

Forests of Stones, Rings of Giants

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We do not know the extent of Megalithic man's knowledge of geometry and astronomy. Perhaps, we never shall. He was a competent engineer. Witness how he could set out large projects to an accuracy approaching 1 in 1000, and how he could transport and erect blocks of stone weighing up to 50 tons.

—A. Thom, *Megalithic Lunar Observatories*, 1971

2.1 The Radiocarbon Revolution

There are places on this planet where the intellect vacillates and common sense protests, places that unsettle and overwhelm, where sometimes the only response is that odd indifference which is the mind's last defense.

Well, we had better get used to it, because these places are exactly where this book is taking us. The first such places we will visit are also chronologically among the first where humans set out to erect monumental stone constructions, for reasons we will get into presently. We are talking about the megalithic sites of Europe, the places where people expended significant amounts of time and energy extracting, shaping, moving, and erecting gigantic hunks of rock, or megaliths. There are single stones (menhirs), two upright stones capped by a third (dolmens), stone corridors covered by earthen tumuli (barrows), stone circles (cromlechs), and larger circles or ovals delimited by a ditch contiguous with a raised bank (henges). People moved giant stones in Brittany, Ireland, England, Scotland, Spain, Italy, and Malta. We call their civilization “megalithic” because their distinguishing characteristic is this extraordinary skill in handling stones whose size range from the merely massive (several tons) to the enormous (several tens of tons) to the colossal (up to 300 tons) (an in-depth discussion on the problem of transporting megaliths in ancient times can be found in Appendix 2).

It is important to remind ourselves that these stones were extracted from quarries, shaped, and transported *without the use of metal tools*. This is true,

by the way, not only for the megaliths in this chapter but for practically all the stones from all over the world that we will encounter in this book (the few exceptions are in Egypt, where it is thought they used copper saws with the help of abrasive sand). So, the quarrying and shaping of the stones was done with tools made of stone. If the quarried stone was relatively soft, like limestone, one could easily use tools made of harder stone. However, for stones like granite or andesite (which is similar to granite, and found in the Andes), one had to use “percussors,” which were chunks of the same material worked roughly into spheres and then violently thrown against the area to be removed.

We know precious little about megalithic civilization. The ceramics of the megalithic peoples of Great Britain, for example, are classified in three main styles—Peterborough, Grooved Ware, and Beaker—with the first being very similar to the third and all three sharing overlapping characteristics for long periods. These people did not have written language as far as we know, and until just a few years ago it was thought that the structures they built and the objects they made were nothing more than feeble attempts to mimic the splendors of the Near Eastern and Aegean civilizations, inept imitations made by “howling barbarians.”

Until the 1970s, archaeologists had no method of absolute dating. This meant that even if you had a stratigraph, which is archeological data from successive layers at the same site, the best you could build was a *relative* chronology (e.g., ceramic objects with a square pattern are older than ceramic objects with a diamond pattern), but you had no way of determining the absolute dates (e.g., the square pattern is from 1800 BC and diamond pattern from 1600 BC). But the inability to know for certain proved to be no obstacle for archaeologists and historians who, instead of prudently suspending judgment or at least qualifying their claims, embraced the nefarious dogma that human civilization was *born (sic)* in Mesopotamia and Egypt around 3000 BC and then slowly, gradually spread through Europe in ever-widening concentric circles, this model being valid for both the diffusion of ideas and the physical migration of populations. The main exponent of this “diffusionism” was Gordon Childe, according to whom civilization passed first through the Aegean and then spread into Iberia and Italy, crossing the Danube into northern Europe and finally reaching the British Isles. One of Childe’s specific theses was that the great Mycenaean tombs called *Tholos* (long corridors with vault-roofed terminal chambers) were the inspiration for the chamber tombs and other megalithic structures that appeared first in Spain and later in northern Europe.

It was only logical, therefore, to date megalithic civilization to the middle of the second millennium BC. That is, until the revolution. No other word,

really, except *revolution* can describe the fallout of the discovery, around 1950, of carbon dating.

The story of the so-called radiocarbon revolution is also the story of how a single, ingenious idea caused the complete upheaval of an entire discipline; I recommend reading the classic (if dated) book by the historian and archaeologist Colin Renfrew (1973), which also contains an exhaustive introduction to the technical aspects of carbon dating. A simple explanation will suffice here: carbon 14 (C-14) is a radioactive substance, meaning that it decays into another substance by emitting particles according to a simple and constant physical law. C-14 is present in the air and accumulates in organisms through respiration; when the organism dies, the accumulation stops. So, by measuring the C-14 present in the remains and checking it against the constant rate of radioactive decay, it becomes possible to establish when the organism stopped breathing (I am breezing right past all the technical problems involved here). The results were slightly variable when it was first used in 1949, but it was later perfected by calibrating C-14 data with that of dendrochronology, the dating technique that uses the growth rings of trees to reconstruct historical wood sequences.

C-14 dating of organic remains from megalithic sites melted away diffusionist ideas as the sun does snow. The Kercado tumulus in Brittany, for example, turned out to be one of the oldest stone structures on the planet, dating all the way back to 4700 BC. And who would have thought that the megalithic civilization of Malta was building temples 700 years before the Pyramids? In England, Stonehenge was already underway by 2800 BC, more than 1300 years *before* the Mycenaean tombs of which it was allegedly a pale imitation (kind of makes one wonder if the Mycenaeans weren't the copycats...).

The diffusionist dogma is, in my view, a perfect example of how history and archaeology have habitually underestimated the thought of civilizations that were inconsiderate enough as to leave us with no written accounts. In fact, every scholar who adhered to that dogma assumed that the great megalithic monuments were built by barbaric people in emulation of their superiors, never asking seriously what purpose they might have served, to the extent that we still do not know much more now than they did then. To demonstrate this, let's take a trip to the realm of the giants.

2.2 Stone Forests

The first site we will visit together is Carnac, in Brittany. Here, sometime between 5000 and 7000 years ago, someone built a forest. The forest is made



Figure 2.1: The alignments at Kermario

of giant stones, or menhirs, disposed in three main alignments: Kermario (10 lines, 982 stones), Le Menec (11 lines, 1100 stones), and Kerlescan (13 lines, 540 stones). The megaliths were selected and arranged so as to create a perspectival effect, such that their dimensions increase with distance.

The ancient inhabitants of Carnac knew what they were doing when it came to big rocks. The largest stones in the alignments reach several dozen tons, and they're not all simple menhirs; there are also other, more complex structures. Circles above all, like the one at the western extremity of Le Ménec, or the two cromlechs of Er Lannic in the nearby gulf of Morbihan, one made of 28 megaliths and the other of 32 (half of the north circle and the entirety of the south one are underwater, proof that the sea level was lower at the time of construction). In addition to circles they also built large, corridor-like structures used as tombs, and dolmens. Some of the corridors are still covered by massive earthen mounds called tumuli, circular or oblong in form, others are not and thus reveal their extraordinary internal structure, while still others were perhaps never meant to be covered. Among the most important of these corridor-type structures are St. Michel, an oblong tumulus measuring 125 meters and more than 10 meters high, the aforementioned Kercado from 4700 BC, Locmariaquer, originally more than 170 meters long, and lastly Gavrinis, a little island in the gulf of Morbihan 4 kilometers from Locmariaquer. Upon it was built a round tumulus 50 meters in diameter and 9 meters high. Inside runs a long corridor whose walls are splendidly decorated with spiral motifs that suggest the whorls of a fingerprint (similar motifs are found at various other megalithic sites, as we'll soon see).

The sheer quantity of monuments in the Morbihan area is impressive. The entire territory is literally bristling with stones that pop up unexpectedly in the woods or pose fetchingly in the planted fields. Among the isolated stones that one encounters, “Le Manio,” at more than 6 meters tall, is particularly striking, but the largest stone ever moved in Brittany is the Grand Menhir. The Grand Menhir could not be more appropriately named. It was originally a truly gigantic object, more than 20 meters tall and weighing at least 300 tons, made from a type of stone that is not found in the immediate area, the nearest source of which is the Quiberon peninsula, a good number of kilometers away. Today the great megalith lies on the ground, split in four pieces (it is not clear when this happened). But when it was standing, it was visible from great distances, announcing itself as the heart of the entire territory.

The few dozen square kilometers around Carnac, then, was the site of a frenetic, even obsessive building program that radically transformed the landscape. It is obvious, of course, that the overall purpose of these operations had something to do with some sort of thought, and no doubt with some form of religiosity, with a particular bearing on death and the dead. Which is why I am strongly tempted to call the complex at Carnac a *sacred landscape*.

The term *sacred landscape* will accompany us throughout this book, and I have to say I am not all that thrilled by the prospect. While the word *landscape* expresses exactly what I’d like to talk about, that is, the “plane of man,” the level (as opposed to above or below ground) to which humans have full access, free to study it, model it, build, invent, and think, the word *sacred* is too easily misunderstood, too quickly classified according to the established schemas that make up our culture and tradition and knowledge, our methods and measures of thought and judgment. I would therefore like us to agree that by sacred landscape we mean an environment in which people live, which has been studied, selected, considered, and constructed in accordance with an idea, a religious, scientific or philosophical mental construct, but whose specific methods and forms of both thought and construction can be completely different from culture to culture. I would also like to agree that having a name to call this thing does not mean we have understood it. I will return to this topic in Chapter 15, where we will see how the sacred landscape was connected to power, to the extent that it could alternatively be called a “powerscape.”

In any case, names aside, the only thing we really know is the dumb truth of facts, and the fact is that at Carnac, there are thousands upon thousands of tons of giant stones that were quarried, transported, and erected. We have nothing written, no book of instructions. We do not know

why people did this at Carnac and in many other places—places like, for example, Ireland.

2.3 Spirals and Mounds

It is difficult to say what Newgrange, in the Boyne Valley just outside Dublin, really is. It is definitely another one of those places where the intellect protests, the mind reels. In fact, we will have to resign ourselves for now and postpone any attempt at understanding it until the second part of the book. For now, let's be satisfied with simply accepting it as a tomb used numerous times over a long period, and try to get a basic idea of what we are dealing with. (Plate 2)

Around 3200 BC, a corridor about 30 meters long was built from enormous stone slabs on the steepest slope of a small natural hill. The structure, oriented toward the southwest, ends in three little alcoves. Additional slabs were placed on top of the corridor to isolate the interior from water, and then the whole thing was covered with a tumulus in the shape of a heart. The external walls of the tumulus are dry-stacked and incorporate blocks of white quartz, which make the structure gleam so as to be visible from many kilometers away. It is surrounded by what remains of a circle of megaliths. Many of the stones, both inside and out, are engraved with delicate spiral or diamond motifs.

Newgrange is the cardinal point of a sacred landscape that includes two other major complexes, Knowth and Dowth. Knowth, a kilometer away, though less famous than Newgrange, is in fact much larger at 95 meters wide. Here we also find an abundance of marvelous incised designs, including those on the slabs that make up the 18 smaller structures surrounding it, forming a sort of archipelago.

Dowth, which derives from the Gaelic word for “house of darkness,” is a structure very similar to Newgrange. Dowth has two passageways with two terminal chambers; one of the two passageways is aligned with the corridor at Newgrange, the other oriented toward the north. The internal chambers at Dowth are built with enormous megaliths, and even more impressively, the ceiling consists of a single slab. Here, too, the walls are decorated with spiraliform motifs, and they have a strange, almost hypnotic effect in the penumbra of the chamber. There is one slab in a corner that is the most unsettling of all, in that the incisions seem to combine to form a human face.

Numerous other subsidiary structures complete the sacred landscape of the Boyne Valley. There are traces, though not readily apparent, of a *cursus*, that is, a concave roadway with high banks. This earthwork, 20 meters wide,

connected two lesser mounds with a U-shaped area in the proximity of the main tumulus. Just a few dozen kilometers from Newgrange is a second concentration of tumuli, at Loughcrew. Once again the mounds are disposed in groups, the largest of which hosts the so-called T tumulus, which is extraordinarily similar to Newgrange.

2.4 Rings of Rock

On the Salisbury Plain in Wiltshire, England, stands the third megalithic site we will discuss in this book. Its most famous component is Stonehenge. But that's not all that's there. Describing Stonehenge is not difficult, but one must keep in mind that what we see today is the result of a long process of successive phases of construction and reconstruction that spans nearly a millennium.

At first, around 3000 BC, Stonehenge was just a henge, that is, a big circular ditch about 2 meters deep and 114 meters in diameter, to which corresponded a concentric ring made from the earth removed from the ditch (the fact that the ditch was normally on the *inside* with respect to the earth-ring of the henges excludes *a priori* any hypothesis of a defensive function). Within this circle was another circle of 56 holes placed at regular intervals, called Aubrey holes after their discoverer, which were perhaps used to anchor big wooden posts.

Some centuries later, wood gave way to stone. The outer ring of the complex structure was a large circle of 30 trilithons, each composed of two vertical megaliths capped by a third, strung together in an uninterrupted circle. Inside this ring were erected five enormous free-standing trilithons, disconnected from one another. The weight of the vertical stones of the inner group is more than 50 tons each, with the horizontal architraves tipping the scales at a mere 20 tons. The architraves are not, as it may appear, simply placed there but rather fixed with mortise and tenon joints, meaning that cavities were carved into the caps to accommodate corresponding protrusions on the top surfaces of the bearing stones. The big free-standing trilithons in the center are disposed so as to form a U (customarily called a horseshoe). The central geometric axis that divides the horseshoe in half corresponds to the axis of symmetry for the monument as a whole. If we project this axis outside the circle, it meets a single menhir known as the Heelstone, clearly placed there explicitly to define this alignment.

Also belonging to the complex are four megaliths traditionally called station stones, which define a rectangle inscribed within the outlying ring of

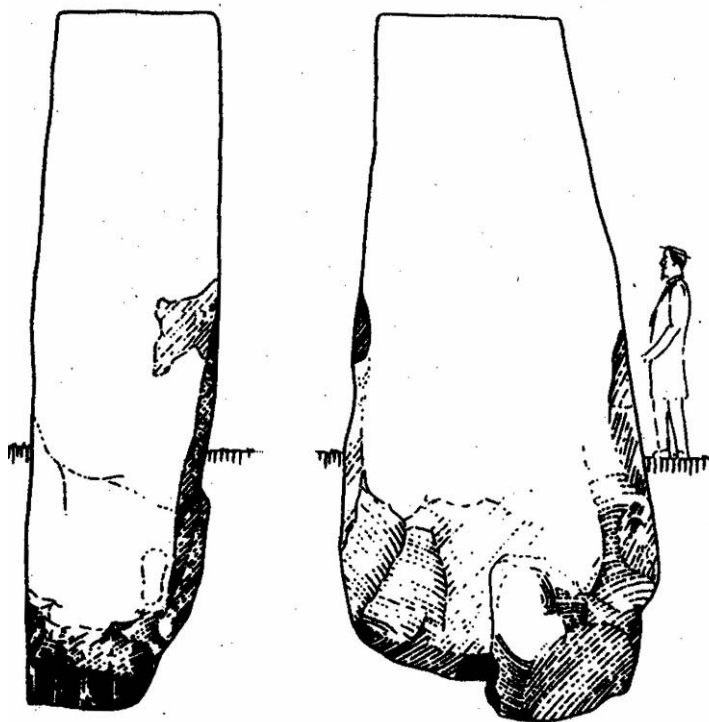


Figure 2.2: A Stonehenge Sarsen stone

Aubrey holes. All the blocks used here are made of local sandstone, called sarsens, and come from an area near Avebury, about 30 kilometers away. These huge sarsens were carefully shaped in the parts that were to remain above ground, while the parts to be buried were crudely “flaked” with a technique similar to that used for making flint tools at the time (remember that Stonehenge is from the early Eneolithic, or Copper Age, and that the only tools available were made of stone, wood, or horn). The result of this flaking method, whether intentional or not, is that these enormous sarsens look an awful lot like macroscopic replicas of hand tools of the Neolithic Age.

Stonehenge also has a secondary perimetral circle and secondary horseshoe made of monoliths much lighter than the monstrous sarsens (3 to 4 tons each on average). There is something curious about them, however; these monoliths are of a type of dolerite known as bluestone, which is not native to the area. In fact, the nearest source is in the Preseli Hills in modern-day Wales, well over 200 kilometers distant.

Scholars have long and strongly doubted that the megalithic people were capable of organizing the transport of dozens and dozens of these stones

(each one about the size of four or five washing machines laid end to end and weighing the same as an adult elephant) along a route as long as it was full of obstacles, to the point where some even posited the preposterous idea that the bluestones were already there at Stonehenge, transported by glacial movement during the previous ice age. Since there is not a trace of even the smallest fragment of bluestone in a radius of many kilometers, this theory was wisely discarded and today it is agreed that the stones were quarried from the Preseli Hills, transported to the banks of the Bristol Channel, transferred onto pirogues, and then floated, first by sea and then up the River Avon to a point as close as possible to Stonehenge.

In that sphere of experimental archaeology that is enjoying so much success of late, one amateur group, the Menter Preseli, managed to get financing for a modern-day attempt to repeat the process of transporting a bluestone, an undertaking that was given the humble and unassuming name of *Millennium Stone Project*.

At first, the volunteers who hauled the stone (which weighed an absolutely reasonable 3½ tons) breezed through the heroic enterprise as if it were a weekend outing. The only problem was that they were going so slowly that it soon became clear that the “millennium” part of the production, which



Figure 2.3: Stonehenge from inside



Figure 2.4: The huge Sarsen trilithons at Stonehenge.

would have seen them arrive triumphantly at Stonehenge on New Year's Day, 2000, was not going to happen. Forging nevertheless onward, they finally got to the hard part: transporting the megalith down Bristol Channel on a wooden pirogue. The pirogue in question, evidently displeased with the monumentality of the task assigned to it, promptly tipped the millennium stone into the drink. The water was deep enough that navy divers were called in to find it, after which it was deftly fished out by a decidedly post-megalithic-era crane. In the meantime, enthusiasm (and the remaining funds) were running out as quickly as the millennium itself. To make a long story short, the millennium stone now lies forlornly, with a little placard that cruelly reports its name, in the Carmarthenshire Botanical Garden, despite the belief of many—myself included—that it belongs back home in the Preseli Hills.

Except for a few ax-shaped engravings on some of the sarsens and maybe a couple of human profiles (which, however, could be of natural origin), Stonehenge is a completely anonymous monument. The reason why the site itself was chosen to erect a structure requiring such enormous time and effort remains unknown to us. What is certain is that the entire plain was conceived as a sacred landscape incorporating dozens of other monuments in the course of many centuries. Among them are two long cursuses. One, called the Avenue, starts in the vicinity of the Heelstone and runs northeast for 400 meters before veering off toward the River Avon. Another, at least as old as the first phase of Stonehenge, 100 meters wide and more than a

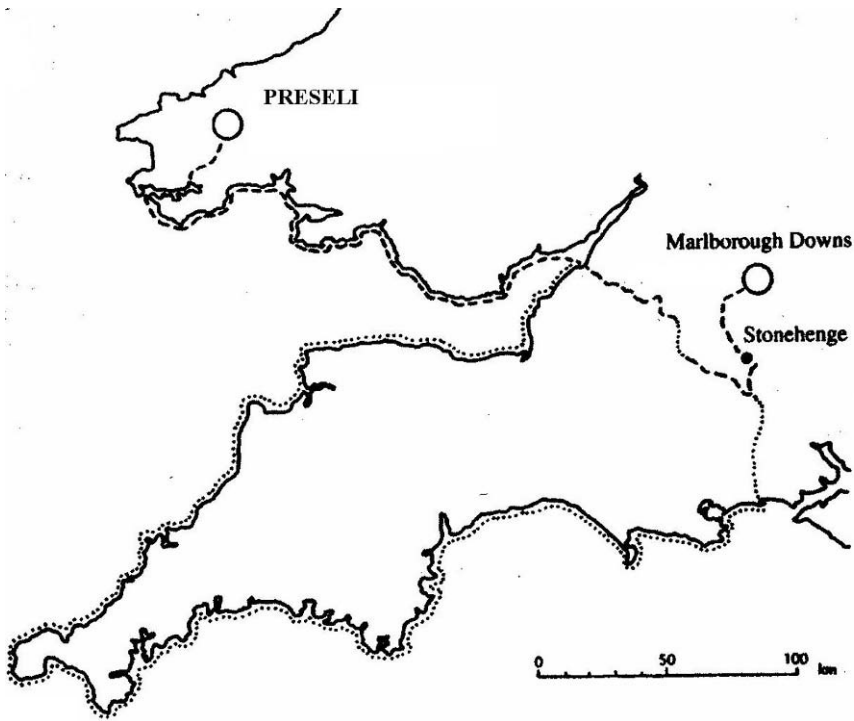


Figure 2.5: The possible paths of the Bluestones from Preseli to Stonehenge

kilometer long, connects it with a group of tumuli. Finally, about 3 kilometers east of Stonehenge there are two other henges, Durrington Walls and Woodhenge.

Durrington Walls, which today is in ruinous condition, was a big henge measuring a formidable 520 meters. The perimetral mound alone was 27 meters wide and the corresponding ditch 6 meters deep. Evidence of post holes indicates that monument was a wooden structure, with two openings at points northwest and southeast onto the banks of the Avon.

Woodhenge owes its name to the fact that it was originally an enormous construction made of wooden posts—stripped trees, basically. Discovered only in 1920 by a reconnaissance flight, it was a ring 85 meters in diameter, open at the northwestern quadrant like its lithic neighbor, Stonehenge, and encompassed six other concentric rings of which there remain only the post holes. Though not very impressive today, the complex must have been quite a sight, with posts which, judging by the diameter of the holes, must have been a good 8 meters tall and weighed at least a few tons; it was thus made of *megadendrs* instead of megaliths. The excavations of Woodhenge have given us little to go on: the tomb of a child and some potsherds.

2.5 Picnic of the Giants

Another sacred landscape, even more powerful and complex than Stonehenge, can be found just a few dozen kilometers to the north.

Imagine a family of giants having a picnic. The parents polish off the wine and then have a nap while the children play in the meadow. The children make two circles with pebbles, and then a third circle around both. They dig a little moat around the pebbles and then fill it with water. They model mounds and bridges, they scratch roads and channels into the ground. At sundown, the family goes home and the traces of the children's games remain.

This is the impression you get when visiting Avebury, one of the most complex monuments erected by any megalithic civilization, anywhere. Avebury is an enormous ring mound 400 meters in diameter with the customary corresponding internal ditch, impressively deep here (I will resist the temptation to urge you to stop and think about how many meters 400 are, or how many tens of thousands of tons of earth were moved to do this). Inside is a circle of preposterously large megaliths; I say "circle," but the stones are not disposed along a true circumference (that would be too easy), but rather on a geometric figure obtained by superimposing the arcs of several circles. Inside are two smaller rings of megaliths, each about 100 meters in diameter. Various other giant stones are distributed here and there, and there were two double rows of standing stones conducting away from the structure, making for a total of about 600 megaliths. One of these rows, called West Kennet Avenue, was originally 2.5 kilometers long and connected Avebury with a smaller stone circle known as the Sanctuary.

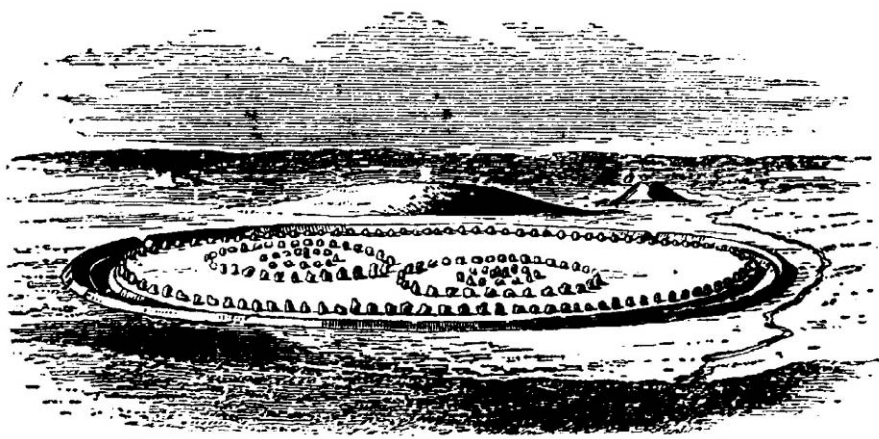


Figure 2.6: Avebury in a reconstruction of the 19 century

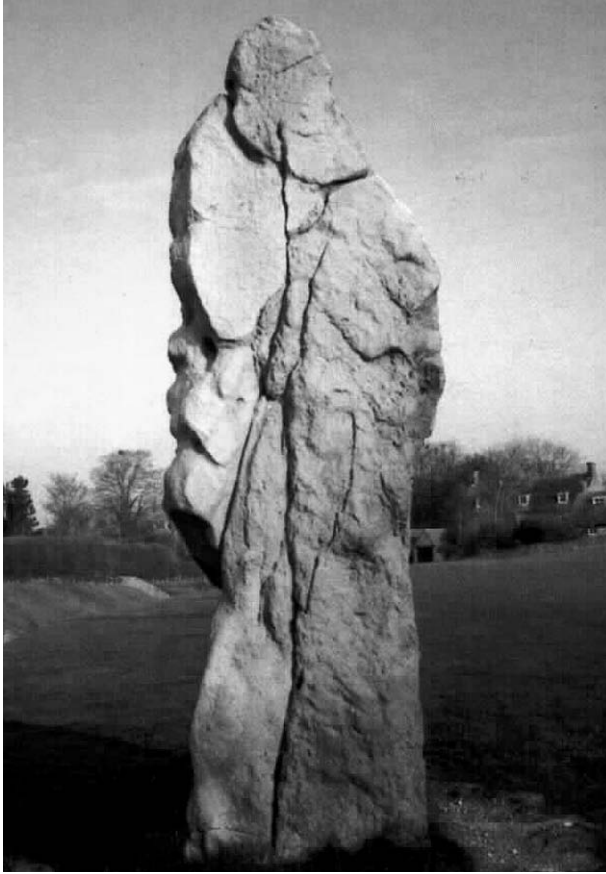


Figure 2.7: One of Avebury's megaliths. Do you see a human profile on the right, on the left, or on both sides?

The date of Avebury is more or less the same as the first phase of stone construction at Stonehenge, around 2800 to 2700 BC. You get a different feeling at Avebury, though. There is an intimacy with the monoliths, and what's more, there is a living, functioning, modern-day village inside the outermost circle, the construction of which unfortunately involved the removal of a number of stones—all of which makes it more immediate. A popular game there consists of finding human faces and profiles on the stones, with “game” being the operative word. While no one will deny that some of the configurations of bumps and fissures and pores thus “discovered” are interesting, that is a far cry from assuming they were created deliberately. Nevertheless, the stones here seem to have lives and histories of their own, like the “Barber Stone,” which fell in the 14th century upon a man, probably during an ill-conceived attempt to remove it, killing

him. The body, exhumed in modern times, turned out to be that of a barber, accompanied as it was by scissors and a razor, the signature tools of the trade.

Looking south from Avebury, one's eye is drawn to a hill—a strange hill, disturbingly regular, similar to one of those monovalves that cling to ships' hulls and coastal rocks, a great big barnacle. It is Silbury Hill, which is not, of course, a hill at all. It is a man-made structure, the largest of its kind in Europe, 40 meters high (equivalent to an 11-story building) and 160 meters wide. To build it, not less than 300,000 cubic meters of material were displaced. I say "material" because I want to distinguish it from mere "earth," for it is a mistake to think of Silbury as a pile of dirt.

An object as massive as Silbury, had it been conceived as an accumulation of soil, would not have stayed there very long. After a while it would have begun to erode, to wash and wear away, such that within a few hundred years it would not have been much more than an amorphous lump.

Yet there Silbury stands, intact, as if it had been built last week, wearing its minimum of 4300 years remarkably well. It would be more appropriate to call Silbury a pyramid rather than a hill, because when it was built it would have been as resplendent as the pyramids of Giza, similarly faced in limestone cladding. To ensure its stability, its builders made stone foundations and a core of alternating layers of impermeable mud. They almost certainly proceeded in an upward spiral rather than using the



Figure 2.8: Silbury Hill

method of stepped terraces, as was thought up until recently. In any case, no one knows why this object, unique in all the world, was built. One thing is for sure: Silbury is not a tumulus—that is, it was not built for funerary purposes (or, should I say, no tombs have ever been found there).

Not far from Silbury, however, is West Kennet, a large chamber tomb. West Kennet is extremely ancient, built around 3700 BC, and consists of an oblong corridor built with huge sarsens and then covered with earth. The corridor ends in a system of three chambers, one central and two lateral, which were used over a long period of time, as the many remains found there attest.

Avebury is thus the center of an extremely complex sacred landscape constructed over the course of the centuries. Because it is composed of separate and distinct monuments that nonetheless are clearly harmonized between them, there is the strong suspicion that the whole thing was developed according to an overarching design. This suspicion was first voiced in the 18th century by the antiquarian William Stukeley, who proposed that the complex seen from above represents an enormous serpent coiled on a ring. Despite the fact that this image probably has *nothing* to do with the aforementioned overarching design, it is right to credit Stukeley with the originality of his idea to interpret an ancient sacred landscape as a monumental replica of an image—an argument that, as we'll see, is central to this entire book.

2.6 Skara Brae

Visiting these enigmatic places, the obvious question is, why were they built? Until now, though, we really have not seen anything that tells us much about the builders. At Stonehenge some deer-horn tools were found that enabled us to date the site, at West Kennet a few dozen tombs, and then the inhumations dispersed here and there at Carnac and Newgrange. That's all. To try to understand a little more, we move further north, to the Orkney Islands of northwest Scotland.

In the winter of 1850 a singularly violent storm slammed into the Orkneys and the winds stripped away enough earth to reveal a group of structures buried in a hill known as Skara Brae. A summary excavation was conducted in 1868, but it was not until the 1920s that a more complete study brought to light a human settlement that, for lack of a better idea, we tentatively call a "village." Obviously, everyone at the time thought they were looking at an Iron Age site, and this assumption remained unchallenged until the early 1970s, when carbon dating blew it, quite literally, back to the Stone Age:

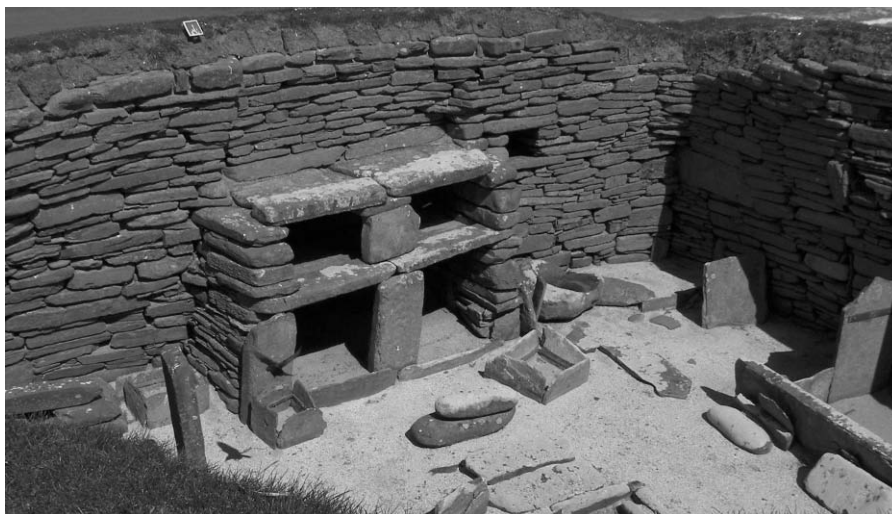


Figure 2.9: Skara Brae: one of the house's furniture.

Skara Brae is a neolithic site, 2000 years older than first thought, already inhabited by 3300 BC.

The village is small, composed of only eight dwellings. These dwellings are connected by roads and configured carefully according to a preestablished plan. A system of drainage ditches not only kept the area dry, but was connected to what are probably history's first toilets, one in each dwelling, thereby also making it history's first sewage system.

One often hears it said half-jokingly that seeing Skara makes you wonder if the Flintstones are going to appear around the corner any moment and invite you to stay for dinner. I don't find this amusing because, as we will see, the people who lived at Skara Brae were not kidding around. In any event, the homes, each about 36 square meters with no internal partition walls, do indeed appear as if they had been just recently abandoned. They all conserve their original stone "furniture," which are objects that resemble the corresponding modern ones, but we have no proof that they had the same function. We thus have a "dresser" with shelves, two "beds," a central "hearth" often coupled with a "bench," and a sort of stone box set into the ground. Simple decorations adorn some of the beds and walls, in which some scholars have even wished to see inscriptions. A number of curious smaller objects were also found at Skara. They are for the most part carved stone balls with a surface like that of a hand grenade for which no one has been able to hypothesize a practical function (similar objects have been found elsewhere in the Orkneys and on the Scottish mainland).

The Skara site was built on a midden, meaning a preexisting mound of garbage, compressed in such a way as to provide a layer of insulation against the brutal weather. Moreover, once built, the inhabitants would pile up their refuse around the perimeter. We have been able to analyze the many strata of refuse accumulated over the centuries, which is why we know as much as we do about everyday life there. We know, for example, that the Skara Braean diet was varied and complete.

Skara Brae presents a number of singular features. First of all, though it was inhabited uninterruptedly for about 600 years, the dimensions of the settlement remained substantially unchanged, which makes it very difficult to imagine it as a true village, inhabited by a self-sufficient community that would be, by definition, subject to demographic variations. The layout of Skara Brae entails a passageway covered with slabs of stone that conducts from the first to the sixth “house” in succession, while the seventh is reached by a deviation from the main corridor, and the eighth is the only one accessed from the outside. Post holes indicate that the entrances to both the village and to the individual dwellings could be closed from the inside by stone doors (the seventh unit, however, closed from the outside, and was thus perhaps a storeroom or prison). The modular, repetitive disposition of furnishings inside each dwelling is clearly indicative of planning, of a governing order to which each space had to conform. Skara Brae looks like a recently remodeled hotel, all its rooms identical.

But upon further reflection, we realize it looks like other things, too. It looks like a monastery, an ordered system of identical cells. Or better still, a guest house for a university, built in a sacred landscape. The Orkneys are in fact scattered with numerous megalithic monuments, particularly the area around the gulf of Stenness, not far from Skara, a dozen or so square kilometers that encompass the Stenness and the Brodgar stone circles, the Maeshowe tumulus, the neolithic “village” of Barnhouse, and various other monuments.

The Brodgar circle, perhaps more recently built than Skara (2500 BC) is a ring of megaliths looking out onto the “loch” (saltwater lagoon) of Stenness. Originally composed of 60 upright stones disposed in a circle 104 meters across, the ring is bounded by a ditch cut into the living rock, 6 meters wide and 3 meters deep. The only tools available to cut this rock ditch were other rocks, most likely used as percussors, a method requiring unimaginable time and patience (the only possible alternative would have been to cut holes with other stones and then insert dry sticks that, when moistened, would expand and split the rock; this method, however, is not documented in megalithic cultures). The Stenness stone circle, which dates to around 3000 BC, vaunts the largest megaliths of all the Orkney monuments, some as tall as 6 meters

and weighing several dozen tons. The stones, which were quarried about 3 kilometers north of Skara Brae, are sharp, almost cold, and give the visitor a strange feeling of aloofness and distance. Though only four of the original 12 stones remain standing, it is clear that they were configured inside a henge with a diameter of about 44 meters; the surrounding ditch, also cut into the rock, has a north entrance. Curiously, we are fairly certain that the ditches of this and other henges in the area were filled with water for most of the year. The result—large mounds with “rings of water” delimiting the stone circles—was thus an imitation, a *replica*, of the surrounding landscape: the promontory of Stenness itself (Richards 1992, 1996).

The entrance to the Stenness Stones points toward Barnhouse, a neolithic settlement similar to but preserved rather less well than Skara Brae. Discovered by Colin Richards in 1984, it is composed of 15 buildings, the majority of which are analogous to those at Skara, replete with “dressers” and “beds.” Two of the structures, however, are markedly different from all the others: structure 8, oriented to the northwest; and structure 2, oriented to the southeast.

Structure 8 is strongly reminiscent of the stone circle at Stenness. It is extremely massive, and surrounded by an external ring. Some sort of ritual use is suggested by a number of features, such as the fact that the central hearth does not seem to have been used to cook food. Structure 2 is divided into two rooms, organized internally much in the same way as the nearby chambered tomb, Quanterness; it is perhaps no accident that a large stone vessel containing human remains was found a few meters from the entrance. As for the building technique, it is identical to that of the Maeshowe tumulus, just up the road.

Maeshowe is a circular mound, 8 meters high and 35 meters wide. Inside is a corridor built with enormous slabs of stone weighing up to 30 tons each. It is oriented to the southeast and terminates in a large central chamber surrounded by three smaller cells, the entrances to which could be closed by slabs that are still in place today. The scarce human remains found in just one of the cells allow us to date Maeshowe to around 2700 BC. Archaeologists agree that it was the communal tomb of the Barnhouse settlement, despite the curious fact that the sole entrance to the corridor was designed to make it easier to close *from the inside*.

Maeshowe is also of interest to medievalists. In fact, during the 12th century the Vikings visited the tumulus and, in keeping with millennia-old tradition of “extemporaneous epigraphy” (i.e., graffiti) that persists to this day, they left signs of their passage in the form of runic inscriptions. Reprehensible a practice though it may be, graffiti sometimes re-humanizes ancient monuments, transforming them from mute objects to living

witnesses of the history that has unfolded before them. Anyone who climbs to the summit of the Great Pyramid of Giza, for example, sees that it is covered with inscriptions left over the course of 4500 years of history. At Maeshowe we encounter, among others, a love-struck Viking who wrote, “Ingigerth is the fairest of all women,” and a group of Crusaders who signaled the presence of a treasure there. There is also a Viking saga that tells of a certain Harald, who was driven to madness after spending a night in the tumulus.

While there is no real proof that Maeshowe was a tomb, a communal necropolis was found in 1958 further to the south, at Isbister. Here we have a large rectangular stone chamber divided into three alcoves. Known today as the Tomb of the Eagles, it was used for about 150 years from the date of its construction, around 3000 BC. One of the three alcoves was found intact and full of human remains belonging to at least 342 individuals. The name of the tomb derives from the intriguing fact that beneath these remains was a layer of human bones mixed with white-tailed eagle bones. Traces of ceremonial activities, such as deliberately broken ceramics and bones of animals that may have been sacrificed were also found in the environs. The white-tailed eagle, a magnificent bird of prey with a wingspan of more than 2 meters, was once common in the Orkneys. It is difficult to interpret the significance of the raptor bones in the tomb, but the fact that the human bones were arranged in an orderly manner after having been stripped of flesh has led some to postulate that the eagles were connected to a cult of the dead not unlike that which was present in some communities in India, where the bodies of the dead were left out in the open until the bones were picked cleaned by birds. The hypothesis remains, however, unproven.

So this is essentially what we know about how the inhabitants of Skara Brae lived, which means we know that transporting enormous megaliths, cutting ditches into living rock, and building tumuli and mounds were normal activities for them, until something suddenly happened and changed all that. Gordon Childe, always in search of invaders waving the magic wand of civilization, proposed that Skara Brae was abandoned under dramatic circumstances. There is no proof of such circumstances, or of invasion of any kind, though it is clear that the site fell into disuse rapidly. Some think that neolithic society in general underwent a transformation that saw small rural communities become larger cultural units, with farming families more widely dispersed over territory that had somehow become safer to occupy. This transformation would ostensibly be proven by certain large monuments in the Orkneys built after Skara Brae, such as Brodgar. However, the age of the megaliths comprises an extremely long an arc of time, and Skara, like its sister site at Barnhouse, dates from this period.

But the questions that concern us here are, What can Skara Brae tell us about megalithic builders? More precisely, what can *the stones themselves* tell us about who built them, and why?

2.7 From Norman Lockyer to Gerald Hawkins

Everyone “gets” Stonehenge; all you have to do is look at it. Wherever we happen to be standing, we have an intuitive sense of the cardinal directions, and this is all one needs to realize that the central axis of Stonehenge—that is, the line that splits the “horseshoe” symmetrically—is oriented east of north. And if you check to see at which point the sun rises on the day of the summer solstice, you will not be surprised to find that it corresponds *roughly* with this axis. Stonehenge is the first example we encounter in this book of a monument oriented astronomically: its central axis was aligned such that, on the day we call June 21st, the sunlight would make its way to the center of the circle, with the same phenomenon occurring at the winter solstice sunset. We could argue endlessly about the accuracy of this alignment, which is *not* good, but the fact that the phenomenon occurs, and that it does so because the builders intended it to, is undeniable, and that intention governed *a priori* the design of the monument’s most magnificent part, the horseshoe.

This is therefore the only information that the builders left us in writing. Granted it is written in stone, and with stone, in the language of the sun and of the stones. But it is nevertheless written; it is there, forever. Consider this: if it is the only thing they left us in writing, maybe it would not be too heedless of us to assume that it might be important. Perhaps it allows us to read something else there, something we had not noticed.

The first person to think this way was the astronomer Norman Lockyer, toward the end of the 19th century (Lockyer 1906). Lockyer is mentioned quite often in this book, because he is the founder, or at least the precursor, of the study of the connections between ancient monuments and the astronomical knowledge of those who built them. Lockyer tried to date Stonehenge by considering the fact that the position of the point where the sun rises at summer solstice shifts ever so gradually over the course of the millennia, thanks to a slight variation of the *ecliptic*, which is the plane defined by the movement of the earth and the sun (see Appendix 1). He failed, and we will see why in a moment. But what is important is that it was the first time that anyone had tried to *astronomically anchor* the date of a monument, which is to say calculate the date of its construction on the basis of its astronomical alignment.

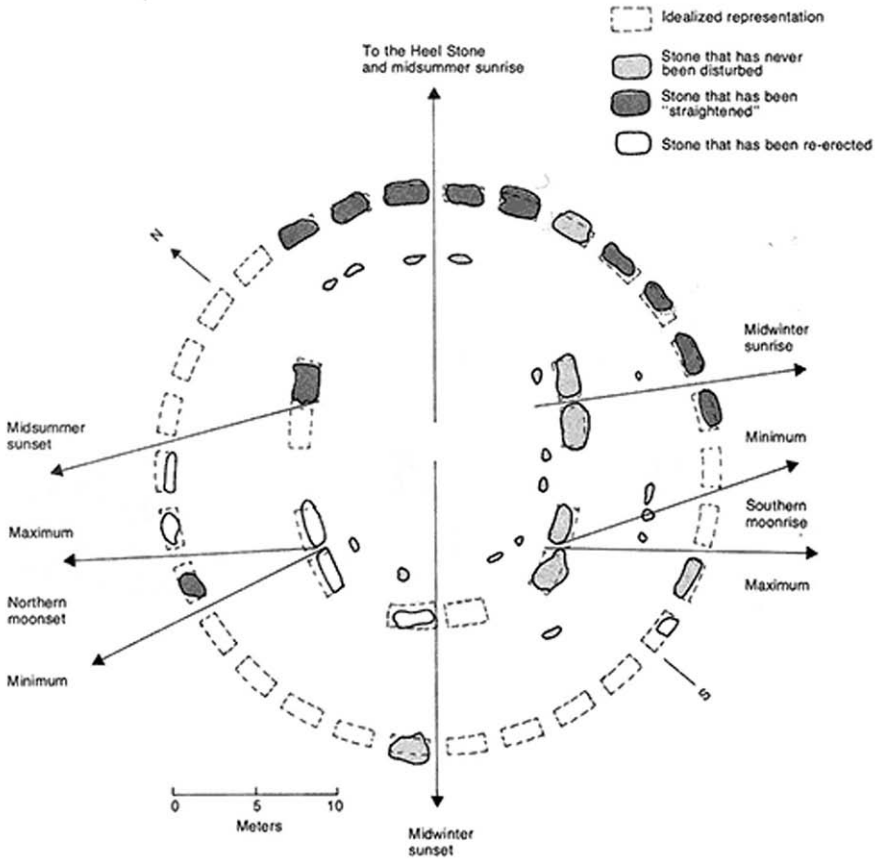


Figure 2.10: Stonehenge alignments according to a famous work by G. Hawkins

The variation of the ecliptic plane is an infinitesimal effect, so in order to determine the dislocation of a solstitial direction over the centuries, we need to know the original alignment with exactitude. Lockyer wrongly hypothesized that the alignment of Stonehenge was calculated using a small hill on the horizon, a hill that we now know is man-made and dates much more recently than the monument. Consequently, Lockyer's attempts have often been fiercely criticized, and still today one runs across sarcastic comments, such as the one present in the Stonehenge "bible"—or so it presumes to be—by C. Chippindale (1994). The authors of these comments, however, would do well to remember that the date of 1800 BC that Lockyer courageously proposed more than a century ago was a lot closer than anyone else was able to come before the era of radiocarbon dating.

After Lockyer (who was also a pioneer in the astronomical alignments of the temples of Egypt; see Chapter 4), the investigations of the astronomical

content of ancient monuments were interrupted until the 1970s. Furthermore, as we have seen, anything resembling *megalithic thought* was dismissed out of hand, so the solstitial alignment of Stonehenge was seen as little more than a curiosity. The first person to rekindle interest in the astronomy of Stonehenge was Charles Newham, an astrophile whose work was followed by the “scandalous” studies of a young astronomer, Gerald Hawkins.

In his famous book *Stonehenge Decoded* (1964b), Hawkins analyzed the configuration of Stonehenge partly from the idea that there could be, in addition to the solar alignment of the central axis, other astronomical alignments (see also Hawkins 1963, 1964a; North 2007). And in fact Hawkins quickly found a great number of alignments, especially lunar ones. Being defined by stones only a few dozen meters apart, the alignments are not particularly precise, and today we know that most of them are likely to be casual. However, at that time, the young scholar’s enthusiasm and his impetuous manner of presenting his findings made him easy prey for the unanimous criticism of the archaeological establishment, and it was in fact for Hawkins’s benefit that Richard Atkinson (1966), one of the most active Stonehenge scholars, coined the historical phrase that its builders were nothing more than “howling barbarians.”

2.8 A Satisfied Visage

I do not know whether the builders of Stonehenge were “barbarians” or if they “howled.” (When Italy won the 1982 Football World Cup, I painted my face blue and I howled. If that makes me a barbarian in the eyes of some, then so be it.) In any case, Hawkins irrefutably attracted attention to the fact that the celestial cycles held great interest for the builders of Stonehenge. The important point is that Hawkins’s work, while controversial and bitterly criticized, sparked a rebirth of interest in the astronomical alignments of ancient constructions and in the concomitant astronomical knowledge the builders must necessarily have possessed, an interest that evolved into what we call today by the somewhat ungraceful—at least in my view—term of *archaeoastronomy*.

One of the most charming examples that fully demonstrates the enormous charm of this discipline is the discovery of the astronomical alignment at Newgrange. As we have seen, the central passageway of Newgrange is oriented toward the southeast, and a simple measurement shows that it is lined up with the point where the sun rises at the winter solstice.

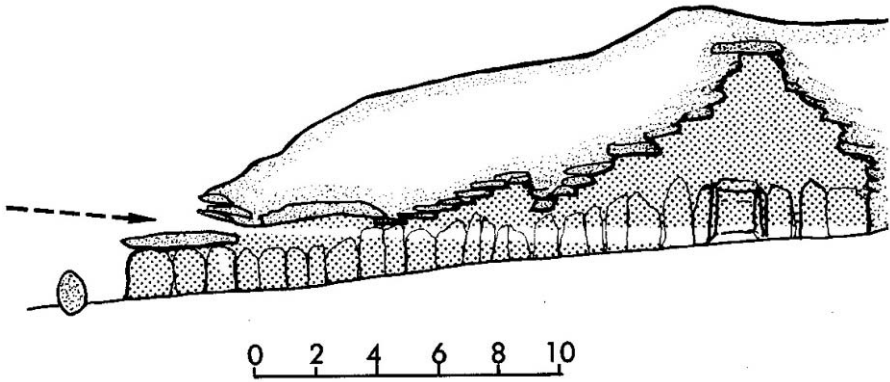


Figure 2.11: Newgrange. Section showing the path of the sun light at winter solstice.

It is natural to assume that this was intentional—obviously so, I would say. However, because of the slightly upward incline of the passage, the sunlight that enters through the door, in alignment with the winter solstice, does not reach the central chamber, stopping short at some point in the corridor. It has therefore been thought that, even if there had been the intention to build an astronomically aligned structure—a dubious notion in itself—the builders of Newgrange just were not up to the task, and failed. This would mean that 5000 years ago, someone built a monument involving thousands of tons of earth and rock, covered it with quartz like a giant jewelry box, carefully measured the direction of the sunrise at winter solstice to line up a corridor built with stones as heavy as many elephants together, but the whole point of it—that the sunlight should reach the central chamber at midwinter—falls apart because the person who designed it miscalculated the inclination of the corridor.

Pity, he must have thought. Maybe next time. But then again, his failure should not surprise us, what with his being a “howling barbarian.”

Up until the restoration that took place in 1969, no one had ever realized that there is a narrow window above the entrance of Newgrange. Over the window is a slab inscribed with a diamond motif repeated eight times; on the sides of the opening are two blocks of quartz that served as shutters, and show signs of having been used repeatedly.

The window now freed from layers of sediment accumulated over millennia, on the night of December 21, 1969, Michael O’Kelly, head of the Newgrange restoration, entered the corridor, *closed the door*, found a comfortable spot in the inner chamber and, yes, waited for dawn.

As soon as the sun peeked over the horizon, its rays penetrated the

corridor *through the window* for the first time after thousands of years, deftly traveled the length of the passageway—the slope of which, by the way, turns out to have been accurately calibrated with this aim by the architect (sorry, the howling barbarian)—to shine upon the satisfied visage of O’Kelly and illuminate the central chamber, exactly as it had been engineered to do.

2.9 Alexander Thom

In a certain sense, then, one could say that the sun on O’Kelly’s face, filtering through that window at Newgrange for the first time after who knows how many years, marked the birth of a new science. If Lockyer was its precursor and Hawkins the pioneer, credit for the first systematic theoretical treatment of this new discipline goes to an affable and very resolute Cambridge professor, Alexander Thom.

Thom began taking an interest in the astronomical orientations of the megalithic sites in Britain and in Brittany during the 1950s. His field studies, in which his son Archibald later joined him, extended over several decades and touched upon thousands of sites (Thom 1967, 1971; Thom and Thom 1978). According to Thom, the purpose of megalithic monuments was mainly, if not entirely, astronomical, and they were intended for the observation not only of the solar cycle but also of the lunar cycle (the lunar stations are the extreme points of the rising and setting of the moon through a cycle of 18.6 years; for more detailed information, see Appendix 1). Because observation of the lunar stations is fraught with practical difficulties, including the rather fundamental problem that the rising of the moon is not always observable, we must allow that megalithic astronomers were able to determine the points where the moon rises and sets on the horizon on the basis of observable intermediate positions. Clearly, familiarity with geometry and mathematics would be indispensable for such operations (even though as recently as the 1970s, archaeologists thought of megalithic man as a grunting, barely human beast, and that there are a few who still think so today). And here we see the second key point to have emerged from Thom’s research, which is that the degree of knowledge of these disciplines had to have been at least up to the task of applying them practically. For example, Thom discovered that many large stone henges are not circular but ovoidal, or half circular and half ovoidal. These forms were obtained by using ropes and poles to lay out quite complex geometrical configurations, many of which are based on those right triangles that are called “Pythagorean”—that is, having all integer legs. The Thom found evidence of their extensive use, particularly the 3-4-5 triangle, but also, for

example, one whose sides measure 12-35-37 ($12^2 + 35^2 = 37^2$; try it to believe it).

One of the best conserved sites in which the geometrical constructions discovered by Thom are visible is Castle Rigg. Castle Rigg is a stone circle built in a splendid setting, on a plateau in the mountains around Lonsdale, England. It is made up of 35 large stones arranged according to a rather complex plan that was laid out in the following way. First, an alignment with the southern major lunar standstill was marked off with two monoliths set 32 meters apart. This line was then used as the base diameter for a semicircle



Figure 2.12: Alexander Thom at the base of the Grand Menhir

inscribed onto the southwest side. On the northwest side, the figure was “ovalized” by the intersection of three circular arcs, the outer two with a radius equal to one third of the base diameter, the internal one with a radius equal to the distance from the point of intersection to the center of the semicircle. (Don’t ask me why ...).

Another point that emerges from the enormous mass of data collected by the Thoms is the probable recurrence in the design of a great many megalithic monuments of a unit of measure equivalent to about 41.5 centimeters. It would be worth it to be able to officially name this unit of measure a “Thom,” as scientists do in physics, where units of measure take the names of the people who discovered the laws of the phenomena they measure (the newton, the ohm, etc.). Unfortunately, however, Thom let himself be swayed by the fact that the double of the unit he had discovered, 82.96 centimeters, is very close to the value of the modern English yard. This is probably coincidence, since all units of distance are vaguely similar because they derive from measures that are naturally available to us—the length of an arm, a forearm, the spread of both arms, a stride. Thom was obviously aware of this, but he nevertheless decided to call this unit of

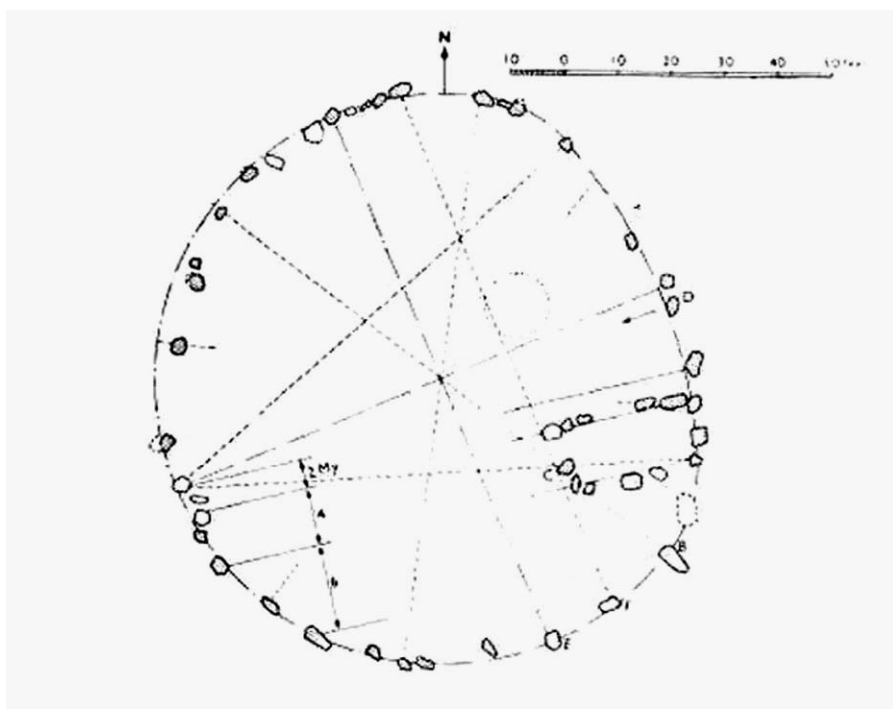


Figure 2.13: Castle Rigg in Thom’s survey

82.96 centimeters a megalithic yard, probably in the interest of making it more easily legible (for British and American readers, anyway). He also introduced the megalithic inch, equal to $1/40$ of a megalithic yard.

As a consequence of choosing this value for the yard, double of the unit probably utilized by the megalithic cultures, all the measurements consisting of odd-numbered multiples of the real unit come out with a fraction dangling clumsily off the end, not only compromising clarity but also encouraging the pettiness of those would present it as proof that Thom was a mad fool for thinking that megalithic man used the English yard. So, despite several pieces of evidence found by Thom, many scholars continue to doubt the existence of the megalithic yard. Even worse, I myself have listened firsthand to an archaeologist (whose shall go unnamed) maintain that Stonehenge was built “using the length of a stride.” If this is so, we can imagine the following exchange (Stonehenge, 4500 years ago):

“Would you mind moving that 50-ton trilith just a bit to the right? I’m concerned that the solstice sun may not get through.”

“How much? An arm? A stride?”

It is abundantly obvious, or should be anyway, that any architect of any period would need a precise unit of measure in order to plan a monument as complex as a henge, and the notion that something like, say, Avebury could have been built “by eye” is patently absurd. Thom’s idea, however, goes well beyond this, for in his view megalithic societies used the *same* unit of measure in a large variety of monuments, and this has far greater ramifications than the relatively simple problem of designing a specific monument. There are many sites, some quite distant from the others, where the use of the megalithic yard looks convincing, though it is difficult to ascertain whether a “standard” was used or whether it was the similarity of some human-related measures (e.g., the arm) that influences Thom’s measures. At Woodhenge, for example, though all that remain are the post holes, it is still possible to make measurements as to how the oval rings of wooden posts were laid out. There are six such rings with circumferences of 40, 60, 80, 100, 140, and 160 megalithic yards and whose axes of symmetry are oriented toward the summer solstice (perhaps one day someone will figure out why there is no 120-yard ring). Other examples can be found on Lewis Island, in Scotland, home of Callanish, a complex megalithic structure composed of a stone circle 12 meters in diameter with a large monolith and the remains of a burial chamber in the middle. Two parallel lines of stones run east of north for 80 meters, while other lines marked by stones point east, south, and west, giving the site the aspect of a bent cross. The interest in astronomy of the builders of Callanish is apparent in both the north-south alignment and the northeast arm, which indicates the direction of the

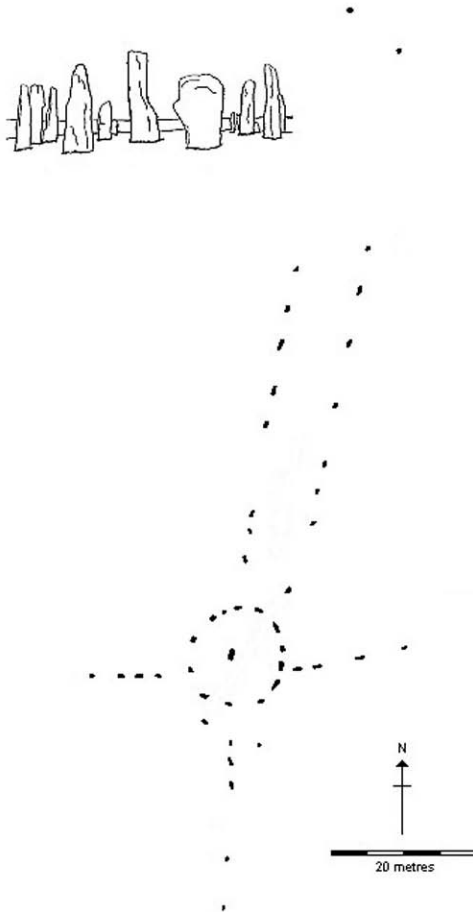


Figure 2.14: Callanish

moonset azimuth at the southern major standstill (Hawkins 1965, Ruggles 1999). Twelve kilometers from Callanish is the beach at Dalmore where a neolithic village was discovered in 1982, yielding a number of interesting artifacts. Among them was a piece of bone 3.4 centimeters long with notches between 4.9 and 5.1 millimeters apart, which might have served as a ruler for megalithic inch measures (Ponting 1988).

The results of Thom's surveys can be summarized as follows:

1. Megalithic builders had a complete and somewhat sophisticated knowledge of solar and lunar astronomy, and their monuments included observational purposes; in many cases Thom found monuments built on sites chosen specifically for their relation to pronounced irregularities of the horizon line, which facilitated

astronomical observation (astronomical use did not, of course, exclude other uses and meanings—religious ones, for example—of which, alas, we are unaware).

2. The megalithic builders' understanding of geometry and mathematics was enough to enable them to build quite sophisticated geometrical constructions, such as oval rings plotted with intersecting circular arcs. Often the starting point for these constructions was a triangle with all integer legs (the reasons for this remain unknown).
3. There is a remarkable uniformity in the planning of megalithic sites; there are also hints at the widespread use of a common unit of measure that Thom called the megalithic yard.

Let us look at how astronomy was used, according to Thom, in the places we have visited thus far. In Thom's view, Carnac was an astoundingly large and ambitious grouping of lunar observatories. The heart of the Kermario complex was the Le Manio Menhir, the departure point for a number of long alignments. The Grand Menhir also served as a reference point for long, precise alignments that parted from Locmariaquer, passing among various tumuli and menhirs to indicate the limits of the lunar stations. It is possible that this great interest in the moon exhibited at Carnac, apart from the likely purpose of predicting the eclipses, arose from its builders having made the connection between the moon and the tides, which in Brittany are an extremely significant natural phenomenon (recently, the Thom's' astronomical interpretation of the site has been strongly criticized, particularly with the thesis that the Grand Menhir could have toppled while it was being erected; however, there is no other available reasonable explanation today for having transported tens of thousands of tons of enormous stone blocks to Carnac, and the whole question fully merits a complete reexamination from scratch).

In Ireland, every element of the sacred landscape of the Boyne Valley was designed to serve some astronomical end. At Newgrange, in addition to the winter solstice alignment we have already seen, there are numerous aspects of the carved inscriptions that suggest the study of both the solar and lunar calendars. One of the corridors at Dowth is oriented toward the winter solstice, while the presence of 18 tumuli in the Knowth group seems to indicate a connection with the lunar cycle; in fact, Knowth 2 and 4 are aligned with the northern major lunar standstill, and several of the figures carved into the stones can be interpreted as lunar calendars. Finally, at Loughcrew, "Tumulus T" bears a striking structural resemblance to Newgrange, though its east-west orientation suggests that its meaning was probably different.

In the Orkneys, the main focus was on the solar cycle. Maeshowe, for

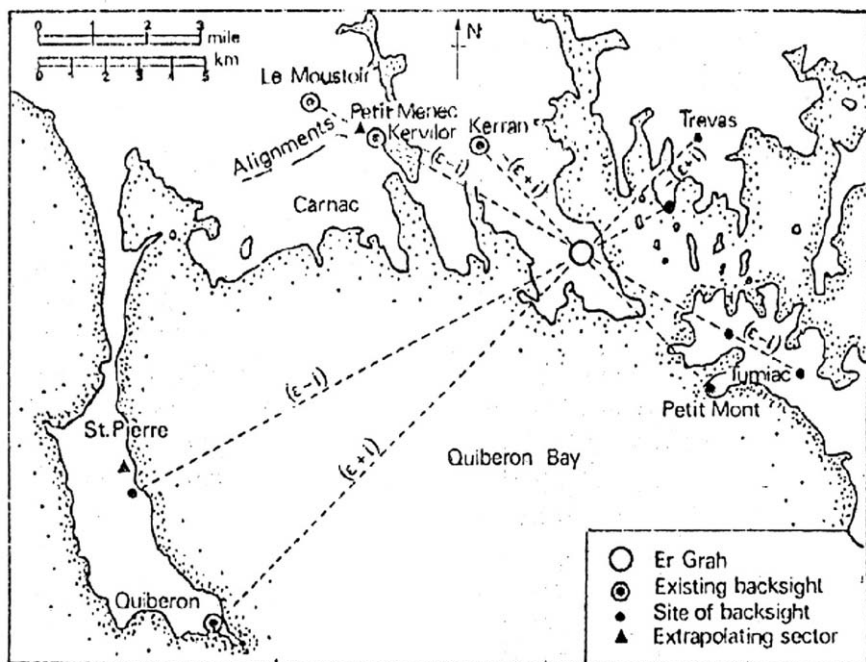


Figure 2.15: Alignments in the Carnac landscape according to Thom

example, is aligned with the setting of the winter solstice. The last rays of the setting sun filter through the complex to illuminate the central niche, immediately after which the sun disappears behind the Barnhouse Stone, in alignment with a tumulus several hundred meters away. Structure 2 at Barnhouse is aligned with the rising of the sun on that same day, while structure 8 is aligned with the summer solstice. As we have already seen, these two structures are probably contemporary and played complementary roles, the exact nature of which continues to elude us. We find at Maeshowe a phenomenon that I personally have always found exceptionally intriguing—as certainly did the neolithic astronomers who built it: looking from Maeshowe toward the western horizon, for some 20 days on either side of the winter solstice, the setting sun disappears behind the crest of Ward Hill, and then rises again for several minutes at the base of the hill. This extraordinarily beautiful event occurs because the sun's trajectory takes it behind the hill's shoulder-like protuberance, interrupting the line of sight from Maeshowe. (Plates 3 and 4)

As far as Avebury is concerned, oceans of ink have been spilled in its name, not to mention rivers of inanity that run from “telluric currents” to the “representation of the human egg cell.” In truth, very little is certain

about this monument. The Thoms, discouraged by the incompleteness of the remains (Avebury had been used for centuries as a ready-made deposit of quarried blocks), preferred to concentrate on how the complex geometry of the three circles was determined, one of their conclusions being that it had been necessary to inscribe a circular arc fully 750 megalithic yards long—that is, 723 meters. This is a colossal measurement to plot when all you have to work with is rope and poles, if only for the fact that it would have been impossible for the persons on opposite ends of the arc to communicate by voice. Finally, the purpose of Silbury Hill remains utterly mysterious, although the prospect of reading it as an astronomical observatory is rather tempting.

2.10 The legacy of Thom's Work

The work of Alexander Thom has had a profound effect on the way that many scholars, myself included, look at megalithic civilization. Indeed, it is difficult to imagine that the homogeneity of methodology and purpose, the precision of calculation and observation, and the likely use of a shared standard of measure do not point to a complex network of communicating civilizations, cohesive in certain ways despite the absence of any central power. The archaeologist Edward Mackie (1977, 1981, 1997), basing his work on Thom's findings, developed this idea into a comprehensive theory that frames ancient astronomical activity in a social structure of megalithic builders. Mackie maintains that there is sufficient archaeological evidence at Skara Brae, to name just one example, to hypothesize the existence of a hierarchical social structure at the top of which was an elite class of astronomer-priests, for lack of a better term, whom he likens to Mayan priests (see Chapter 8). They would have had their own residences, as well as spaces where they would teach their apprentices, an example being the "guest house" at Skara. The level of knowledge possessed by these individuals was necessarily high, as Mackie demonstrates by evoking the studies of Thom.

Mackie's thesis sounds convincing, and I will explain why in the more general context of Chapter 15. Nonetheless, in the 1980s and 1990s, the work of Thom and, by extension, Mackie's interpretation of it were subjected to heavy critical revision, exemplified in a volume published in honor of Thom, *Records in Stone* (Ruggles 1988), which contains a number of contributions that are critical about many aspects of Thom's work.

The position from which Thom's work was criticized holds that he had overestimated the technical capacities of megalithic builders grossly enough as to have upgraded a "symbolic" interest in the sky to scientifically based

astronomical practices. In particular, Clive Ruggles (see Ruggles 1999 and the references cited therein) rigorously reexamined many of the sites studied by Thom. When the new measurements are plotted on a histogram, Thom's "peaks," which indicate noteworthy alignments, are dramatically blunted, the science of the megalithic builders shrinking along with them to become a matter of "purely symbolic interest." Lying at the root of these discrepancies is, for instance, the fact that Thom occasionally committed technical errors (understandably, given that he studied thousands of sites). But the discrepancies are mainly owed to an "amplification" effect resulting from the data selection criteria used along with the involuntary prejudices intrinsic to such choices. This effect can manifest itself in a number of ways. For example, if there are five possible horizon alignments in a group of megaliths and two prove to be astronomically significant, recording only these two gives the site a statistical weight that it would not have if all five were recorded. If an alignment incorporates a monolith 2 meters wide, the direction it defines will change (and can be made to appear more or less accurate astronomically) if the line is run through the center as opposed to off of the upper left or right corner. And so on. In some cases Thom considered intentional certain alignments that are in fact lacking any common archaeological context, inventing connections between, for example, standing stones of the Neolithic Age and tumuli of the Bronze Age.

The critical revision of Thom's work certainly casts serious doubts on many of his extreme ideas, such as his conviction that megalithic man used a calendar divided into eight seasons that survived, in modified form, to this day, filtered through the Celtic calendar (this included the feasts Beltane, around May 5, today's May Day; Lammass, early August, today's Feast of the Assumption; Samahin, early November, today's All Souls' Day; and Imbolc, early February, today's Candlemass). The widespread and accurate use of the same unit is challenged as well, together with the precision of many alignments. What concerns us most here, however, is the fact that the technical criticisms of Thom's work may have profound consequences for anyone attempting to base even a part of the study of ancient thought on archaeoastronomy, for to dismiss the observation of the skies in megalithic times as a matter of "purely symbolic interest" entails negating the possibility of an astronomical thought, which in turn dismisses any scholarly insight, via archaeoastronomy, about the megalithic thought as a whole. Thus, although I agree with most of the technical critics, I tend to disagree with the "reductionist" position they might imply.

First of all, the equation "low precision = symbolic knowledge" is somewhat misleading. There is, indeed, no absolute definition of precision. A clock that loses two minutes per year is very precise with respect to our

daily requirements, but terribly imprecise if it is being used to program a Space Shuttle mission. Any definition of precision must be conditioned upon the purpose for which the measurement is made. The sun, for example, is very close to the solstice point for a period of several days, which could have led people to believe that the inversion of the movement of the sun's rising point at the horizon was predicted for a certain day, without necessarily knowing whether the exact day had been predicted or not. Even if the degree of precision in such a case is not high by modern instrumental standards, it was precisely what was needed to establish the authority of those who made the predictions (see Chapter 15 for more on this point).

This preliminary observation aside, we then have the strictly technical problem of determining if the criticisms of Thom's research are applicable to *all* the monuments he studied. Indeed, as Mackie has pointed out—and I tend to be in agreement with him—it would be sufficient to provide a thorough demonstration (e.g., by including analyses not only of the astronomical aspects but of the complete archaeological context) of the existence of just a single site in which Thom's "high criteria" for precision had been met, and the "purely symbolic" argument would have to be reconsidered, without taking anything away from the importance of the critical studies of Thom's results.

As an example, Mackie studied an isolated and rather unspectacular megalithic site, Kintraw, on the west coast of Scotland. Kintraw is home to a small tumulus and a single menhir. It is difficult to imagine Kintraw as a gathering place, as the site of rites and ceremonies, so there must be another reason why the megalithic builders chose it. Thom had discovered a curious phenomenon that allowed Kintraw to lend itself to extremely precise measurements of the sunset azimuth of the winter solstice, a phenomenon similar to the one we encountered at Maeshowe: the "double sunset." Seen from Kintraw, the sun sets behind a rocky pinnacle on the island of Jura, then *rises again* for a few moments after having passed behind the pinnacle, finally setting definitively at the horizon. The thing is, you cannot really see this from ground level; you have to climb the tumulus. How, one might ask, did they know where to build the tumulus? Well, on the other side of the complex, on the side of a hill, Thom had found a natural clearing with a half-buried boulder that, when he stood on it, allowed him to calculate the alignment with precision. To test the validity of Thom's results, Mackie studied Kintraw with the aim of establishing whether there was any archaeological proof that would confirm the significance of this particular alignment. Although he did not find any datable archaeological material, he did discover that the aforementioned boulder which had appeared to be natural was in fact a pair of hewn slabs configured like a V: the slabs had

likely been placed there deliberately to mark the exact point from which to view the “double sunset” of the winter solstice. In addition to Kintraw, Mackie also studied other sites, such as the lunar observatory of Ballinaby, where “precise” measures are likely to have been performed (Mackie 1974; for discussion see Mackie 2002, Ruggles 1999, Ruggles and Barclay 2000).

New results on megalithic astronomy accumulate year after year, and though the debate on accuracy and megalithic science remains open, I think it has become impossible to deny the central role played by astronomical observations in the planning, construction, and use of megalithic monuments, so that Thom’s work will always stand at the foundation of this important achievement. An especially significant example of astronomically related megalithic monuments that has been well studied in recent years is that of the so-called *recumbent stone circles*, which can be found by the dozens in northeastern Scotland. They are circles of stones, all standing except for one, which is laid horizontally on the ground between two vertical elements to form a sort of altar. This singular disposition gives the circle a main axis of symmetry, creating a resemblance to the megalithic “sanctuaries” of the Balearic Islands, which we will discuss in the next chapter. As a rule, the axis of the recumbent stone circles is oriented west of south, and the archaeoastronomical studies of these monuments (Burl 1976, Ruggles 1984, Ruggles and Burl 1985) demonstrate beyond all doubt the interest of the builders in the azimuth of the southern major lunar standstill. The monuments were therefore used for rites that included observing the setting of the moon, which would have appeared to “sit” upon the recumbent stone, framed by the flanking vertical members.

Together with the problems of interpretation goes the question of the date of the earliest expressions of astronomically based architecture, which is continually being pushed further back into the past as archaeologists steadily make new discoveries. The last one was in 2003 in Gosek, Germany, where aerial photography revealed what remains of a henge of wooden posts approximately 75 meters in diameter, with three openings aligned, respectively, with north and the sunrise and sunset azimuths of the winter solstice. Carbon-14 testing of remains from the site gave a date somewhere around 5000 BC.

Mysteries and Discoveries of Archaeoastronomy

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Magli, G.

2009, XII, 444 p., Hardcover

ISBN: 978-0-387-76564-8