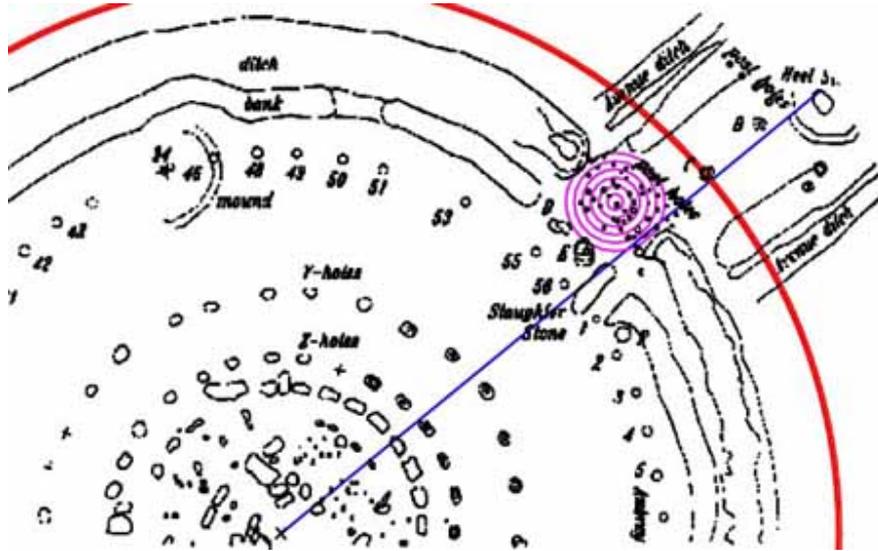


Figure 19: The blue vector, originating at site centre, brushes a series of posts of the Avenue "post holes" circle. It then brushes the side of a central Avenue component designated "C" before resolving onto a position at or very near to the NNE side of the Heel Stone. This vector is set to an azimuth angle of 50.4-degrees, which is an extremely important number found upon the Great Pyramid of Egypt. Trigonometry would dictate that the "flat floor" altar atop the Great Pyramid have a side length of 44-feet. Reducing PHI values from the base of the Great Pyramid would dictate that the altar worked, in part, to a value of 42-feet, which is 504 inches. The sexagesimal size of the Earth @ 3,024 (the Great Pyramid's base perimeter value and 1/2 a minute of arc) X 43,200 (a derivative of the Sun's radius value in miles) = the sexagesimal system's Earth size value of 130,636,800 feet. This number, when divided by 504 renders an expression of the Precession of the Equinoxes value of 259,200. The Precession of the Equinoxes cycle endured for 25,920 years.

The thickened red circle is, in fact, 4 close-proximity circles in one. These 4-circles are representative of the 4 main geodetic systems, used for world-wide navigation in ancient times and component "C" was set, specifically, in that position to code the 4 systems. It is assumed that the original component would have had slightly increased, incised marks (calibrations) across the top surface to indicate the diameter limits of each, marginally different, geodetic circle.

The centre of component "C" complies to a measurement of 207.36 feet from the centre of Stonehenge and this measurement was intended to convey THE EXACT SIZE OF THE EARTH'S EQUATORIAL CIRCUMFERENCE. Let's review how this radius value coded the size of the Earth:

1. The Great Pyramid's builders wished to encode 3 primary geodetic systems, as well as a 4th very accurate rendition of the Earth's size, into the assigned or true height value of the pyramid. The actual height was set to a PHI value of 168 Megalithic Yards or 453.049492 feet. This figure provided the basis for calculating the Earth's circumference according to a PHI geodetic system. The PHI system itself appears to be a little cumbersome, as well as the least accurate of the 3 systems for describing the Earth's true size. It's plausible to assume that the PHI method would not have been used, to any great extent, for ocean traversal and general navigation. The formula used

was: $453.049492 \times 22 \text{ (1/2 the altar length)} = 20.59315873 \times 1200 = 24,711.79047$ (read as miles). This was a shortfall on the ancient, refined equatorial size of the Earth by .006936346%. The system allowed for mathematical progressions, based upon Megalithic Yard and other PHI values, to calibrate the "ring of the Earth". Some Egyptian "Royal Cubit" rods would have been fashioned, as close as possible, to 20.59315873 inches for mnemonic reference to the "PHI rendered" size of the Earth. It is assumed that an incised calibration mark on component "C" at Stonehenge, would have been 205.9315872 feet from site centre or 2471.179047 inches (interpreted as meaning 24,711.79047 miles, 130478253.7 feet or 48,384,000 Megalithic Yards. The Megalithic Yard value for the Earth's size is also the PHI height of the Pyramid (168MY) X 288,000.

2. A 2nd incised calibration on component "C" at Stonehenge would have marked the distance of 206.1818182 feet from site centre (2474.181818 inches). This was derived from a symbolic, sexagesimal height assignment for the Great Pyramid, set to 453.6 feet. The formula for determining this height is found by applying a 3,4,5 triangulation principle to the pyramid's true base length...756 feet ($1.666666 = 453.6$. In 3,4,5 triangulation the "adjacent" is always 1.666666 less than the "hypotenuse". The Great Pyramid height set to $453.6 \text{ feet} \div 22 \text{ (1/2 the length of the altar)} = 20.61818182 \times 1200 = 24,741.81818$ (read as miles). This system reduced beautifully into degrees (362,880 feet...the Great Pyramid's base perimeter value was 36,288 inches); minutes of arc (6,804 feet...the Great Pyramid's base perimeter value was 3,024 feet or 1/2 of 6804); seconds of arc (100.8 feet...the diameter of the inner Sarsen Circle at Stonehenge was set to 100.8 feet, through one sectional cross-measure, to encode 1 second of arc under the versatile sexagesimal geodetic system). Note also that an Egyptian Royal Cubit rod, at the Turin Museum, has a length of 20.618 inches... for mnemonic reference to the sexagesimal size of the Earth. This system would have been very popular for grid referencing the Earth into degrees, minutes and seconds of arc. It was, however, probably not the "most utilised" system of navigation by ancient mariners and explorers. Under this system there was a shortfall on the ancient, refined equatorial size of the Earth of .005714286%.

3. A 3rd incised calibration on component "C" at Stonehenge would have marked a distance of 206.25 feet (2475 inches) from site centre. This was based upon a symbolic height assignment for the Great Pyramid, set to 453.75 feet, which was part of an "11 series" geodetic system. Out of this system the British measurements of the league, mile, furlong, chain, rod / perch, fathom and link were derived...at a very early epoch when Indo-European peoples lived in the environs of Egypt. Under the 3, 4, 5 triangulation rule, a 453.75 feet "adjacent" would mean a 756.25 "hypotenuse". The Great Pyramid, under its "11 series" geodetic system was assigned a base perimeter value of 3,025 feet (756.25×4). Therefore, $453.75 \text{ feet} \div 22 \text{ (1/2 the altar length)} = 20.625 \times 1200 = 24,750$ (read as miles). This value was also 7,920 leagues (@ 3.125 miles per league). The true diameter of the Earth is very slightly in excess of 7,920 miles. Mariners could have navigated fluently using a world grid set to leagues and this marvellously conceived system would have been the most popular for world exploration and trading. Under this system the shortfall, on the ancient, refined equatorial size of the Earth, was .005381818%.

4. The centre of component "C", as stated, is 207.36 feet from Stonehenge's centre and this value X 120 = 24,883.2 (read as miles). If this circumference value, in miles, is divided by PI (3.1416) we have: $24883.2 \div 3.1416 = 7,920.550038$ miles for the Earth's diameter under the ancient refined coding. This is a mere 6.126 miles short of the modern-day, official, equatorial diameter of the Earth, which is a shortfall on the modern circumference calculation (24,902.44532 miles) of only

.000773426%. The 24,883.2-mile system reduced well in degrees, minutes and seconds, rendering 69.12 miles per degree of arc. The half value of 69.12 is 34.56. Remember that the outer rim of the Sarsen Circle at Stonehenge was 345.6 feet. A minute of arc under this system was 1.152 miles (the dynamic 1152 code) and a second of arc was .0192 miles. This author assumes that certain, slightly elongated, Egyptian Royal Cubit rods will prove to be 20.736 inches (1.728 feet) and were used for mnemonic reference to the ancient refined value for the Earth's equatorial circumference.

It seems unlikely that the 4th system was much more than an exacting value for the Earth's true size. It could be used for making slight adjustments (refinements) when working in the 3 primary geodetic systems. The ancient mathematicians, undoubtedly, knew that the polar circumference (24,816.55084 miles) was somewhat shorter than the equatorial circumference. The average, true circumference of the Earth (equatorial and polar combined) is 24,859.49808 miles, which means that the ancient figure is only 23.7019207 miles in excess of the average or 19.2453185 miles less than the true equatorial circumference.

There is no doubt that the repetitive numerical values found from the Giza Plateau of Egypt to Britain and onward to the South Pacific, clearly express this knowledge of the "refined" size of the Earth. To have been in possession of such knowledge demonstrates a very high degree of scientific achievement, by the pyramid builders of Egypt and their latter progeny who built Stonehenge.

To have designed mathematical progression systems, based upon the true size of the Earth, which reduced so coherently into small workable increments, shows brilliant innovative thinking by individuals who can only be described as mathematical geniuses.

THE AVENUE CALIBRATION CIRCLE.

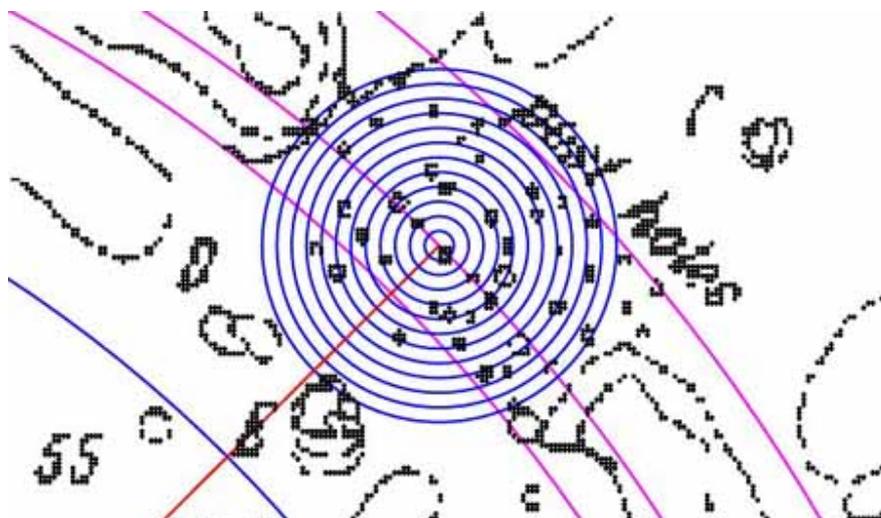


Figure 20: Arrays of former posts dotted this region of the Avenue and were intended as markers for:

- (a). The flaring of degree angle lines, which originate at site centre, by 1/2 degree increases.
- (b). Marking the radius limits of specifically sized circles, which code lunar, geodetic or other important numbers.
- (c). Creating azimuth vectors from site centre, which carry codes in their degree angle reading.

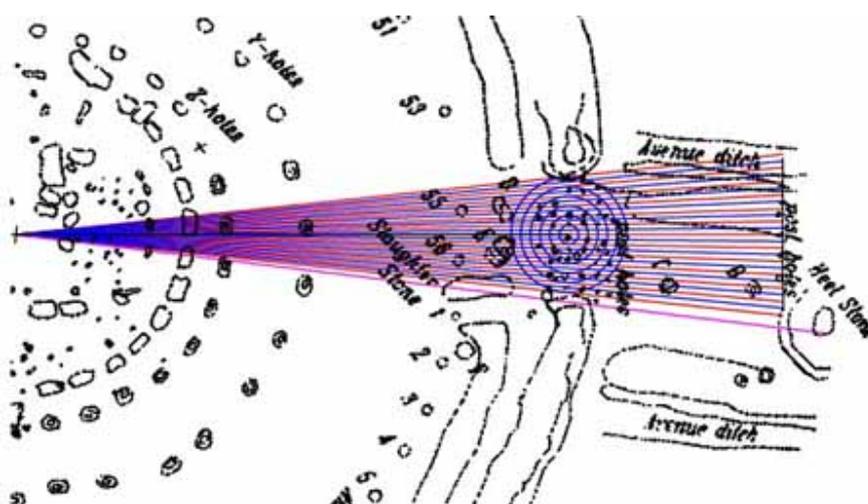


Figure 21: The special calibration circles on the Avenue, flaring lines by 1/2 a degree. Note also that the "circles" represent the "orb" and the configuration of the adjacent embankment (top)

represents the head of the snake, with mouth ajar to swallow the "orb". This symbolism is found from Continental Europe to North America.

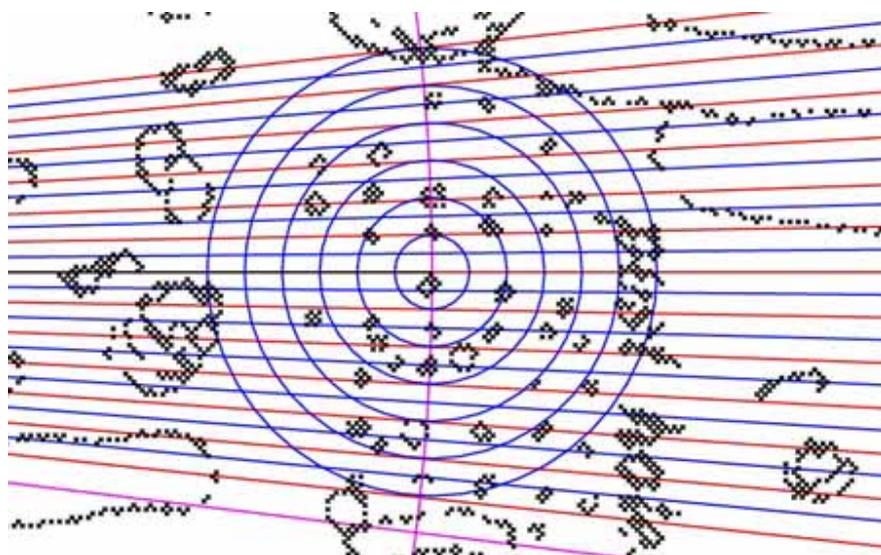


Figure 22: A close-up of the Avenue set of circles. Note how the post-positions demonstrate both lines that flare by 1/2 a degree and circles increasing by 1/2 of a degree (1-degree circle increases shown herein). A magenta circle line, running through the centre of these small calibration circles on the Avenue, has a diameter of 350 feet. The centre of this small set of Avenue calibration circles was the resolving position for making "Precession of the Equinoxes" calculations.

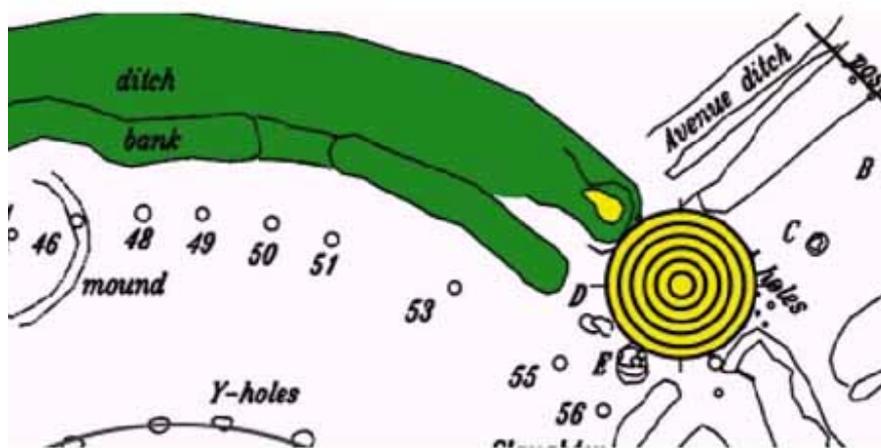




Figure 23: The snake and the orb or egg symbolism displayed on two separate continents. The upper picture is Stonehenge, whereas the lower picture is "Serpent Mound" in Adam's County, Ohio USA. Despite numerous similarities in building styles, symbolism, artefacts, writing, etc., die-hard isolationist archaeologists and historians of the United States continue to deny the possibility of ancient migration and diffusion of culture to North America from Europe and the Mediterranean. The same schools of "isolationists" dominate "allowable" New Zealand and Pacific archaeological or historical interpretation. Such obstructive individuals have held back "scholastic endeavour" for years, world-wide, by cleaving tenaciously to long-obsolete concepts, which they'll never relinquish. Photo courtesy of, *The Worlds Most Mysterious Places*, Reader's Digest.

FURTHER CODES OF THE AVENUE CALIBRATION CIRCLES.

It has been shown that the Avenue set of small calibration circles, flare a number of out-running lines, originating at site centre, by $1/2$ a degree increases. The centre post of the small set of calibration circles resides at an azimuth angle of 45-degrees and 175 feet from the centre of Stonehenge. The post positions of the small, Avenue calibration circles also comply to curved perimeter lines that follow the edges of larger, coded diameter circles expanding out from site centre. Let's look at a series of these and identify the intended codes.

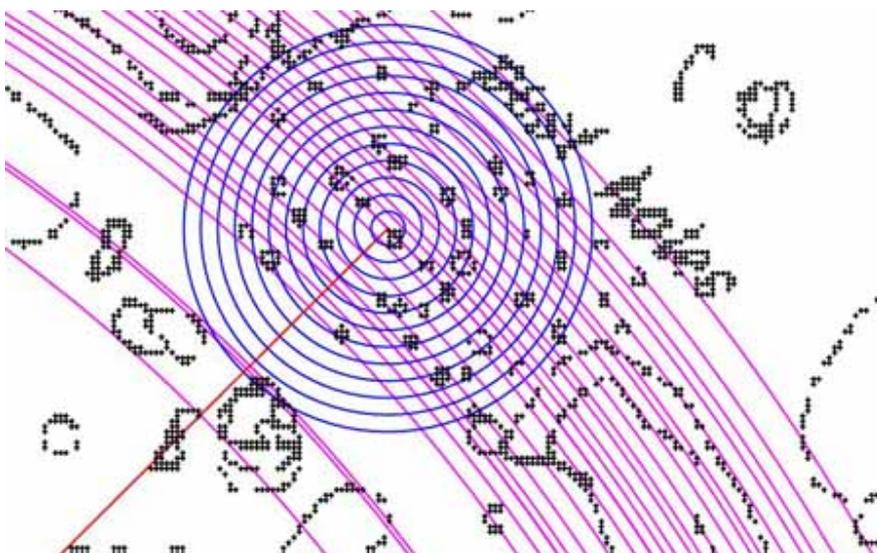


Figure 24: A series of circles, marked by arcs of posts or the edge limits of the Avenue calibration circles, preserve in memory a sampling of the most important numbers and mathematical progressions of antiquity. Here are some, which appear to have been encrypted:

- (1) 192 feet...important sexagesimal progression, which provides a drove of Pyramid numbers.
- (2) 189 feet...1/4th of the base length of the Great Pyramid and the size of the grid squares of the Giza Plateau. There was copious usage of this number anciently, including as an incremental value to describe the duration of the 18.613-year lunar nutation cycle (calibrated to $6,804\text{-days} \div 189 = 36$ lunar periods of 189-days). Equally, 16 lunar years, calibrated under their system to endure for $5,670\text{-days} \div 189 = 30$ lunar periods of 189-days.
- (3) 187.5 feet...a very important septimal / decimal progression, which provided important azimuth angle and navigational numbers, including many applicable to the "11 series" (league & furlong) geodetic system.
- (4) 18.66666 feet...1/3rd of 56 and used in progressions of 7 and 8. Also functional within "weights and cubic measures" numbers like 2,240. The 56 series was of extreme importance to Sabbatical calendar and lunar calendar day counts and computations.
- (5) 183.33333 feet...this is 1/3rd of 550 feet, which was highly important to the "11 series" geodetic, navigational system.
- (6) 182.625...used to describe the number of days between equinoxes.
- (7) 181.44...a Great Pyramid number and expressing 362.88 feet in the full diameter of this Stonehenge circle. The Great Pyramid was 36,288 inches in its base perimeter value under its sexagesimal assignment. The length of 36,288 feet represented 1-degree of arc for the "ring of the Earth" under the sexagesimal geodetic system.
- (8) 180 feet...everything from degree angles to increments within the "Precession of the Equinoxes" calibration.
- (9) 178.5...or 357 feet for the full diameter. The Menkaure Pyramid was assigned a base length value of 357 feet when computations of the Sabbatical Calendar system were being applied. This referred to 357-days (12.75 months of 28-days each). A similar system was used on the Aubrey Circle, using the 56 posts as counting positions, to an accuracy of 3.408 hours in 49-years. The manual count system allowed ancient society to enter into their Jubilee Year (50th) with everything fully corrected and running true to the solar cycle.
- (10) 178 feet or more literally, 177.9937985 feet...the diameter of "Y" Holes and 1/2 the base length of the Menkaure Pyramid under its PHI assignment. This Stonehenge circle's full diameter would, therefore, be in deference to Menkaure Pyramid.
- (11) There appears to be an expression of 176 feet, which would refer to the "mile" related measurement and progression.

(12) There is a 175 feet radius circle, inasmuch as the small, Avenue set of circles are centred on a position 175 feet out and at an azimuth angle of 45-degrees from the centre of Stonehenge.

(13) 170.1 feet...this is an important increment in the lunar determinations for both the 18.613-year (6,804-day) nutation cycle, as well as the 16-lunar year (5670-day) calibration.

(14) 168.75 feet...another value useful to lunar computations.

(15) 168 feet...this is one of the most important circles of Stonehenge, which designates the crown of the embankment and was used extensively for 3, 4, 5 triangulation onto the alighting or ascending positions of stars. The merits of this circle will be explored in depth as we proceed.

(16) 166.66666 feet...clearly marked and a very important number in 3, 4, 5 triangulation, where the "adjacent" is 1.666666 less than the "hypotenuse".

(17) 165 feet...this measurement is the basis of the rod and perch measurement (16.5 feet), as well as the league (16,500 feet). This radius at Stonehenge is also 30 fathoms. Alternatively, 165 feet X 4 = 1 furlong. It is also 1/32nd of a mile.

We will now explore the codes found within circle diameters, as well as azimuth angles onto components, inward from the Avenue set of small calibration circles.

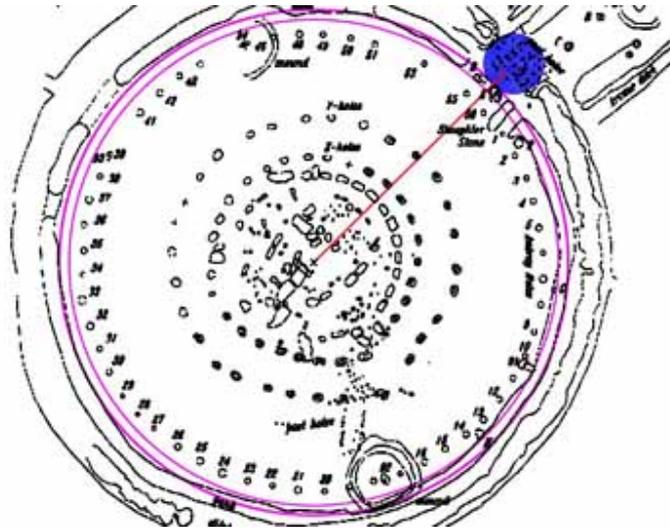


Figure 25: The larger of the magenta circles shown is exactly 314.16 feet in diameter and was intended to code PI (3.1416). Note how it coincides well with the earthwork, inner edge of the embankment. The "PI" circle is also marked by 3 stone components, 2 of which reside at the Avenue entrance and another near the equinox rise line to the east of the site. The 2nd circle has a radius of 151.2 feet and this is a Great Pyramid value. The diameter of this circle is 302.4 feet and the Great Pyramid was 3,024 feet in perimeter around its base under its literal, sexagesimal length assignment. This Stonehenge 302.4 feet diameter circle is also clearly marked by both earthworks and stone components on the eastern side of the site. It is further marked at the Avenue entrance by components there.

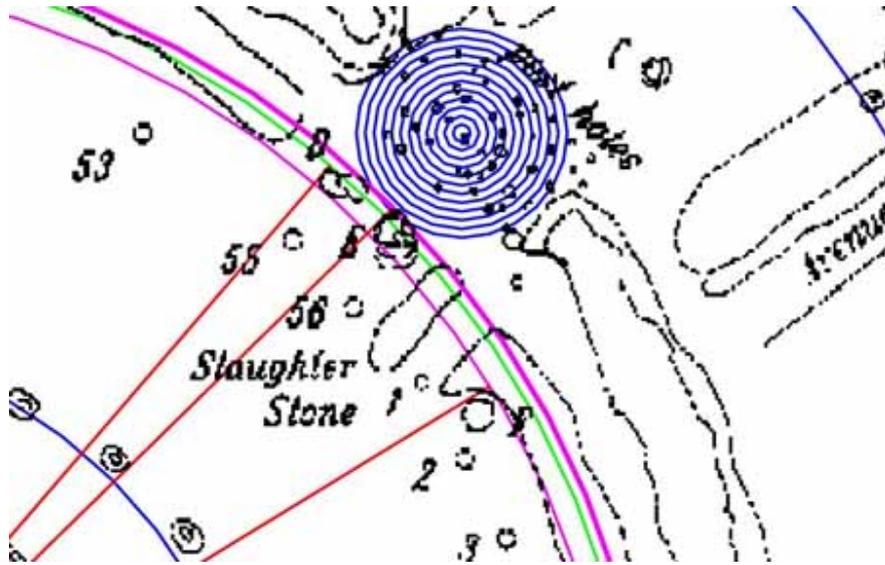


Figure 26: Three vectors (red) are shown to align onto component stones of the Avenue. Their azimuth angles are 40.5, 45.3049492 and 58.3333333-degrees respectively. The 40.5-degree vector codes a lunar progression and produces many of the main numbers used in lunar cycle calculations. This vector resolves upon a position to the northern side of an Avenue component, at a distance of 57.6 Megalithic Yards from site centre. The 2nd vector, on an azimuth angle of 45.3049492, codes the PHI height of the Great Pyramid (168 MY or 453.049492 feet). It also resolves upon the 57.6 MY circle or the one related to PI, set 157.08 feet from site centre. The PI circle brushes the outer face of the same marker stone. A 3rd vector is set to an azimuth angle of 58.3333333-degrees. This strange value occurs from Egypt to Britain. The angle of the Great Pyramid @ 51.84-degrees X 58.3333333 = 3,024 (the perimeter value of the Great Pyramid...3,024 feet). The 58.3333333-degree vector resolves to a circle of 151.2 feet radius. This means the diameter of the circle was 302.4 feet, in homage to the base dimensions of the Great Pyramid.

Note also that the circle being interpreted to relate to 314.16 feet diameter (PI...3.1416), would also have related to 315 feet in a simultaneous dual coding.

THE COMPLEX and DYNAMIC CODES of the STATION STONES.

At the very heart of Stonehenge's geometry are four marked positions called the "station stones". There was, anciently, yet another position, long since eradicated, slightly to the north of the Heel Stone, which seems to have been directly related to the 4 station stones.

There have been several theories about the purpose of the station positions, but few effectively explore the surveying aligned geometry by which the stations were conceived and accurately placed. Indeed, it is out of an understanding of the intended geometry in the station positions that we can begin to fathom the minds of Stonehenge's architects, as well as the approach they took to laying out the observatory.

Let's unravel the tangled cobweb of "station stone" codes strand by strand and layer by layer:

The first thing we have to discuss is the "orientation" of Stonehenge and the seemingly strange angle, off North, at which the station stones rectangle reposes. Why does the rectangle lie on that angle, with the 4 stations at or near 342, 296, 162 and 115-degrees respectively?

Also the midsummer sunrise appears to be at 90-degrees to the line running from the mound station (stone number 94) at 342-degrees, to the station stone at or near 115-degrees (stone number 91)...is this significant?

Next, what do we know about these ancient astronomer / mathematicians...what kind of information did they value and wish to encode?

We now know the majority of the numbers that they used in the implementation of their art, so doesn't it make sense to sift through those number codes for clues related to the station positions?

We also know that the ancient "Masters of the Craft" were sticklers for tradition and followed known, universal systems that replicated usage of the selfsame numbers from generation to generation. "The knowledge" had to be religiously preserved and passed on untainted to progenitors. This would suggest that there not be any confusing innovation that deviated markedly from the norm and that all parts of standing stone circle sites remain easily decipherable throughout ensuing generations...based upon a standard set of numbers.

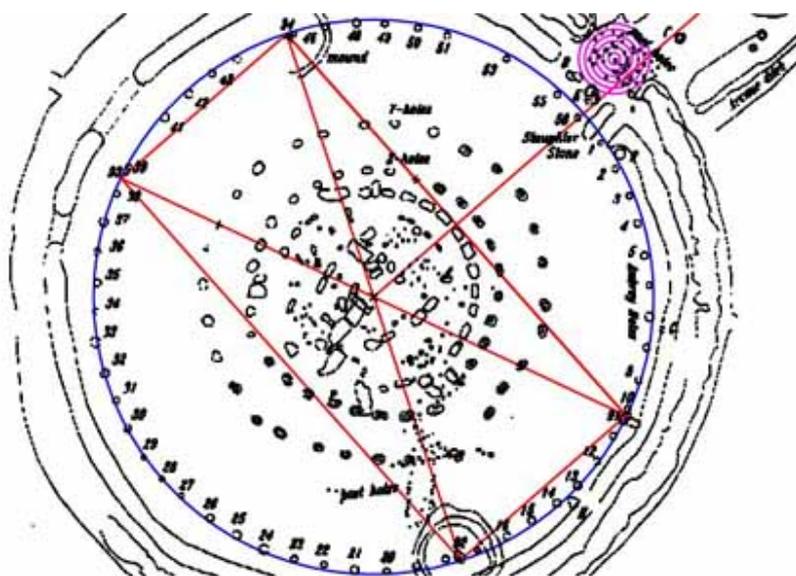


Figure 27: Knowing the traditional approach taken, coded numbers used and general modus operandi of the ancient astronomer / mathematicians, aids us in deciphering what they intended to convey via the "station stones" layout. There are many codes related to the station stones rectangle, its orientation, its dimensions and the geometry it supports, from the Sarsen Circle to the near vicinity of Heel Stone.

THE CODES OF POSITION.

(1). Stone 91 resides at 115-degrees azimuth, approximately. Given the width of the fallen stone, that degree angle falls into a range of azimuth between 114.8 to 116.8-degrees, with an average of around 115.8-degrees.

Two very important numbers spring to mind, which were dynamic codes. The first and foremost is 115.2, which in various volumes, ranging from 1,152 to 11,520 or greater, was incorporated into all major sites. It is logical to conclude that stone 91 included 115.2-degrees as the primary code in its intended azimuth reading. A second, lesser used, code relates to placing a 14-pointed star onto the Aubrey Circle, with one ray on east and another on west (equinox line). Such a star pattern perfectly fits into place at Stonehenge and was used for "Sabbatical Calendar" calculations. Station stone 91 relates to a ray of that star pattern, falling on 115.7142857-degrees azimuth.

(2). If we go 180-degrees opposed to the 115.2 - 115.7-degree position, then we are in the vicinity of stone 93. Technically, this should put the stone at 29.52 - 29.57-degrees, but the stone lies slightly north of that mark by about another degree. Of the 4 station stones, this one proves to cause a slight irregularity in the geometry of the station stone rectangle and one could easily surmise that it has been pushed or rolled to the north at some time in history. The distance between it and stone 94 could, however, have been deliberately "shortened up" to incorporate another code...a distance of 112 feet, instead of the expected 113.4 feet, looks plausible.

There are "checks and balances" in the station stones geometry, which would suggest that this stone should reside (centre) at 295.2-degrees but also represent 295.3125-degrees (to code the ancient number

for the lunar month...29.53125-days). It is tantalisingly close to where it should be, theoretically. We'll leave it for the moment, weigh up the totality of factors leading to an understanding of the "station stone" geometry and codes, then return to stone 93 later.

(3). Returning to the eastern side of the site, station stone 92 sits on a mound and complies nicely to 162-degrees. This is a very clear-cut and sensible code for "rounded PHI" or pure PHI (1.6180339). The ancient measurement system, in many sexagesimal applications, is resolvable by 162. The Great Pyramid base dimensions, when divided into 1.62 increments, provides the number sets upon which the British system of "weights" was devised. Number sets within the British standard measurements were founded on 162 as a base number and there was a second set of measurements based upon pure PHI, such as the Megalithic Yard (32.360678 inches true...1.6180339" X 20).

(4). Going 180-degrees opposed to the 162-degree position is station stone 94, which resides nicely on a mound at 342-degrees. But why 342-degrees...what merit does such a degree angle have as a surveying benchmark or locating position? Well, let's see...342-degrees is exactly 18 degrees short of true north (360-degrees). It's indicative of dividing a circle up into 20 parts, with station stone 92 (@ 162-degrees) representing the 9th increment and station stone 94 representing the 19th increment...but what's the relationship, in degrees of arc, between stone 94 (324-degrees) and stone 91 (115.2-degrees)?

(5). This is where it starts to get very interesting and where the genius of the ancient architects is revealed. The whole business of establishing a surveying line between 324-degrees and 115.2-degrees had to do with a 90-degrees opposed, central fix onto the rising sun, as it made its appearance on midsummer's day (summer solstice). Everything had to work to known numerical codes and here's the apparent formula:

(a). The degree of arc difference between 324-degrees & 115.2-degrees is 133.2-degrees.

(b). Half of 133.2-degrees is 66.6-degrees.

(c). The sun's point of rise, above the north-eastern horizon, was calculated to be 66.6 degrees around to the east of either stone 91 or stone 94. This places the sun's true calibrated azimuth angle, for time fix observation, at 48.6-degrees azimuth.

This should describe conditions at Stonehenge reasonably well, as the midsummer sun rises on a severe diagonal angle a couple of degrees north of the Heel Stone.

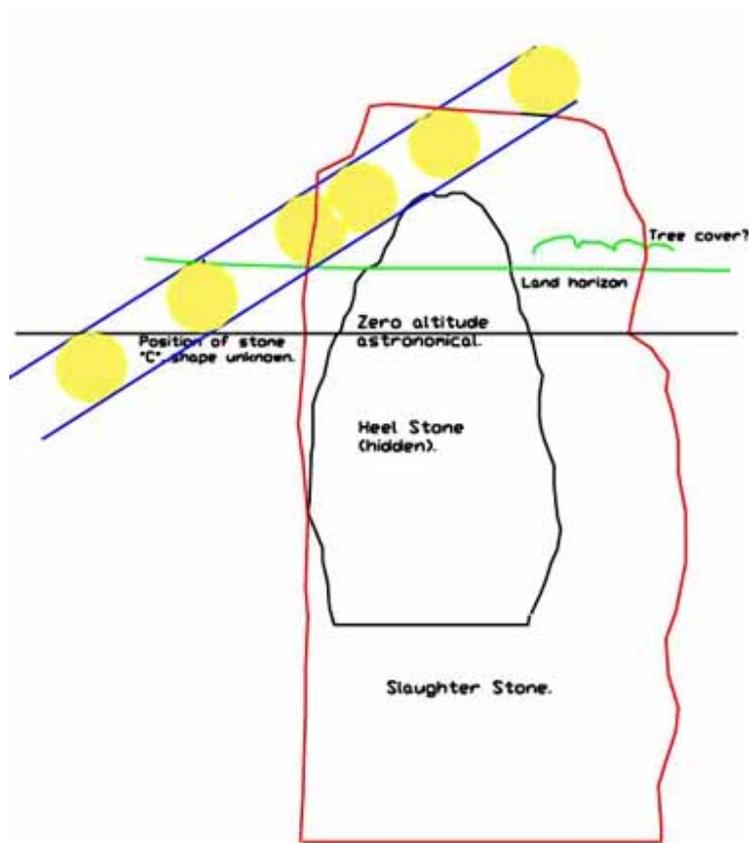


Figure 28: The summer solstice sunrise, as viewed at Stonehenge. Many authors are under the illusion that the event occurs over the Heel Stone. In fact the sun is quite elevated when it traverses the Heel Stone position and has already made its initial appearance a couple of degrees to the north. The above picture is based upon Prof. John North's depiction of the event at Stonehenge (see Fig. 183, pg. 467, Stonehenge, Neolithic Man And The Cosmos). The red outline shows how the Slaughter Stone, when standing, would have blocked the view to the Heel Stone, as observed from site centre.

It's of interest to note that there is a "missing stone" position (stone 97) that once sat to the left and beyond the Heel Stone. Perhaps its size and position once marked the true point of midsummer sunrise. Did it once comply with a 48.6-degree azimuth angle?



Figure 29: The picture shown depicts a summer solstice sunrise, as observed from Stonehenge in 2500BC. The dark foreground shown indicates where the sun would rise were the horizon level with the observer (like from a beach, looking toward the sea horizon). A red cross depicts the approximate level of the horizon as seen from Stonehenge, simultaneously to the azimuth angle of 48.6-degrees. The evidence would suggest that "first glint" from the sun's fiery corona was observable from very close to 48.6-degrees and that this was the most extreme northern azimuth angle from which "first glint" could be observed at Stonehenge. Prof. John North calculates first glint of the upper limb of the summer solstice sun (circa 2500BC) to break upon the Stonehenge horizon at 49.37-degrees...another .77-degrees further south of 48.6-degrees.

WHAT OTHER CODE BEARING EVIDENCE INDICATES 48.6-DEGREES AS THE SURVEYOR'S BENCHMARK AZIMUTH FOR THE ERECTION OF STONEHENGE?

Quite a lot actually! The process of finding 48.6-degrees off north is based upon the arc difference between 342-degrees and 115.2 (both excellent numbers) to attain a 3rd dynamic number...66.6-degrees...this being the mid-arc value.

It is this type of approach that ancient astronomer / mathematicians would have taken, such that marked, measurable positions could always provide a key for renewed decipherment of forgotten principles. From the pyramids to Stonehenge, the archaic structures themselves fulfilled the role of eternal teachers. Beyond war, plague and the disruptive, uncertain circumstances of mortality, the stone repositories of humanity's most cherished knowledge retained the ancient codes, safe and intact for future, enlightened generations.

There are several more codes in the pipeline, which support the choice of 48.6-degrees as the chosen benchmark / summer solstice azimuth. One compelling piece of evidence relates to the nature of 48.6 itself.

This is a strong lunar code, which might account for choosing it as an easily remembered surveying benchmark.

With the 18.613-year, nutation cycle of the moon using a calibration of 6,804-days to describe it, the sum of 48.6-days = 1/140th of the period. We know that this 18.613-year period endured for 243 months (of 28 days each) and 48.6 is 1/5th of 243.

THE STATION STONES GEOMETRIC CODES AND 48.6-DEGREE ORIENTATION.

This next phase of code extraction might prove to be a little ponderous and involved, as there is a lot of geometry to identify. Each linear or circular feature of the geometry is also coded to the "most used" values of antiquity. To begin:

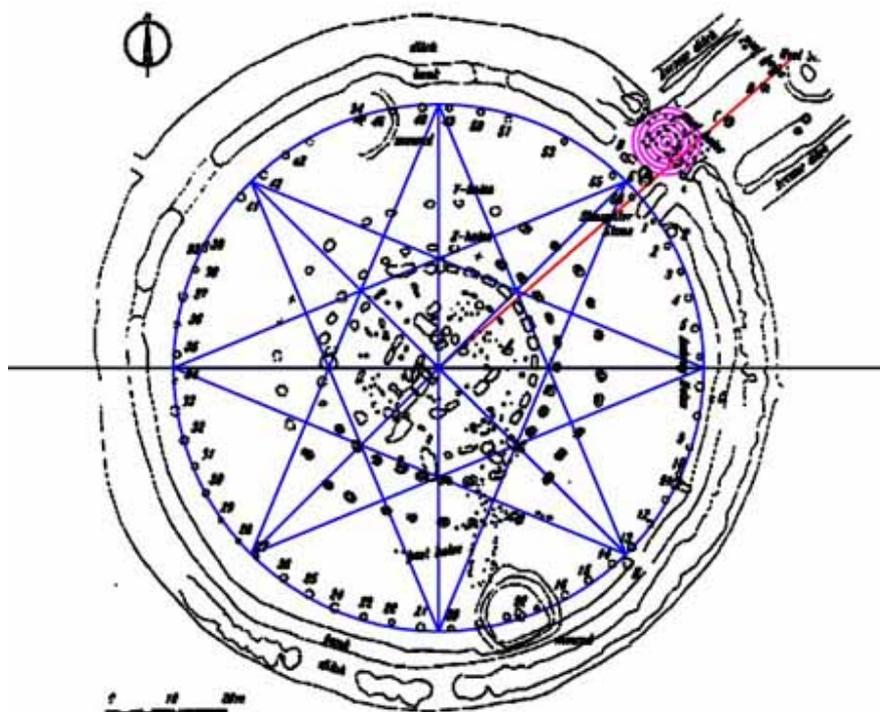


Figure 30: An 8-pointed star is placed upon the Stonehenge site with ray points extending to the Aubrey Circle (288 feet diameter). Ray-points reside upon the primary and secondary points of the compass. Simultaneously to this a fix is taken from site centre onto the "first glint", horizon position of the rising sun and it is determined that the dynamic code, 48.6-degrees can be used to very adequately describe this annual occurrence. The star geometry will now be adjusted to suit this close proximity midsummer sunrise vector, which involves rotating the star 26.1-degrees clockwise.

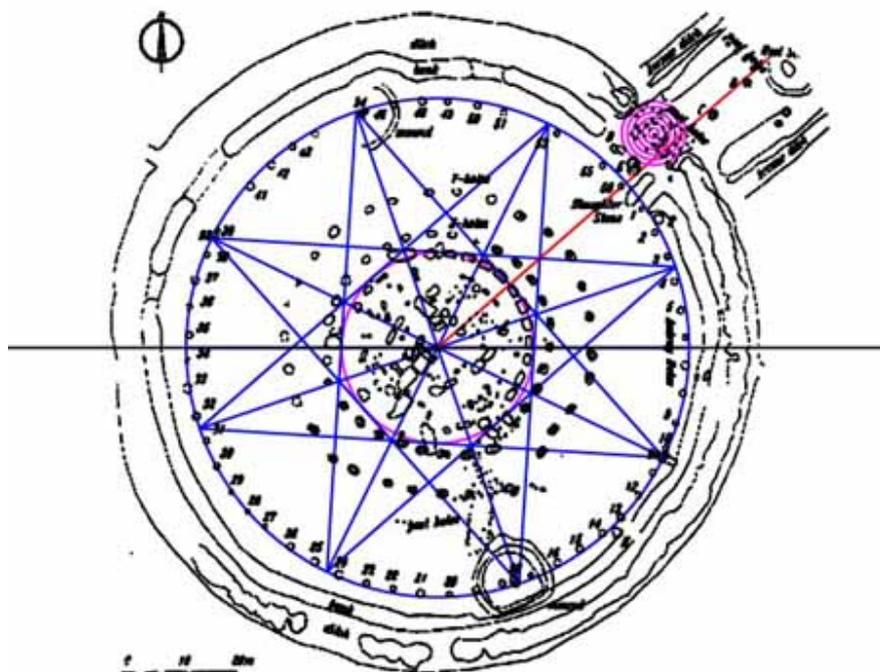


Figure 31: A centre section of the star, between ray points, now resides upon 48.6-degrees and this azimuth angle provides the viewing alignment to the summer solstice sunrise. Note how 4 ray-points of the star now fall onto or extremely close to the station stone positions. The central rectangle of the 8-pointed star, which falls to those positions, will be retained and then very marginally adjusted for the extraction of additional codes. Note also the central magenta circle, which is two PHI reductions of the Aubrey Circle (288 (PHI (PHI = 110.00 feet). This diameter describes what the PHI based, symbolic, coded outer diameter of the Sarsen Circle was, however the actual, physical Sarsen Circle structure was manipulated into an elliptical shape to build in additional codes. We will now discuss why this was done and the coded values that were being sought after.

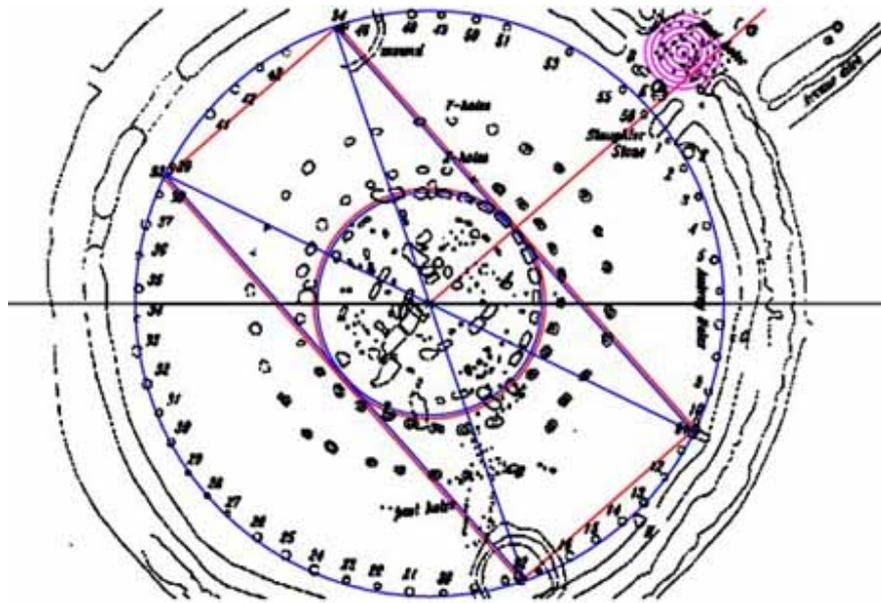


Figure 32: This is a very important picture, the significance of which leads to an understanding of the mathematical template, which formed both the station stone rectangle and the "elliptical" extremity positions of the Sarsen Circle. Consider the following carefully:

- (1). When an 8-pointed star pattern is placed perfectly within the confines of the Aubrey Circle, its centre square would, with only minor error, contain the Sarsen Circle...if the Sarsen Circle was configured to be a perfect circle. In such a case the Sarsen Circle's outer diameter would be 2 PHI reductions of the Aubrey Circle.**
- (2). The central rectangles of the 8-pointed star would measure 265.94 feet long X 110.2 feet wide, but the ancient astronomers decided to manipulate this slightly in order to include or extract two additional, very useful codes. The intended size of the station stones rectangle was 264 feet long and 113.4 feet wide.**
- (3). With this small adjustment to the 8-pointed stars central rectangle, the Sarsen circle was made elliptical, such that its outer limit, facing toward 45 - 48.6-degrees azimuth through 225 - 228.6-degrees azimuth, achieved 113.4 feet of diameter. Let's see how this truly relates to the existing ruins of the Sarsen Circle:**

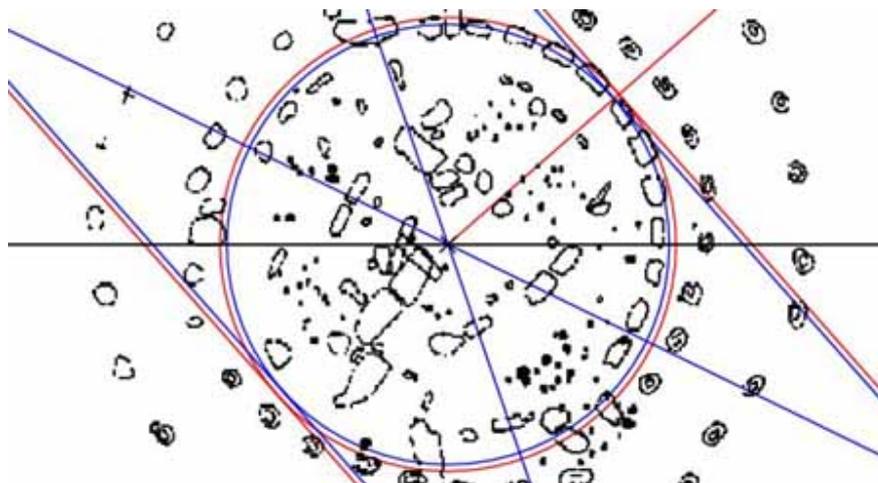


Figure 33: Although little symmetry remains of the present day Sarsen Circle at the 225 - 228.6-degree end (SW), the structure remains in measurable condition toward 45 - 48.6-degrees (NE). Two sets of vectors or circles are shown herein. The blue set relates to the dimensions achieved by internal geometry of an 8-pointed star placed within the confines of the Aubrey Circle. The red set is based upon a marginal adjustment of the central rectangle of the 8-pointed star. Note how the red circle, as well as the red rectangle's facing line brush the outer edge extremity of the Sarsen Circle at 45 - 48.6-degrees azimuth. This is the template that led to the creation of an elliptical Sarsen Circle, which was 113.4 feet in diameter through this azimuth angle. The question must therefore be asked...why was it necessary to code 113.4 feet on the main structure of Stonehenge?

CODES, CODES, CODES.

A number value, derived from a measurement onto the Sarsen Circle's most elliptically extreme fascia to at least one of the outer circles, converts to a dynamic mathematical progression in the distance achieved. Let's look at a sampling of relationships to do with the station positions:

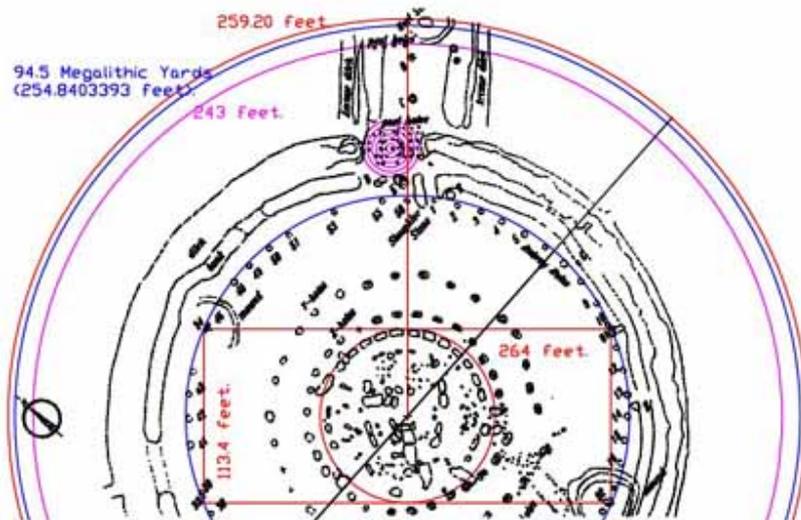


Figure 34: The length of the "station stones" rectangle is 264 feet and its width is 113.4 feet. Also shown is a circle, clearly marked by components, of 243 feet radius. Beyond that is another complying to 94.5 Megalithic Yards. Further out still is an extremity circle of 259.20 feet, which effectively sweeps the outer face of the Heel Stone. So what are some codes inferred in this sample?

- (1). The 264 feet diameter of the station stone's rectangle is 132 feet X 2 and we have already seen many coded expressions of 132 at Stonehenge or the Giza Plateau of Egypt. This number is integral to the geodetic systems, which set distances to miles. The two long sides of the station stone's rectangle, under this "perfect" representation, add up to 528 feet. The British standard mile, with origins in Egypt, was 5,280 feet.
- (2). The 113.4 feet of width in this "perfect" rendition of the station stone positions is a very dynamic lunar code. It was used for determining time periods in the 6,804 day lunar nutation cycle (60×113.4) or within the period of 16 lunar years, according to the Khafre Pyramid calibration...5,670 days (50×113.4). The half value of 113.4 is 56.7. The base perimeter of Khafre Pyramid was 2,835 feet...1/2 of 5670 feet.
- (3). The 243 radius circle is a part of the lunar coding, with 243 months of 28 days each representing the 18.613-year (6804 day) nutation cycle. The numbers 243 or 113.4 were, therefore, used as septimal or sexagesimal breakdowns of 6,804 days.
- (4). If the 113.4 feet were read or adjusted to a PHI value of 42 Megalithic Yards (113.262373 feet) then this would be 1/4th of the Great Pyramid's literal height. Alternatively, 113.4 is 1/4th of the Great Pyramid's height under its sexagesimal assignment. As shown, Great Pyramid coding is strongly represented in component positions around the Stonehenge site, like in the clearly marked 189 MY

diameter circle, which has an inch value of 6116.168142" (the Great Pyramid's PHI, face diagonal length, if it had a capstone, would have been 611.6168142 feet...226.8 MY...113.4 MY X 2).

(5). The distance from the face of the Sarsen Circle to the 48.6-degree rim of the 259.20 circle (brushing the Heel Stone) is 202.5 feet. This value is a lunar and rounded PHI, mathematical progression number, which produces numbers like 1,620, 2,430 and 4,860.

(6). A 16.2 value exists in the difference between the 259.2 feet radius circle and the 243 feet radius circle (16.2 feet), again accentuating this important "rounded PHI" code. Remember also that 162-degrees featured as one of the "station stones" azimuth angles.

(7). Although the geometric method shown appears, strongly, to have constituted the benchmark and surveying approach taken for the initial layout of Stonehenge, it's possible that station stone 93 was manually adjusted to be 112 feet from station stone 94. In this way it could be used for recall of the "weights" system, which used both 16 (ounces) and 14 (pounds). The weight of 112 pounds was a hundredweight (cwt) and there were 20 cwt in a ton (2,240 pounds). There were 22,400 "rounded" PHI inches (1.62") in the perimeter circuit of the Great Pyramid (36,288 inches)...a continuance of the Egyptian legacy, at Stonehenge, demonstrated yet again?

MAJOR & MINOR STANDSTILL OF THE MOON...RELATIVE TO THE STATION STONES.

Several authors have stated that the "station stones" positioning relates directly to major and minor standstill positions of the moon.

A comprehensive explanation of lunar movements will not be attempted here, as the moon follows a long, complex cycle that even reasonably adept astronomers have difficulty visualising and staying abreast of.

To partially explain major and minor standstill, let's quote author / astronomer John Edwin Wood...**'the moon swings each month from a maximum value of declination to a minimum value and back again...the amplitude of this oscillation will at some time be at its greatest, from about 29-degrees north of the celestial equator to 29-degrees south of the celestial equator...The time when the moon is swinging its farthest is called the major standstill, because the moon reaches about the same maximum height in the sky every month for something like three years. At the major standstill the moon's movements are at their most dramatic. Not only does it reach its highest possible elevation each month, but two weeks later it is very low in the sky, and barely rises in the high latitudes of the Shetland Islands.**

These movements would have been very conspicuous to early man.

Just over 9 years after the major standstill, the moon's orbit has completed a full half turn and the monthly oscillation in declination will be much smaller: from about 19-degrees north of the celestial equator to 19-degrees south...At this time the moon is said to be at minor standstill, because once more it reaches approximately the same height in the sky for months on end. From the observer's point of view its movements in the sky are far less dramatic than at the major standstill. Its maximum height in the sky is about 10-degrees lower at this time, and its minimum height is 10-

degrees higher, so it does not show such a wide swing in its monthly movement (see, *Sun Moon And Standing*, pgs. 68-69...also Figs. 4.7, 4.8 and 4.10).

We'll now try to demonstrate the effect of the moon's major to minor standstills (rises and sets) as they relate visually to what's observable around Stonehenge's horizon.



Figure 35: An alignment exists at Stonehenge, which would seem to indicate that the most northern point of observable "major standstill" rise of the moon was about 41-degrees. A set of posts mark an alignment at 40.5 degrees (to the left side of the posts), but one assumes a viewing corridor to "first glint" at the right of the posts (about 41-degrees). The white circle in the above picture indicates the moon close to observable rise (circa 2499BC) and a red cross near the top edge of the moon orb shows the horizon level, as seen from Stonehenge. The azimuth angle of 40.5-degrees contains a dynamic mathematical progression used for breakdowns of, primarily, the lunar numbers, 6,804 days and 5,670 days.

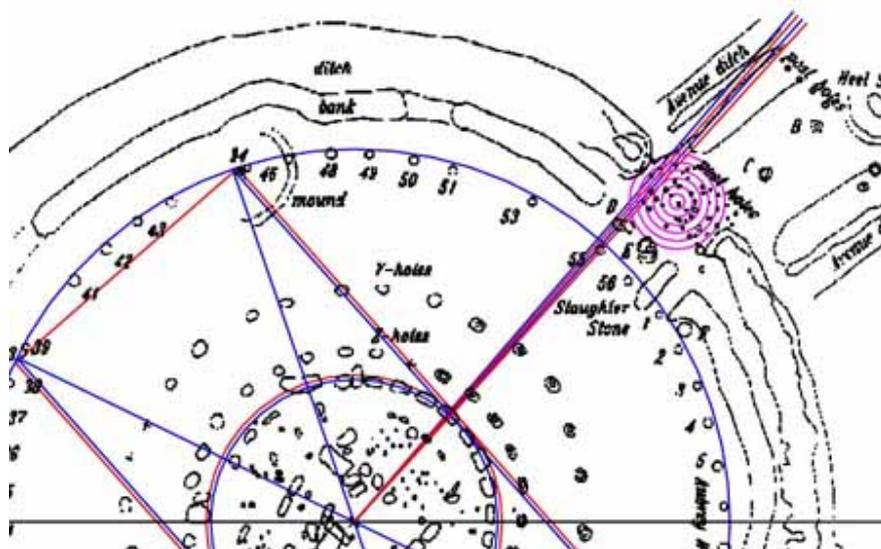


Figure 36: Ample scope existed in the Avenue post or circle calibrations to fix onto and track the northern-most rise position of the moon at major standstill. The top vector shown (blue) extends to the side of posts, set out along an azimuth of 40.5-degrees. Subsequent vectors clockwise increase in angle by 1/2 a degree, some falling to the side of post alignments or, in the case of full degree angle readings, to the edge-line of the concentric, Avenue calibration circles. All indicators would suggest that observing the northern major standstill rise position of the moon was of considerable importance to Stonehenge's astronomers.

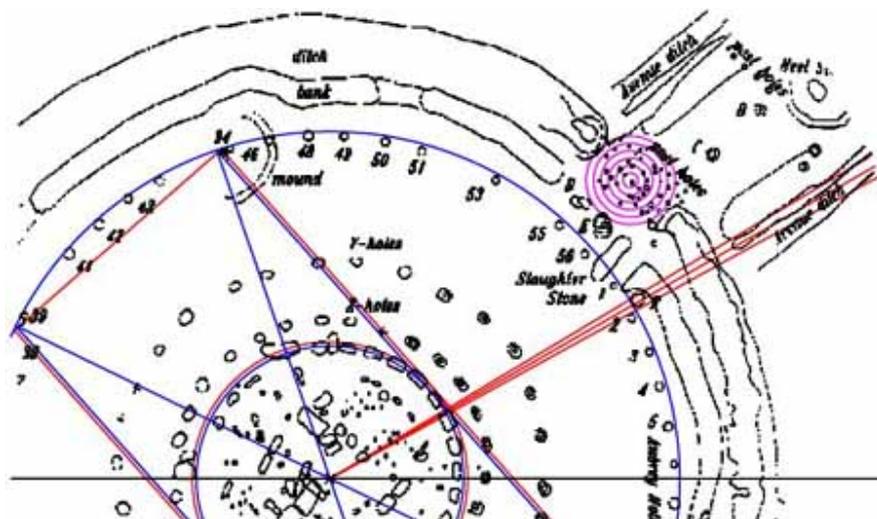


Figure 37: The 3 outrunning vectors (red) would converge upon the general position of the emerging and observable, northern minor standstill of the moon. The vectors shown run to 59, 60, and 61-degrees respectively. Given the slightly elevated, distant horizon beyond Stonehenge, the northern minor standstill was probably observed at about 60-degrees azimuth. This would seem to correspond to the Avenue ditch. A large alignment marker, adjacent to the Aubrey Circle, probably indicates the northern minor standstill of the moon to its right side.

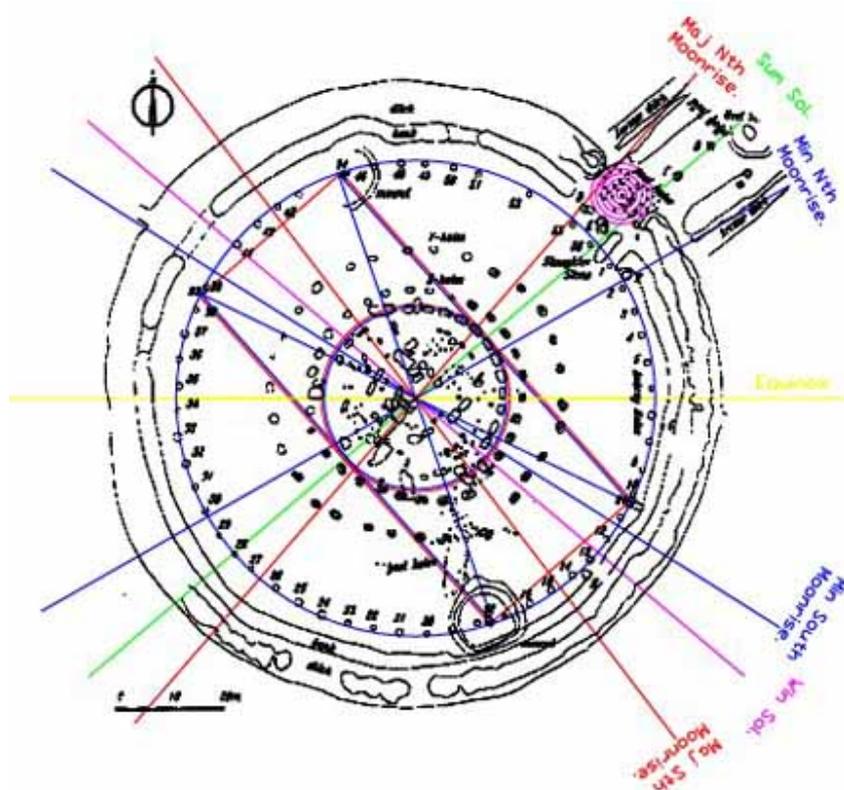


Figure 38: This picture should adequately describe the significant points of rise and set for both the sun and moon (circa 2500 BC). The labelled positions of rise are based upon calculated "first limb" appearances observable around the Stonehenge skyline horizon (see pgs. 570-572 of *Stonehenge, Neolithic Man & The Cosmos*, by Prof. John North). In his book, Prof. North gives the following readings on the height of the natural horizon: NE .6-degrees; E .65-degrees; SE .7-degrees; SW .6-degrees; W .45-degrees; NW .3-degrees.

Judging by the distribution of components or shaped features of the Stonehenge site, the positions of northern major standstill of the moon, summer solstice and northern minor standstill of the moon (Avenue region) were pre-eminent points of observation and clearly marked. The southern major and minor lunar positions and the winter solstice are, more conspicuously, marked at the points of set rather than rise, although one cannot discount the features of the southeastern natural horizon in providing distant "rise" outer markers for these events.

In summary, the station stones' positions work well in providing a corridor for southern major and minor lunar or winter solstice rises and sets. The survey benchmark azimuth, upon which the station stones rectangle is centred and 90-degrees opposed to, remains, most plausibly, 48.6-degrees. The northeastern side of the Heel Stone marks, with very good relative accuracy through many epochs, the mid-point between northern major and minor moonrise...(50.4-degrees).

THE 18.613 LUNAR NUTATION CYCLE & THE 5670-DAY (16 LUNAR YEAR) CALIBRATION

The four "station stones" were set out at Stonehenge to provide a corridor for the southern major / minor standstill positions of moon (rise and set). It was also situated 90-degrees opposed to the summer solstice, with the summer sun acting as the primary surveying benchmark for the station stones orientation. Working in conjunction with these marked positions were 56 posts on the Aubrey Circle, which acted as markers for counting, in days, the duration of both the 18.613 -year (solar years) nutation cycle of the moon, as well as 16 lunar years. The lunar nutation cycle endured for 6,798.32 days (ref. *The Moon*, by Zdenek Copal) but was calibrated, for mathematical breakdowns (progressions), through 6,804 days. The period of 16 lunar years was calibrated to 5,670 days.

Author / astronomer, John Edwin Wood, in commenting on Hawkins's suggested method of counting the 56 post positions to predict the occurrence of eclipses adds, 'It has been criticised on the grounds that a large circle of holes is not needed simply for counting up to 56' (see *Sun Moon And Standing*, pg. 75). What the critics overlook is that tangible, component based systems were always put in place, such that a forgotten principle could always be retrieved from the regional site or edifice. Whether or not the astronomers ever did manual counts on the Aubrey Circle posts or needed to refresh their memories by reference to its physical layout seems irrelevant...the circle was there primarily for mnemonic recall of the calendar and lunar cycle methods or as a teaching aid to apprentices of the astronomical arts.

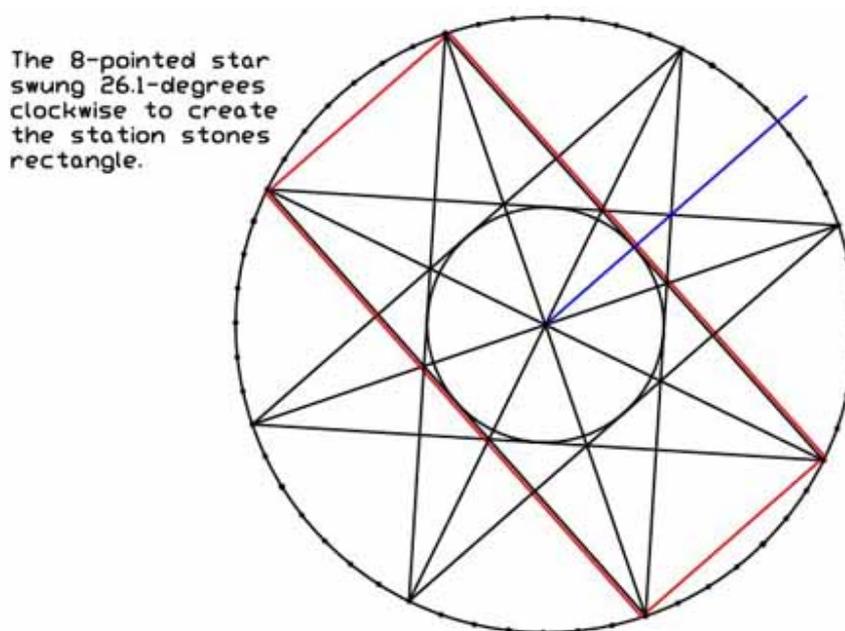


Figure 39: The red rectangle represents the 4-corner positions of Stonehenge's station stones, which were conceived by geometry within this 8-pointed star. The rectangle geometry was then marginally adjusted to provide 264 feet (geodetic code...2 sides 528 feet) and 113.4 feet (lunar code used to describe both the 6,804-day nutation cycle, as well as the 5670-day, 16 lunar years period).

The circle in the centre is the PHI dimension (110 feet diameter of the Sarsen Circle, which was made slightly elliptical to code 113.4 feet between the Avenue (45-degrees azimuth) and Stonehenge's SW (225-degrees azimuth).

Calculating these two cycles could be done within the confines of the Aubrey Circle posts and between the rays of an 8-pointed star.

In one approach to doing the 6,804-day count, the ray-points of the star had no value in providing numbers, but simply divided the circle into 8 parts, with 6 posts per part. Each of the 6 posts, between ray-points, was assigned a value of 141.75-days. This is a part of an important numerical progression which produces numbers found on the Khafre Pyramid (Egypt's Pyramid of the Moon)...141.74, 283.5 (Khafre's perimeter value was 2,835 feet), 425.25, 567 (16 lunar years was 5,670-days and the width of the station stone rectangle was 56.7 feet X 2), 708.75 (Khafre Pyramid was 708.75 feet per base side...2 X 354.375...the lunar year is 354.375-days long), 850.5, etc.

A second method could utilise all 56 positions and break the 6,804-day period into 121.5-day period's ($6,804 \div 56$). This method can be turned around to simply mean 243 months of 28-days duration each, between major standstills. Ancient "Lunarists" (those who calculated by the moon) used a "28 lunar mansions" methodology. Thus the 56 post positions (28 X 2) of the Aubrey Circle lend themselves admirably to the Lunarist modus operandi.

As far as the 5,670-day (16-lunar year) period is concerned, it could also be calculated within the confines of an 8-pointed star, with each post representing 118.125-days. This is exactly 1/3rd of a lunar year or 4 lunar months of 29.53125-days duration each. Note also that the Khafre Pyramid base length was 708.75 feet, which was 29.53125×24 or 118.125×6 . The degree of allowable error in the ancient lunar "mathematical progression" system was 57 seconds of excess time per lunar month.

One could also apply other types of calibration to these two periods (6,804-days or 5,670-days) as both were joined by ratio...6,840 to 5,670 is a ratio of 1.2 to 1.

Judging by the repetitive numbers occurring at Stonehenge or on Khafre Pyramid, it would seem that the count of 113.4-days was used to calibrate these two lunar periods... $60 \times 113.4 = 6,804$ and $50 \times 113.4 = 5,670$. Remember that the station stone rectangle is 113.4 feet wide and the Sarsen Circle appears to have been made slightly elliptical to comply to a diameter of 113.4, from 45-degrees azimuth to 225-degrees azimuth.

The number 630 (which was the basis of the Greek Stadia...630 feet) and by consequence 105 or 10.5 (which became the basis of the reed measurement) were very important to the ancient people. With that in mind it's interesting to find that if the 56-post Aubrey circle is assigned a "beginning point" post and 180-degrees opposed, an "end point" post, then the whole lunar calibration can work very effectively within two halves of the Aubrey Circle through counts of 54 posts....27 per side.

$6,804 \div 54 = 126$ (the ancient reed measurement was 126 inches). Alternatively, $5,670 \div 54 = 105$ (the ancient reed measurement was 10.5 feet).

This system would allow for counts in increments of "reed type" values and in whole day numbers, simultaneously. For example: $6,804 \div 630 = 10.8$ (the Brasen Sea of the Temple of Solomon was 630 inches in circumference...the inner Sarsen Circle at Stonehenge was 315 feet...630 (2). Note also...one calibration of the Aubrey circle worked to 10,800 inches (900 circumference feet X 12).

$5,670 \div 630 = 9$...it's very easy to create suitable, easy to interpret calibration of these two lunar periods by utilization of 54 posts (out of 56) for calibration...and the other two representing points of departure and termination.

The significance of a calibration set to 16 lunar years might seem elusive and of little practical usage. It is mentioned here solely on the basis that 56.7 occurs as a primarily important measurement code between components of Stonehenge. The numerical value had obvious importance to the ancient astronomer / architects of the observatory and seems to have, accordingly, featured fairly prominently in lunar cycle determinations. Two circuits of the Khafre Pyramid, at 708.75 feet per side, were 5,670 feet.

Researchers of the calibre of Hawkins, Hoyle, Colton and Martin have speculated that the eclipse cycle (Saros... 19 eclipse years...223 lunar months... 6,585.32 days) could have been calculated using the 56 Aubrey Circle posts and have suggested various simple, plausible methods for doing so. Other cycles, such as the 19 solar years (235 lunar months...6,939.69 days) Metonic cycle could also have featured within the wide range of calculations undertaken on and amidst the 56 Aubrey Circle posts.

THE AUBREY POSTS, THE EMBANKMENT & 3, 4, 5 TRIANGULATION.

Stonehenge was set up to function as an observatory onto the array of stars and planets traversing or descending upon it. The site itself was a finely tuned calculator of celestial positions or events and any descending star, at many given days of the year (when the alighting position was seen between the standing pillars of the Sarsen Circle from a viewing position at site centre) could be assessed as to its degree angle on the horizon.

From a low, central viewing position the circumnavigating embankment represented a "false or artificial horizon" and was created specifically for marking the alighting positions of stars and planets. No such determinations were possible unless the descending stars were alighting into a pre-built, calculating matrix, where specific degree angles had been pre-set by the positions of component stone and post markers.

The system worked like this:

Say for example the Stonehenge astronomers wished to fix onto the exact alighting position of Aldebaran, the bright star in the Hyades (Taurus Constellation), on the night of 1/1/2400BC when it set very close to, but short of, due west.

An astronomer would take up a position at site centre, where a clear view onto the alighting star was (seemingly) possible between the western standing stones (now ruined) of the Sarsen circle.

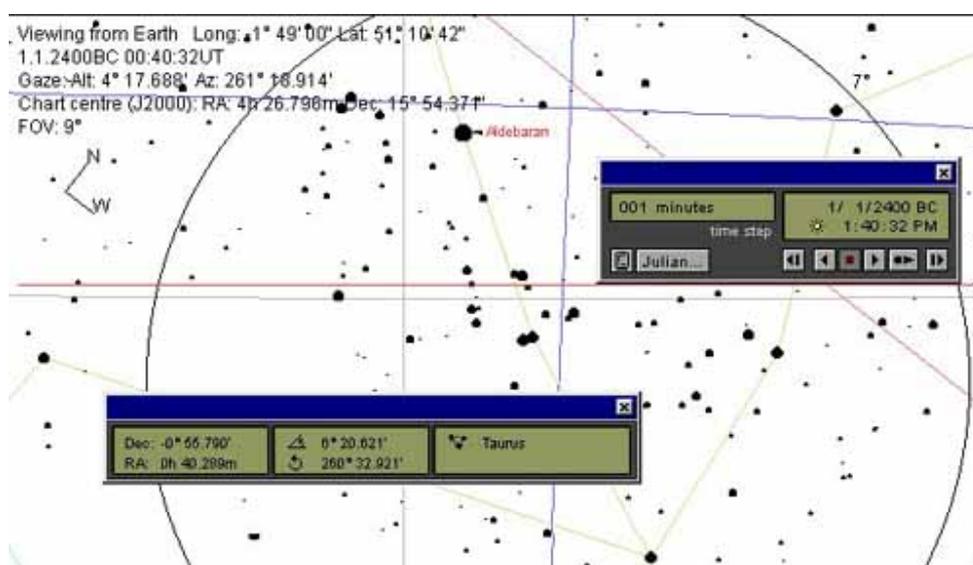


Figure 40: The star Aldebaran descending upon Stonehenge's embankment for the date of 1/1/2400 BC. It is assumed, for the purposes of this demonstration, that an observer, situated at site centre, could watch Aldebaran alight upon the embankment... in a clear view between the standing megaliths of the Sarsen Circle. The red horizontal line represents the approximate level of the embankment artificial horizon. The final landing position would have been very close to 262-degrees.

The astronomer situated at site centre, made his/her observation from a rigidly fixed position, where the eye would not waiver from side to side or up and down. An eyelet sight, probably shaped like the Egyptian Ankh, was slotted into a precisely positioned plane table (set by a plumb-bob onto a ground marker peg and to a standard, angled height orientating slightly upward to the crest of the embankment). The observer could view through this "Ankh" eyelet to the alighting position of Aldebaran. Alternatively, one could slot a swivelling alidade (sighting ruler) into the plane table's centre hole and view along its straight edge to the alighting position of the star.

Based upon artefacts recovered from Bush Barrow tumulus mound near Stonehenge, the plane table and alidade method appears to have been used at the observatory. Professor John North comments, **'Fragments of wood that the excavators had thought were the remains of a shield were now described as the remains of an alidade (a sighting rule) and wooden drawing board or plane table'** (see Stonehenge, Neolithic Man and the Cosmos, page 508).

There would be a standard, upward angle from the fixed sighting position to the artificial horizon and this angle would not vary through 360-degrees of potential observation. It is assumed that the chosen angle would place the alighting position of the target star sufficiently above the thickened horizon atmosphere to eliminate positional distortion caused by parallax (a bending and magnifying effect that gives a false reading as to the exact position of an object hovering near the level horizon).

Working in conjunction with the observer at site centre would be a second individual, situated at the rear or outer face of the embankment. It would be the task of this individual to place a manageably sized, pointed marker stone onto the top of the embankment...as per the "left or right" instructions issuing forth from the centrally located observer.

Finally, Aldebaran would be made to alight onto the precisely positioned stone or chalk marker and further calculation work could now be postponed until the next morning when the sun rose.

After dawn a series of ropes or strings would be pulled out across the Stonehenge site, which would finally form a giant 3, 4, 5 triangle. The triangle would be formed by post-markers (primarily on the Aubrey Circle) that were preset when the observatory was first built. The 3, 4, 5 triangle used to calculate Alderbaran's nocturnal position, for the night previous, would be one that came very close or the closest to the star's alighting position.

This is how it looked:

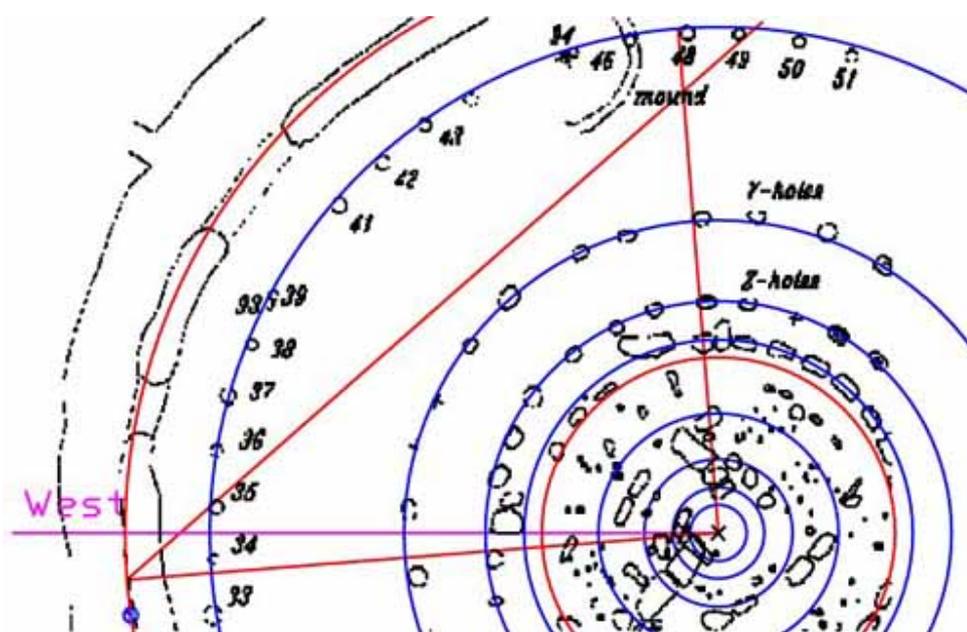


Figure 41: The post positions of the Aubrey circle were set out to be 3, 4, 5 triangulation stations and a giant 3, 4, 5 measuring 126 feet (adjacent), 168 feet (opposite) and 210 feet (hypotenuse) was used. This 3, 4, 5 triangle swivelled through 360-degrees of arc and was fixed to site centre at the 90-degree intersection of adjacent and opposite. The intersection of adjacent and hypotenuse had rope extensions, which ran all the way to the sides of posts on the Aubrey Circle (in this case post 48 for the adjacent and post 49 for the hypotenuse). Alternatively, the opposite ran past post-positions on "Z" or "Y" Holes, before brushing the side of a post on the Aubrey Circle (post 34). It intersected with the hypotenuse, which ran to the side of post 35. That point of intersection (opposite and hypotenuse) was beyond the Aubrey Circle on the embankment (at a point exactly 168 feet from site centre). This was the circle line (embankment) where the observable setting of stars and planets were periodically marked by manually positioned stones (as determined by careful observation from site centre).

It will be noted that a blue dot sits on the embankment circle (red) just below the intersection of opposite and hypotenuse. This is the estimated alighting position of Aldebaran on the night of 1/1/2400 BC...so how do we very accurately determine its exact degree angle by utilisation of this static, inbuilt 3, 4, 5 triangle (made from ropes drawn to the sides of carefully positioned posts)?

Each of the multiple, pre-built 3, 4, 5 triangulation positions were at known degree angles. All the astronomer / mathematicians had to do is choose one at close proximity to the star alighting position, then measure how far the star marker sat from the known angle.

The embankment circle was fashioned to be 1,056 feet in circumference (528 feet X 2...336 feet in diameter X PI). This means that every 35.2 inches represented 1-degree of arc or every 17.6 inches was ½ a degree of arc. Remember, the 176 number was integral to geodetic, earth navigational determinations (the altar atop the Great Pyramid was 44 feet per side or 176 feet for the whole perimeter...there are 1,760 yards in a mile...1/8th of 35.2 inches is 4.4 inches...there are 2,880 increments of 4.4 inches in 1,056 feet, etc.).

One geodetic circle in use at Miringa te Kakara's Crosshouse in New Zealand was based upon a circumference of 176 feet (56 feet X PI...marginally rounded). This put the ratio of the Crosshouse's intended 176 feet circle (1/30th of a mile) @ 1:6 of the Stonehenge embankment circle. The full circumference of the embankment circle (1,056 feet) was exactly 1/5th of a mile.

Although there are slight discrepancies to be found in individual sections of Stonehenge's Aubrey Circle, the distance between one 3, 4, 5 triangle station and another next to it, was, generally, set to a 6.4-degree spacing. On the Aubrey Circle, that translated fluidly to every 16 feet.

There were two swivelling sets of 3, 4, 5 triangles configured as mirror images of each other. Both could run either anti-clockwise or clockwise. There are some areas of the site where the distance between Aubrey stations exceeds 6.4- degrees and the reader is encouraged to experiment with the following **ANIMATED DRAWINGS** to see the multiples of 3, 4, 5 triangulation possibilities. There are simply too many to show them statically within this limited article.

<http://www.celticnz.co.nz/US16.html>

Figure 42: By clicking the mouse on the picture, the reader will be able to move this red 3, 4, 5 triangle to any desired position around the Aubrey Circle. Remember that the ancient astronomers were using ropes, running to the sides of Aubrey Circle posts to form the 3, 4, 5 triangles. Carefully position this red triangle such that the "adjacent" and "hypotenuse" crossing vectors touch the sides of Aubrey Circle posts then observe all other sides of the triangle to see the relationships to post positions elsewhere within the site. It will become quickly apparent that the Aubrey and other posts were carefully positioned to relate to 3, 4, 5 triangulation onto the embankment (star alighting) circle.

<http://www.celticnz.co.nz/US16.html>

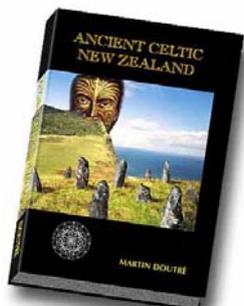
Figure 43: A second animated and movable 3,4,5 triangle, this one a mirror image of the first

doutre@celticnz.co.nz doutre@celticnz.co.nz

Martin Doutré was born in Altadena, California, USA, in December 1946, but was raised and had his formative education in New Zealand.

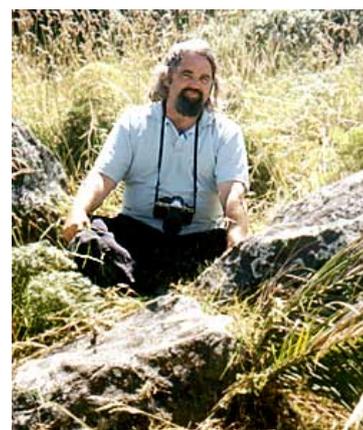
He has lived "back and forth" between the US, Continental Europe and New Zealand and has been educated in each region.

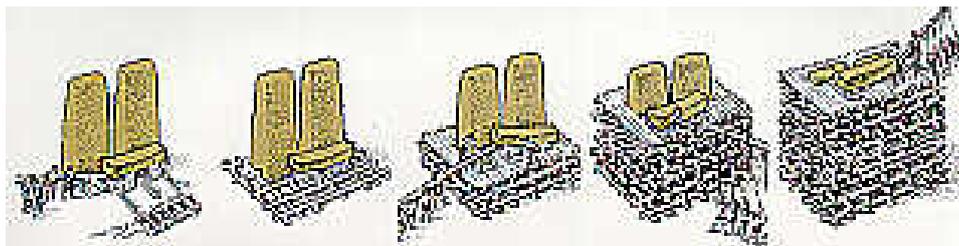
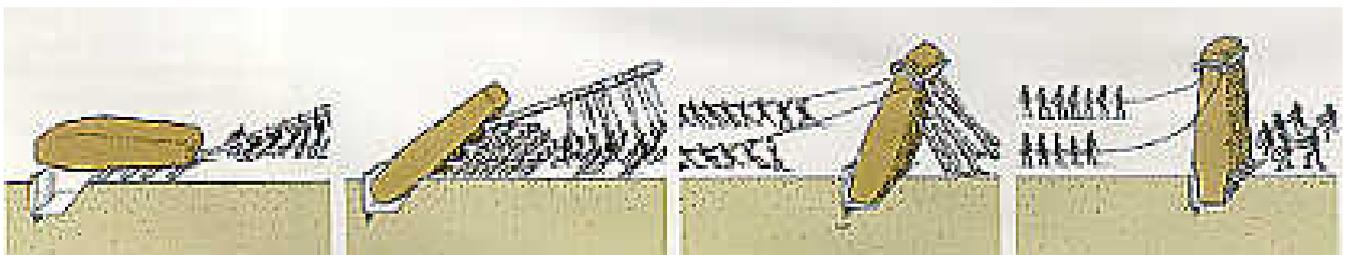
He first became interested in archaeo-astronomy in the 1970's and, by applying exacting surveying and measurement techniques, has made a close study of mysterious, New Zealand, pre-Polynesian structures.

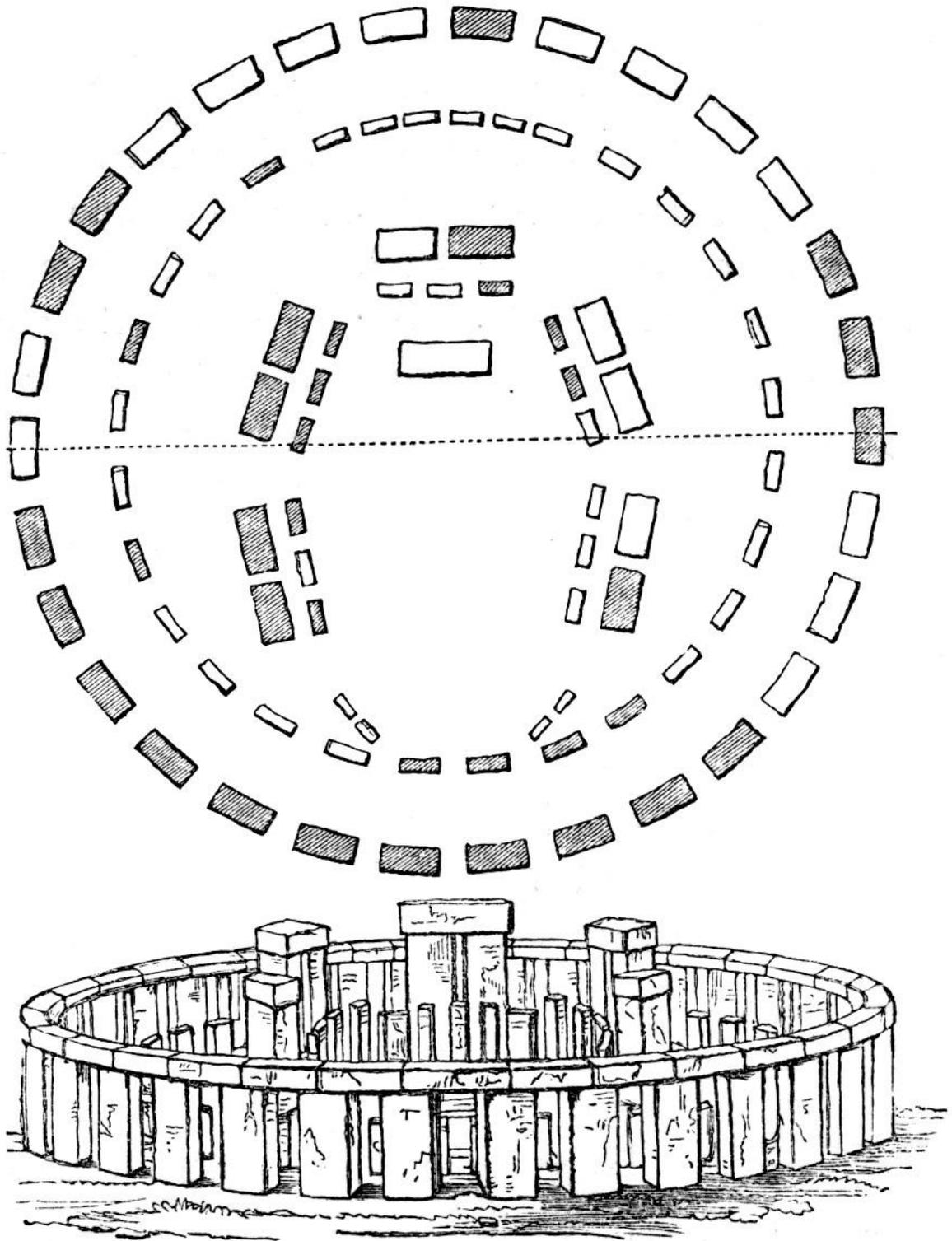


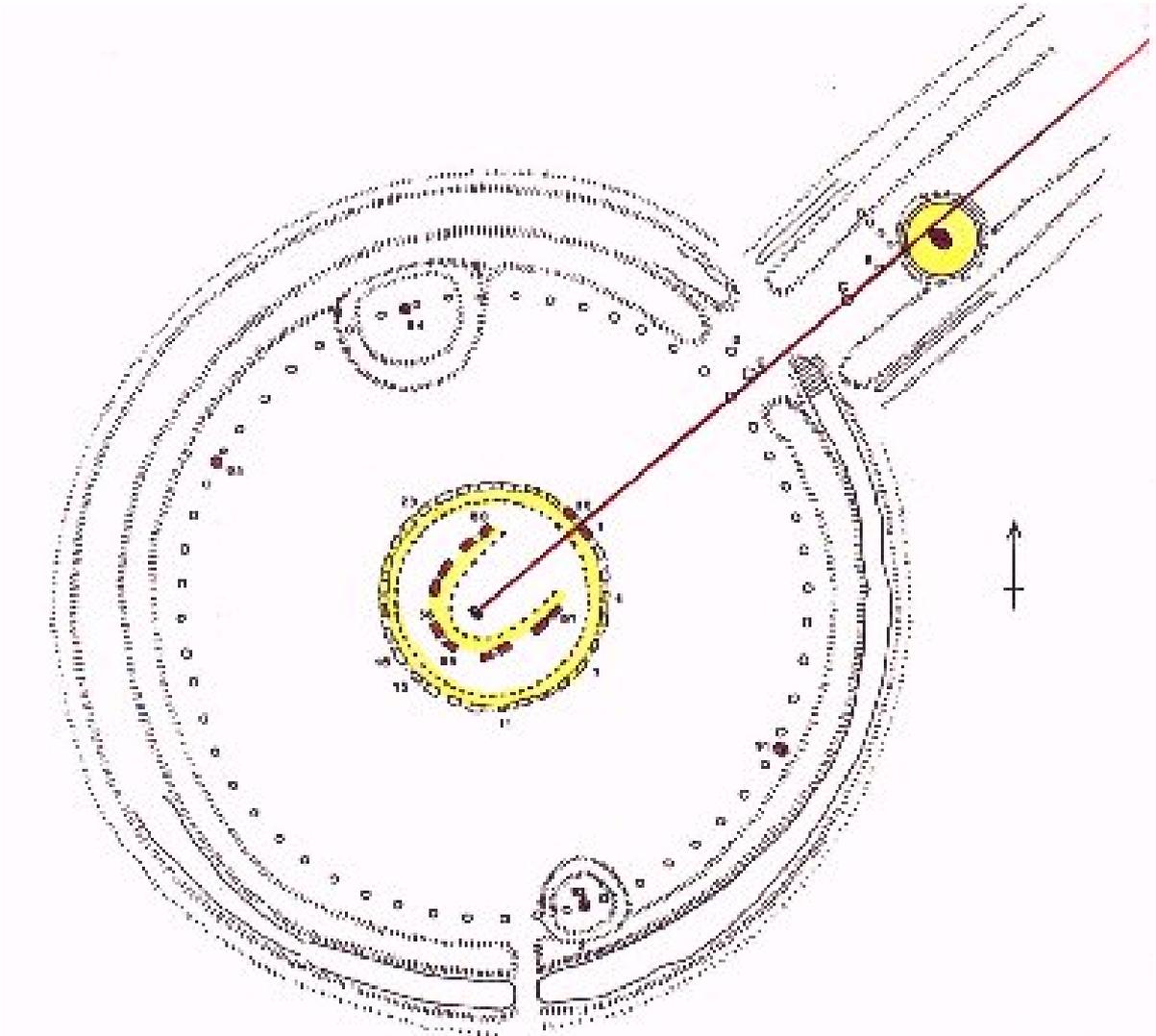
Dé Danann Publishers attempts to "bring back into vogue" the works of dynamic Historians of the 19th and 20th century, and to make some of these "alternative" explanations to history, as well as other interesting works, available once again.

66 Highway 28, Coatesville, Auckland, New Zealand.



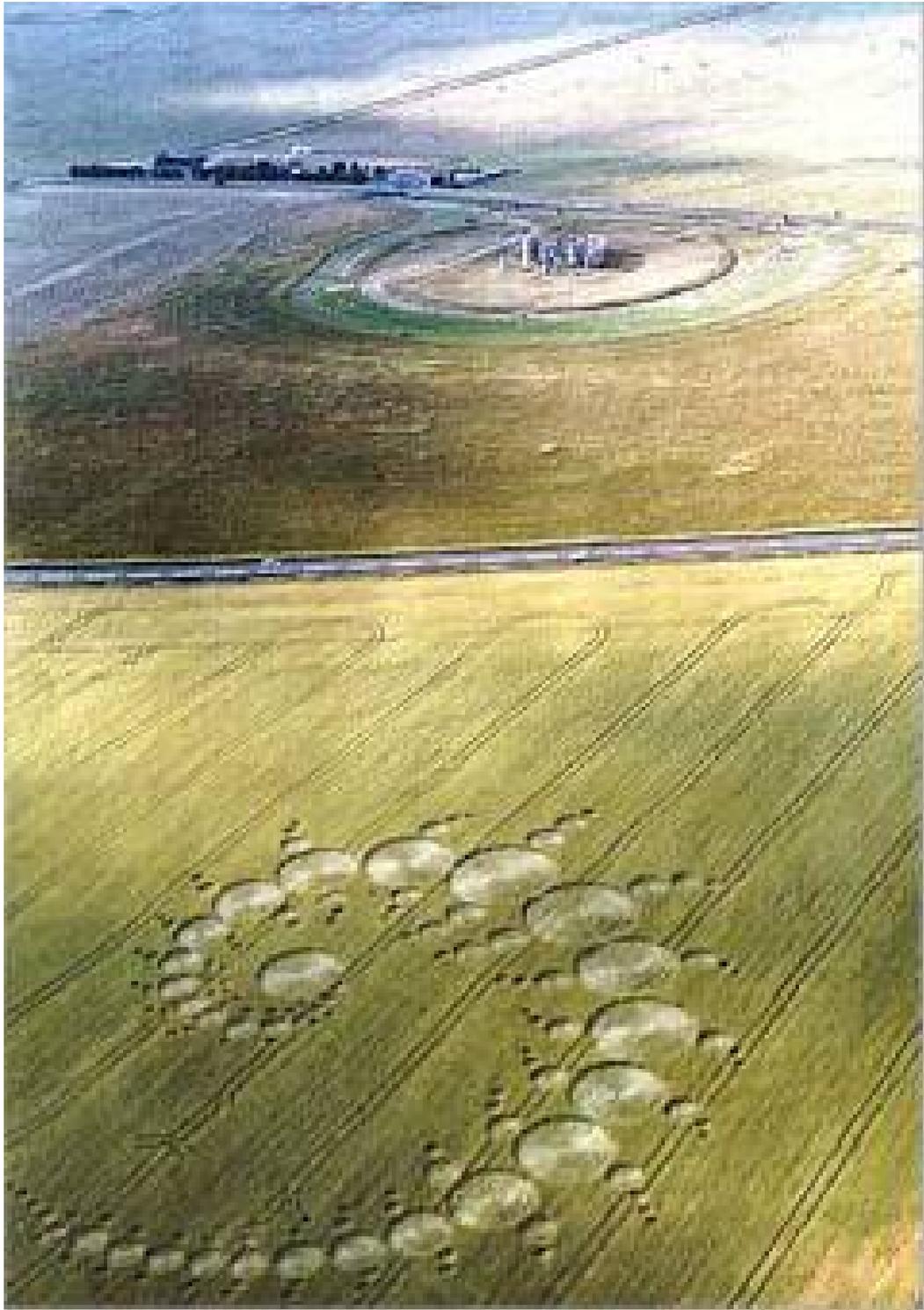






Stonehenge with the central stones in their final arrangement, about 1900 BC, but with the visible earthworks (the banks and ditches) shown largely as they are now. The positions of the 58 Aubrey Holes are indicated but not the Y and Z holes.





STONEHENGE Questions & Answers:

<http://www.pbs.org/wgbh/nova/stonehenge/qanda/>

Question: How do you know how much the monoliths at Stonehenge weigh? ~Jane

Answer: We know how much the monoliths weigh as we can calculate to their overall volume, including the bit that's underground, and we know what the density of sarsen, or bluestone, is. Also, some of them have actually been lifted by train while being reset not that long ago, which is also a good guide.

Question: It's one thing to drag a ten ton stone over three step middle planks. Was anyone making nice new planks 4,000 years ago? Probably a lot harder to drag a stone on rough cut timbers from ~Brad

Answer: People at this time were capable of quite fine timber work and we have evidence of this from preserved prehistoric trackways in peat bogs. So, yes, they would have been able to make smooth planks.

Question: Why was Stonehenge built? I've heard that on either the longest or shortest day of the year, the sun rises or sets just at the entrance. Why did they build it like this? ~Scott

Answer: The structure of Stonehenge is actually laid out on the line of the midsummer sun rise and the midsummer sunset, the longest and the shortest days of the year, and it seems likely that Stonehenge was built to mark these two events, which would have been enabled people to chart the changing seasons.

Question: Without the use of the wheel, the builders must have used sledges, log rollers, and many people, right?

Answer: Yes, and our experiments show that it seems more likely that some form of sledge would have been used to transport stones as log rollers are very prone to getting bogged down, particularly in softish ground.

Question: How far has the procession of the equinox moved the position of the summer solstice on the horizon since the time Stonehenge was built? ~Raymond

Answer: It has moved slightly, but not significantly enough to alter the fact that we can tell that it is this alignment that Stonehenge incorporates within its structure.

Question: On the Stonehenge raising, they used a weighted tip to tilt the main riser stone into the hole. Why not just have the stone dragged up an Earth ramp with wood rails to a pivot point of wood (timber) and just burn the timber? The loss of the support will drop the stone or is the angle too great for the raising? I can't see the stone (re: concrete) angle stone under the pivot point being used. ~Don

Answer: Burning a timber structure would, I suspect, cause a loss of control of the stone and also the heat generated would actually damage the sarsen. It's possible that any one of the stones which we now see built into the structure could have been used as that pivot stone before being erected. There are some that have a suitable cross section.

Question: Using the techniques from the show, how long did it take to build the entire structure? ~Jerry

Answer: To build the whole of Stonehenge will obviously depend on how many people you can use for the task. What we suggested was that, given a great concentration of effort, is the sarsen structures, the biggest bits of Stonehenge, could have been built within a period of three years. We suspect that probably it took longer.

Question: How do you know when it was built? ~Scott

Answer: The evidence for when Stonehenge was built comes from radio carbon dates which have been obtained largely from fragments of the antler picks used to dig the holes for the stones and the ditch.

Question: What kind of language or dialect did this ancient community speak? ~Jeff

Answer: Unfortunately, archaeology cannot give us any idea of the language that the builders of Stonehenge spoke.

Question: Why didn't they use pulleys to lift the monolith? ~Rich

Answer: Basically because it appears that the wheel had not been invented at that time and a pulley is a sort of wheel. If they did have pulleys, there is absolutely no evidence in the archaeological record.

Question: The ropes that you used, were they purchased or did you make them? ~Kenny

Answer: We purchased the ropes that we used. They were modern hemp ropes which we were obliged to use to comply with health and safety regulations. We would have liked to have made lime bark ropes to carry out the whole experiment, but this was impossible.

Question: I saw from the show that the ancients of the time had gold. Did they have any other metals? ~Robert

Answer: At the time when Stonehenge was started, no metal was used in the British Isles, but then copper, bronze, and gold were used, came into use.

Question: Where did you get stone slabs that big? ~Mike

Answer: We weren't able to get stone slabs that big. The ones we moved were replicas made of concrete. The places where both sarsens and bluestones come from are both now protected sites and it's not possible to extract stone from them.

Question: Where are the stones you have erected in this experiment now? Will they be left on this site? It appears they are a bit heavy to move. I hope to visit Stonehenge in July, hence these questions. ~David

Answer: The new trill is no longer on the site where it was erected. It rapidly became a place of New Age pilgrimage, and the farmer insisted on it being taken down the stones are currently in store.

Question: Is there an estimated population size at the time of construction that would have helped move the monoliths easier without the use of such elaborate devices that you used? ~Pat

Answer: Calculating the population which this time is very difficult because we have no clear indications of where people were living and how many settlements there were around. We felt that just using larger and larger numbers of people was not the answer, and that the builders of Stonehenge probably thought up a scheme which used less people in a safer and more controlled way.

Question: What was the closest known settlement to Stonehenge at the time of its construction, not including the area where the workers may have stayed? ~William

Answer: There are indications of settlement within a mile or so of Stonehenge, but the remains of settlements of this period are very difficult to find, in great contrast to the massive structures that that these people built.

Question: A thought occurs to me as I sit and think of the Indian burial mounds in my area: Wouldn't something like that have been useful in making the ramp for the piece on top? How old is the idea of mortice and tenon? Also, are there any writings on the stones at all? ~Patty

Answer: We know that people at this time were capable of constructing very large Earth mounds and so could quite easily have built a ramp to drag the stone up. Mortice and tenon joints, we have examples of these preserved from wet sites in this country that date back to at least a thousand years before Stonehenge, and there are no writings as such on the stones unless you count more modern graffiti, but there are carvings of daggers and axes that appear to date to the time of Stonehenge's building.

Question: I saw from the program that people were used to pull the ropes. Is it possible that beasts of burden were used for the heavy pulling? ~Sondra

Answer: It is possible that oxen were used to assist with the pulling and we would have liked to have carried out some experiments. Unfortunately, oxen, unless they have worked together before, are remarkably uncooperative beasts, and we were unable to get a team together. But this is possible.

Question: What type of marks, if any, were left on the monoliths as evidence of how they were moved? ~Keegan

Answer: There are no marks on the monoliths that provide evidence of how they were moved.

Question: In a book I read, it said that they probably put burning branches on a place they wanted to cut, then poured cold water on, cracking it. Is this what your experiment showed that they did? ~Scott

Answer: We didn't really go into the shaping of the stones, but fire is one way of breaking and shaping a stone like sarsen. It obviously carries risks, and having quarried a 40-ton block, it would be unfortunate to crack it in the wrong place. My feeling is that most of the shaping is done by pounding the surface of the stone with mauls ranging in size from footballs to small grapefruit.

Question: To move the stones, could the ancients have lashed enough logs to the stone to form a cylinder, loop ropes around the complete assembly, and pull on the upper loops to roll the stones to their site? ~Dave

Answer: This was one of the ideas that Mark and I discussed and then rejected when we were thinking about how we could move the stone. It would certainly work, but could be potentially very dangerous when trying to control a 40-ton garden roller going downhill.

Question: Who owns the property on which Stonehenge is located? ~David

Answer: The land on which Stonehenge lies is owned and administered by English heritage. Effectively it's owned by the English people.

Question: Most religious practices in those days involved some sort of ritualistic or actual animal sacrifice. Is there any evidence of such at Stonehenge? ~Botkin

Answer: I don't think we can be certain that most religious practices at this time involved sacrifice and there is no direct evidence of this from Stonehenge.

Question: How did they carve out the holes in the top piece and how did they make the stone pins that fit inside? ~Mark

Answer: Both of these elements of the mortice and tenon joint could only have been made by pounding away the surface of the stone. Obviously, to make the pin, all of the stone around this would need to have been removed, leaving the pin standing proud.

Question: Could it be that the large stones were moved not on tracks, as such, but on streams or slusways for irrigation / flood control systems? ~David

Answer: Water transport would obviously be an ideal method for these large stones, but unfortunately, there are no convenient river which runs between the source of the stones and Stonehenge. The route crosses high and undulating chalk downland, so this method could not have been used.

Question: Have you considered using a series of sliding fulcrums where each end of the 40-ton stone is pulled in turn, and in effect walking it balanced in the middle? I have done this with large 18th century logs for a log house with only one helper. ~Willard

Answer: Although the walking method of moving large weights can be used and was used to move some of the Easter Island statues, we felt that stones of 40 tons could not be moved in this way over relatively soft ground with any degree of safety.

Question: Might the weather conditions have been different enough 4,500 years ago to use snow and ice to reduce the friction of dragging and also to build ramps? ~Ken

Answer: The weather conditions at the time that Stonehenge was built were not dissimilar from those that we find today. Ice or snow would be a great way of sliding the stones, although it would make pulling for the pullers a lot more difficult, but could not be relied upon.

Question: Were the workers forced labour, or was it perceived as a community goal with benefit for all?

Who was doing the farming during the construction? ~Joan

Answer: It seems unlikely that Stonehenge was built by forced labour. We have no evidence of this in society at that time. I feel that the people probably gave their labour willingly in the construction of a monument that had significance for a great many. Obviously, there would need to be sufficient people still left to carry out the farming, although the building work could be a seasonal activity, perhaps carried out at times in the agricultural cycle when not everyone was needed to work in the fields or look after animals.

Question: If, as is estimated on the show, it took up to three weeks just to carve out the bowl for the tenon for the lintel, how long may it have taken to shape the stones themselves? How much work did they put into the shaping of the stones? After all this time, it's fairly rough-looking. ~Joe

Answer: The shaping of the stones was obviously a very laborious process. As far as how long each stone took, we obviously can't tell from their finished form how much stone had to be removed to achieve this shape. Some of them do look quite rough, whereas others are very finely finished, and we suspect that they simply chose the optimum shape as the stone came out the ground, and then shaped it as much as they possibly could.

Question: Any sense of the role women may have played in the creation of Stonehenge? ~Bob

Answer: Personally, I'm sure that the building of Stonehenge was a truly communal task in which everyone participated, whether young or old, man or woman. It's interesting to note that the depiction of the building of Stonehenge which English Heritage had on display until quite recently showed only men involved in its construction.

Question: Since there were previous wooden structures at the site, why do you think that particular spot is so special throughout time? ~Heidi

Answer: The reason why that particular spot was first chosen for the construction of a simple earthen circle and some burials is uncertain, and why that simple circle then became the focus of such an extraordinary building is equally something that archaeology can't explain. Archaeology can't get into the minds of the builders.

Question: I believe when the holes were dug, the dirt was put in a large mound in front of where two of the upright stones were to be placed. The stones were then raised to upright with a mound of Earth acting as a stop support and later as an incline to facilitate moving the lintels in place. ~Gayle

Answer: The holes that the stones were set into certainly wouldn't have provided enough soil to construct a stop or a ramp for erection of the uprights. What is obvious is that if a ramp was used, then large quantities of soil and chalk would have had to have been brought on to site and later removed. This is why I still personally feel that the use of the timber crib was more likely for raising the lintels.

Question: I am trying to figure out how the original Stonehenge could be raised by using your methods, since you required a couple hundred yards of empty space on one side of the stone and enough space to

lay the stone flat in the other direction. In the pictures, these stones appear to be very close together. By the way, great job and very interesting. ~Trudi

Answer: The stones in the centre of Stonehenge are set quite close together, and the requirements of space certainly seem to suggest the order in which certain elements of the building were erected. The sarsen trilithons in the centre clearly had to go up before the outer sarsen circle. But Mark thinks that his methods would work, and that there was enough space to carry out in the way that he suggested.

Question: Living in rocky New England, my mother-in-law and I had to use ingenuity to move a huge underground stone in order to plant a straight row of border hemlocks on our property. I would not say we were muscular types, but my elderly neighbour showed us how to dig a small hole next to the boulder, toss in stones, dig some more, toss in a few more stones, until we actually made the bolder pop out of the ground. Might the stone age builders are used stones as leverage instead of ramps to set the Stonehenge stones upright? ~Dorothy

Answer: The difference here seems to be between moving something out of a hole in the ground and raising something up above the ground, but basically, the principle is the same. You are presumably levering your stone up onto its bed of small stones, and I think you are suggesting dragging our stone up a ramp made of small stones. Chalk was certainly easier for them to get hold of to construct a ramp in this area.

Question: Do you know if they've sunk deeper into the ground since they were first placed and erected? ~Adam

Answer: Chalk is actually quite firm bedrock and it's unlikely that they have sunk further into the ground since they were first directed. What has happened is that the surface of the chalk has lowered the solution perhaps by as much as half a metre and so less of the stone is actually set into the ground than when they were first erected.

Question: What is the purpose of a calendar that only accurately forecasts two days of the year? ~Shea

Answer: It all depends how significant these two days are, and if they are times in the year which mark significant turning points at which people can gather and celebrate, then that calendar has a lot of purpose. My feeling is still that the midwinter solstice, which is pretty close to our Christmas, was the most significant of these turning points.

Question: It was mentioned that the monoliths stand 20 or 30 feet above ground. How deep below ground level are they buried? ~Dory

Answer: The depth below ground varies quite significantly. The one that fell over and broke a couple of hundred years ago was not buried as deeply as many of the others. Anything up to about 10 feet of stone is still buried under the ones that we know, but some have never been investigated.

Question: You mentioned the use of a timber crib, since the U-shaped circle of stones in the centre were after the ring. The earth ramp is limited by the area inside the outside ring, right? ~Dawn

Answer: We can't be exactly sure of the order in which the sarsen horseshoe and the outer sarsen circle were built, but common sense suggests that the inner horseshoe was built before that complete outer ring; otherwise, getting those big stones into the middle and erecting them would have been very difficult.

Question: Why did one of the largest monoliths fall over? Was it an earthquake? ~Mark

Answer: No. It was probably due to the fact that it wasn't set as deeply into the ground as many of the other stones and there is evidence that the people have been digging at the base of that stone possibly looking for treasure.

Question: Do these rock structures have any connection with the menhirs? ~Joe

Answer: There are part of the same megalithic tradition-- in other words, a tradition of building using large stones of which the menhirs and alignments in Brittany are a part-- and they're all constructed at roughly the same time.

Question: Considering the accuracy with which the monoliths were placed, what tools were found, not for building, but for measuring distance from the angles necessary for the use of such elaborate principles of physics to construct the trilithon? ~Brian

Answer: No measuring or surveying tools have been found from this period, but as they would presumably have been made of wood, it's not surprising that we haven't found any.

Question: I was wondering if there was any truth to the statement made by someone about the circumference of Stonehenge. I heard the circle would fit exactly inside one of the Great pyramids in Egypt, with each of the walls touching the circumference of stonehenge. Could there be some possible link between these two great mysteries? ~Alfred

Answer: I'm afraid that I don't know whether Stonehenge would fit inside one of the Great Pyramids but if it would then I'm sure that it is co-incidence. There doesn't seem to be anything else to link tie two great sites.

Question: When I visited Stonehenge in 1987 I was told that the current monument was the 6th or 7th on the site and that it had never been a place of habitation, except during the various constructions and a few religious caretakers. It is still a windy hill top without a large settlement in sight. Is this current thinking? And, if so, what do we know of the people who built Stonehenge that they would take so much trouble in a place away from where the bulk of them lived, hunted, farmed, etc.? ~Mary

Answer: Stonehenge has a long sequence of construction and modification and I suppose that you could say that there have been several separate monuments on the same spot, starting with a simple earth circle and ending up with the elaborate stone structures that we see in ruins today. People appear never to have lived at Stonehenge itself, in the same way that people don't live in most churches. The evidence that we do have suggests that there were settlements in the vicinity at the time Stonehenge was built and used but not close by. There appears to have been a sacred area surrounding it, defined by cemeteries of burial mounds, within which people were presumably not allowed to live or farm. Just beyond this prehistoric

life carried on just the same as everywhere else. The reason that Stonehenge seems so isolated today is that all the medieval villages which are the villages of today lie in the river valleys to east and west. For centuries Stonehenge has been surrounded by pasture and now arable land.

Question: I think that instead of erecting the two bigger stones and then putting the third on top, that perhaps the protrusions in the two larger stones were used to help hold the third stone on. I realize that it would take more than just these protrusions but it seems to me that it might be easier to erect all three vertically at once. Perhaps incorporating your ramp to help raise all three stones. This is just a suggestion. Great show and great work. ~Mark

Answer: You are not the first one to suggest erecting the whole trilithon at one go. Personally I wouldn't like to try 90 tonnes (plus all the timber you would need to hold the whole thing together) even with the mortice and tenon joints holding the lintel roughly in place. Thanks for your comments about the show.

Question: Very little was said about the numerological (dimensional) aspects of the site. Any ideas why there were the number of stones there were in the circle or why the stones were set at the specific height they were? Do they align with any constellations or particular stars or is it purely a solar tool? ~Dave

Answer: We were really concentrating on the construction aspects with a bit about the site and its context thrown in. You would need a whole series of programmes to look at aspects like the geometry, astronomy etc. I personally am not a great fan of the complex astronomy idea but try looking at a book called 'Stonehenge; Science and Society' published last year which has a good article about astronomy. Basically, as far as I'm concerned, Stonehenge is a big seasonal calendar (and a wonderful place).

Question: Besides the greased rails that may have been used to move the stones, is there any evidence that the builders slid stones down hills (perhaps after a rainstorm) to take advantage of the natural terrain to ease the transport? ~Kevin

Answer: No evidence at all I'm afraid. There appears to be no trace of any route or construction but I'm sure that the builders would have used anything to make their job easier.

Question: Is it possible that the purpose of stonehenge was a sort of gateway to the heavens, what these early thought of as the transcendental realm? It seemed to me that the clustering of the grave sites around stonehenge might give a clue to this. ~Jack

Answer: Possible but the one thing that archaeology won't do is give us access to the minds of the people that built Stonehenge.

Question: 1. Why use the animal-fat-based greased "cold" - why not keep pots of it heated for continual application as needed?

Answer: I'm not sure that this would give you much of an advantage, it might make the fat too thin.

Question: Another question addressed ice / snow - but why not dig a shallow ditch to pour water in during sub-freezing yet non- snow times - stone slides on this frozen railway, but lack of snow outside it, gives traction for stone-moving team.

Answer: Possible but given unpredictable weather this could severely restrict the time that was available for stone moving.

Question: For hoisting stones, consider tripod lift structure, not just A-frame. No pulley; just run ropes over vertex. Alternately add notched post as third leg to A-frame - can rest vertex of A-frame in each notch for incremental lifts. ~Ria and Brooks

Answer: Mark and I think that a 40 tonne straight lift would have been impossible. The sort of ropes that we assume were available probably would not have been able to cope with this.

Question: I know that on the summer solstice, the sun rises directly above the heel stone, the one in the opening of the circle. If one were to draw an imaginary straight line from the centre of Stonehenge and through the heel stone, is it possible that this line would intersect with the Bosphorus ("Cow crossing") or Heliopolis ("Sun city") in Egypt? ~Richard

Answer: No

Question: What do you think of water being used to move the stones into position. I created a mock experiment. I discovered that a circle of wood timbers supported by the mounding of earth around them, for reinforcement and ramp, would provide the perfect arena to manoeuvre the stones into exact positions. The most man power needed would have been in pulling and pushing the stones up the ramp, as you demonstrated in your show, and then sliding them down into the water. Ropes secured around the stones would allow workers to move into place with much less man power than expected! I think this theory has merit. This method could be accomplished without the wheel pulley's or hundreds of men. Perhaps they even made a ravine filled with water to move the large stones using beasts of burden over (below) ground to their destination? This theory has merit. I'm interested in your thoughts. ~Brian

Answer: I'm not sure exactly what you are suggesting and can't see the advantage of having the stones in water (they would sink - or have I missed the point). There is a problem too as Stonehenge lies on chalk which is probably the most porous sort of bedrock that you can find. There is no evidence of a water channel (canal) to transport the stones in and there would be a problem here too as the route that the stones would have to take is over very undulating terrain.

Question: If they used one A-Frame could they have linked two or three of them, and reduced the effort more? ~Doug

Answer: Possible, but I suppose there comes a time when the construction of more and more A frames is more trouble than rounding up a few more volunteers. It's a good thought though.

Question: Is it possible that Stonehenge was created as a place of healing for those with nasty contagious diseases? That might explain who paid for the work (the wealthy who had taken ill). It might also explain the burial mounds (quarantine areas) and way the burial mounds were ranked with the wealthiest men being closest to Stonehenge. The fact that at least some of the gold artefacts were not stolen from the barrows might indicate that people were afraid to go near these places. Also doesn't it seem possible that the fellow that used the ramp to cap the trilithon got it right. If you were going to excavate enough earth

to place a 40-ton stone would you not want to utilize the product of your labour to make a ramp? This would also enable these people to raise and cap the trilithon in one day. Maybe during an elaborate ceremony to celebrate the work. ~Brad

Answer: Lots of things are possible with Stonehenge but I haven't heard the idea of the wealthy and infirm funding it before. I'm not sure about your ideas concerning quarantine. Regarding the ramp, the volume of chalk that you would get from the stonehole is comparatively tiny compared to that which would be needed to construct a ramp (maximum of eight cubic meters compared with at least 100 cubic meters). How would this enable the people to raise and cap the trilithon in one day? I am quite sure that however it was done there must have been a celebration when they finally completed the building work.

Question: I noticed several questions about using pulleys. I, too, thought of this idea, and considering how simple it is to make a wheel, I am wondering why you think the wheel hadn't been invented. Also, considering that wood would not last these thousands of years, why would you expect to find any archaeological evidence of pulleys? I think you are underestimating the intelligence of these ancient engineers. Also, do you have any real engineers working with you? I doubt you, as archaeologists, have nearly the mechanical know-how or ingenuity of even the least intelligent ancient engineer. ~Daniel

Answer: As archaeologists we have to take the absence of evidence seriously. There have been enough excavations of waterlogged sites with artefacts of all types surviving (but no wheels) to lead us to believe that the people that built Stonehenge were not using the wheel. Of course we don't underestimate the intelligence of the ancient engineers. You seem to have overlooked the fact that Mark Whitby, who played a central role in the experiment that was part of the NOVA program, is a "real" engineer. I am sorry that you have such a low opinion of archaeologists; maybe we don't have the accumulated skills of an ancient engineer (even one of the least intelligent ones) but we do have a genuine love of the past and a healthy respect for its inhabitants.

Question: You've probably answered the concepts of "counterweights" a million times, or even the compulsion for it. With buckets, ropes, logs, ramps, sand and/or rocks - progressively increased sizes of rocks - could these wonders have been built by just a few folks? Is there a technically disqualifying aspect of this concept or simply a, "why SHOULD they use counterweights"? ~Lee

Answer: Theoretically it would be possible to move large weights by using a small weight to help move a larger one, etcetera, but I think the idea of Stonehenge being the work of a small group of people is unlikely. You certainly couldn't move the big stones in this way.

Question: I was wondering if it would be possible if they could have built a hill over the entire area. Then simply dig a hole or possibly used forms before the dirt was hauled in. In this manner the large stones could be set in place in much the same way as shown on May 5. I would have to see a Geothermal map of this area to be able to tell if there were any large holes dug that would suggest this. ~Randy

Answer: Theoretically possible, but unlikely. The volume of chalk and soil required would be huge and there are no signs of any quarries in the vicinity of Stonehenge which could have provided this material.

Question: Could there be any link between Stonehenge and other large stone works elsewhere on earth, such as the pyramids? As there is no reliable written history, could the "giants from Africa" be Egyptians,

or another race, and isn't it funny that they all came from relatively the same time period?....the workmanship is a little different, but still, the tactics used to move large pieces of stone seem to be the same, at least in modern re-creations..... ~Jay

Answer: Although it is tempting to see similarities between Stonehenge and other large stone structures, the only ones which have a real link are the great alignments and other megalithic structures in Brittany. The idea of the architecture of Stonehenge coming from the Mediterranean area (or even from further afield) effectively died when radiocarbon dates became available and showed that Stonehenge was older than all the civilisations that were supposed to have influenced its design and construction.

Question: You mentioned that Stonehenge was erected 4,500 years ago. How many 1,000s of years ago did human first habitate in this area (U.K.)? I always thought the Mediterranean (Egyptian) area was one of the first locations for human inhabitants. Am I correct when I say that was about 2000 BC? ~Scott

Answer: There has been human (or initially hominid) occupation of what was to become the British Isles since about 500,000 BP. After this various ice ages meant that there were no people around for long periods. Further south in Europe and beyond they didn't have to contend with ice so there has been habitation for even longer. There isn't the time to go into this in detail but, suffice it to say that people had been around in the areas that I have mentioned for a very long time by 2000BC.

Question: I visited Stonehenge when I was eight. I do not remember the dimensions. But, is it possible that all three pieces of a trilithon could be raised together? Perhaps tied together and lashed to a wooden frame, then raised? I believe this would be labour intensive, but more simplistic in engineering it. Has anyone tried? ~Bill

Answer: No one has tried to raise the three components of a trilithon together. The whole thing would weigh about 90 tons, not counting the timbers that you would need to hold it together for the lift. It certainly couldn't be done for the Great Trilithon as we know that the two uprights are of unequal length which would make this method impossible.

Question: I have heard a brief mention of a way that someone could lift a mega ton stone. By finding the Zero gravity spot on these stones single individuals could lift massive tones with ease. Have you heard of such an explanation? Is there any proof that this could be possible? ~Jim

Answer: I'm not sure what the zero gravity spot is but it seems to be against all the laws of physics.

Question: In the Stonehenge project, what if the hole that was dug for the vertical stones was "c" shaped so that the stone would slide in, then use its own momentum to stand itself erect? Is this possible? Thanks for your input. ~John

Answer: I don't think that the stone would stand itself erect in the base of a "c" shaped hole. You would have to balance it there before packing it firmly in place and I think that it would be potentially much more unstable than if it was in a hole with one vertical and one ramped side.

Question: The show was very interesting. However, the people in the show forgot about the one resource that the people back then had. That was time and lots of it. The construction of Stonehenge may have

taken many many years, not the short period of time that the show seemed to be portraying. The stone age people also undoubtedly used many many more people than the show did. They may have also used captured enemies to do the work also. The cap piece could have been "walked" up the ramp by pulling on one set of ropes at a time, effectively doubling the manpower. Did the stone age people know about the block and tackle or even an early form of it? Overall, though, a very educational and wonderful show. Please keep up the great work. ~Clifford

Answer: We are quite aware that people had a lot of time and we did not intend to imply that Stonehenge was built in a short period of time. What we showed was that it could have been built in a shorter time than many people estimate. I disagree that they undoubtedly used many more people than we did. As numbers grow then the ability to co-ordinate effort lessens. Prof Atkinson suggested that over 1,000 people were needed for some of the tasks, but such an army of labourers would have been well nigh impossible to manage. I disagree about "captured enemies" - there is no evidence for slavery in the British Neolithic / Bronze Age. We have no evidence for block and tackle (the wheel was not used until much later). Sorry to disagree with so many of your points. Thanks for your comments about the show.

Question: Would it not make sense to only roughly cut the stones at the location in a cylindrical form and roll them to the final assembly point, where the final square cutting would be performed? Do the dimensions of the uprights + the dimensions of the topping stones add to a cylindrical shape? The tracks seem to be way too much capital and human investment for the task at hand. Does the quarry have evidence to show the stones were cut square at the site? Another method would be to build wooden cradles shaped like wheels for either end (actually best if placed at 1/3 and 2/3's of the length) of the stone, using the stone as the connecting axle. Clearly from the shape of the final building and the burial mounds the concept of the circle, and hence the wheel, was probably well understood. Enjoyed the program but agreed with the analysis that the solutions were over engineered. ~Jon

Answer: The sarsen stones at the place where they originate are found largely as flat slabs (sarsen is a sedimentary rock). It is therefore unlikely that any of cylindrical form would be found which could be rolled as you suggest. Regarding the quarry - the stones are not cut out of solid rock, they exist as detached slabs of rock embedded in redeposited chalk. Why do the tracks seem too much capital and labour investment for the task? You would only need to make a short length of track which could be taken up and relaid in front of the sledge and stone. If it makes the task easier then it would be well worth it (there are earlier sophisticated and well constructed Neolithic wooden trackways in peat bogs in nearby Somerset). Despite the circular henges and barrows there is no evidence of the wheel at this time. Glad you enjoyed the show.

Question: Could you have tipped the large stone to vertical by men pushing the top with timbers and driving wedges or filling with stones behind? Also, were the pits dug that deep? Wouldn't a considerable amount of silt layers have accumulated over the thousands of years? ~Bruce

Answer: I think it would be difficult to generate enough force to tip the stone by pushing with timbers as you suggest. Wedges would help but filling in with stones behind can cause problems if they trickle round the sides and front and hinder moving the stone to upright. The pits were dug that deep, the stones put in and then the remainder of the hole packed tight with stones and chalk. No room for silt to accumulate.

Question: During the NOVA program, raising Stonehenge, the question of the methods used to erect the

stones was bandied about, in particular how the lintels were raised. Simply put has any stratigraphic analysis of the soils around Stonehenge been done with an eye to spoils piles removed from putative dirt ramps? Could these piles be detected to this day by virtue of the disturbed strata and presumably undisturbed soils in the area of the monument? ~Don

Answer: The soils over the chalk are very thin in the vicinity of Stonehenge and there is no sign of the spoil from an earthen ramp. There is also the question of where the chalk etc would have come from in the first place. You may gather that I am not a fan of the ramp idea and prefer the timber crib method.

Question: I had thought that the stones in Stonehenge were of a sort that came from Wales? Sorry to make your Herculean effort sound trivial but perhaps boats were used to bring to a spot even further than yours? Also how does one use bronze tools to cut rock? Thank You for you foray in History. ~JTB

Answer: It's the smaller stones, the so called "bluestones" that come from further a field, from the Preseli mountains in Wales to be precise. It is suggested that they came part of the way by water. This can't be the way that the larger Sarsens were transported, as there aren't any convenient rivers that run from the place where they are found to Stonehenge. You can't use bronze tools to cut rock, except very soft ones like chalk. You certainly can't cut sarsen with bronze -- even iron makes little impression.

Question: I think the idea of the A-Frame lever was very good. Why not use another mechanical advantage for transporting the stones, namely a pulley? Rope is affixed to a post in the ground, run around a post attached to the stone, then pulled upon by the pullers. 2X advantage! ~Dave

Answer: We didn't use a pulley because there is no evidence for pulleys, or for any other type of wheel, from this period in prehistory.

Question: What was the average life span of the stonehenge builders? ~Scott

Answer: We have no firm evidence about the average life span of people at this time. Many people have the idea that life was "nasty, brutish and short" but human bone specialists may have been routinely underestimating the age of people at death and there is no reason why you couldn't survive at least into your 50's if not beyond. It might seem simpler but the forces required to raise this would be huge. We know how much the monoliths weigh as we can calculate their overall volume (including the pit that is underground) and we know the density of sarsen (or bluestone). Also, some of them have actually been lifted by crane while being re-set which is also a good guide.

STONEHENGE Pictorial:

