When we think about people building Stonehenge, we picture log rollers. But, argues Barney Harris, they were almost certainly not used

Moving megaliths: Time to park the rollers

From Charles II's physician to modern TV films, explanations for how ancient megaliths were moved always comes down to one thing: rollers. The theory, probably one of archaeology's longest-held beliefs, is that they would have allowed fewer people to move a heavy stone than if it was simply dragged over the ground. Everything we can see in experiments and ethnographic reports, however, shows there are simpler and more reliable ways of doing it. Not only is there is no evidence that rollers were actually used – it seems highly unlikely. This is not just about engineering. At the heart of the debate lie ideas about the abilities of people who did not have industrial technology and what it meant to build structures such as Stonehenge.

Archaeologists have put timber rollers under Easter Island statues, the giant stelae of Aksum, Ethiopia and, of course, the megaliths of Stonehenge. Rollers regularly appear in histories of technology and educational resources on prehistory. They are enshrined at Newgrange tomb, Co Meath, and Stonehenge, where life-sized, fibreglass replica stones set on rollers are seen by millions of visitors every year. They appear on interpretation boards at megalithic sites across north-western Europe, and from a BBC re-enactment in 1954 to an educational BBC animation in 2014. Yet experiments around the world have shown the technique to be highly impractical, of little benefit in terms of efficiency, and even downright dangerous. Contemporary megalith-building societies do not use loose, rotating rollers. So where did the idea come from?

Roll me a great stone

On September 18 1586, Domenico Fontana, a Renaissance architect, completed a four and-a-half month operation to re-erect a 327-tonne obelisk. It had been brought to Rome from Egypt by emperor Caligula in AD37, and Pope Sixtus V now wanted it moved nearer to the Vatican. Fontana lowered the obelisk onto seven wooden plinths on two long, wooden sledges, which were themselves balanced on some 30 loose rollers. With winches and capstans, 907 men and 75 horses hauled the obelisk along a track made of revetted, rammed earth. The ambitious achievement made news throughout Europe.

John Wilkins, a founding member of the Royal Society, described the works in his book Mathematical Magick (1648), inadvertently launching the notion of rollers into the antiquarian world. Some years later, Walter Charleton, physician to both Charles I and Charles 11, was instructed by the latter to produce a new study of Stonehenge. He was a student of Wilkins, and drew on the story of the Vatican obelisk when he wrote Chorea Gigantum (1663). How could such monuments as Stonehenge, he said, be raised without "the Leaver, Roller, Wheel, Pulley, Wedge, and Screw"?

This is the earliest reference to rollers I have found in in relation to building Stonehenge and though we might now question their relevance, Charleton's rollers were important in that they embraced the idea of rational, humanist prehistories based on material remains. This contrasts with earlier works which often invoked supernatural agency (in the oldest surviving text about Stonehenge, Merlin flew the stones from Ireland). In the 1720s, William Stukeley wrote a detailed description (not published until 2005) of how a megalith, fixed to a sledge laid on rollers which "slid upon another work upon the ground," might have been manoeuvred with levers – avoiding Fontana's "pompous apparatus".

After this, European antiquaries were more interested in the ethnicity of the megalith builders than their engineering. The fully-fledged roller hypothesis was not developed until the 19th century, with more rational, deductive accounts reflecting contemporary analytical thinking. Frederick VII's 1857 depiction of rollers at a Danish *hunebed* (megalithic passage grave) is the earliest known in print.

In Victorian Britain a significant sector of the scientific establishment still regarded the study of nature and history as serving theology. In 1840, pastor Robert Weaver noted that remarkably early references to the roller hypothesis could be found in the Old Testament. When Saul said, "Roll me a great stone" (Samuel), and when in Ezra it says "the second temple was built by stones of rolling," this meant, claimed Weaver, that buildings made with large stones were "erected by the aid of rollers". Thus stones "might be placed upon rollers… [and] a causeway might be prepared upon which the rollers might run," not just at Solomon's temple, but also at Stonehenge (he went on to argue that this authenticated the Bible).

Little known today, Weaver's work was well regarded at the time. A reviewer in the Gentleman's Magazine praised him for recognising the Bible as an "authentic source, even for secular history," and accepted that rollers were probably used to build Stonehenge. The explicit link between rollers and the Bible would later be reinforced by Austen Henry Layard. If Charleton can be credited with introducing rollers to megalithic construction, then Layard was responsible for cementing the idea within popular culture.

Wandering logs

In 1840, Layard—a young solicitor turned adventurer—left England for Ceylon (Sri Lanka). Along the way he stopped at Mosul, Iraq, where he learned of the spectacular Assyrian bas-reliefs unearthed at Khorsabad by the French. He quickly recognised the archaeological potential of the area and developed his own scheme to dig for antiquities at the nearby site of Nimrud. Over the next seven years he removed many neo-Assyrian sculptures from several sites in Iraq, nearly all of which he shipped back to London to be exhibited at the British Museum.

Layard also identified numerous sites referred to in the Bible. Nimrud was Calah from Genesis, and Kouyunijik was Nineveh itself, the legendary city described in the Book of Kings and home to King Sennacherib's Palace. While excavating Court VI in

Sennacherib's south-west palace, Layard uncovered a series of carved stelae. Each panel depicted a different stage in the quarrying and transport of a giant winged-bull statue. He vividly described how one revealed the Assyrians' exact method for transporting the colossus:

"The sledge was dragged by cables and impelled by levers… The sculpture moves over rollers, which, as soon as left behind by the advancing sledge, are brought again to the front by parties of men."

Layard's findings were hugely popular and stories of his exploits – along with his rollers – were broadcast to an unusually wide audience. Fraser's Magazine reported that simply "everybody read and talked of Layard". The roller hypothesis became firmly ingrained in public consciousness.

Yet there are problems with Layard's identification of rollers. First, the lengths of wood depicted on the stelae are, in fact, roughly trimmed branches with stubs where smaller branches had been incompletely removed. Such protrusions would, of course, have seriously inhibited their use as freely rotating rollers. Another problem is their orientation. Even in Layard's published drawings, numerous lengths can be seen lying parallel to the direction in which the sledge is being pulled.

Why was Layard so confident about rollers? Perhaps it was a simple mistake. But it should be remembered that he was writing at a time when science was eroding the canonical authority of the British establishment. Boosting the Bible's historical veracity had political resonance. Whether or not Layard was aware of Weaver's writing linking scripture to rollers, he certainly cited both the Bible and rollers generously throughout his own publications. Layard had himself hauled a winged-bull statue over rollers when he removed it from Nineveh. Using rollers balanced on timber rails, his team successfully dragged the statue some 200ft (60m) along a flat, pre-excavated track, before loading it onto a cart. Indeed, Layard could not resist suggesting that his own methods were comparable to the Assyrians'.

Rollers gained a further boost from the late 19th century when European archaeologists argued that log rollers represented a "missing link" in the evolution of locomotive technology: the natural descendant of the sledge, it was said, was the roller, from which the wheel had surely evolved. Civilisations that knew the wheel must, therefore, have known the roller, and their evident reluctance to employ it when moving heavy objects confounded archaeologists. In 1930, for example, two archaeologists described the transport of a colossal statue by 172 workers without rollers, depicted in an Egyptian painting from a 21st-dynasty tomb at Deir el-Bersha, as "subhuman in intellect".

By the 20th century experimental archaeologists were keen to test the now familiar roller hypothesis. In all but a few cases, they reported that they had successfully used rollers to move loads weighing above two tonnes over short distances (100–800m). However they encountered numerous problems navigating uneven ground.

At Stonehenge, for example, Richard Atkinson noted that the sledge carrying his replica bluestone slewed dangerously to one side when his team attempted to drag it obliquely uphill on rollers. He attached ropes to either side of the sledge with which more hands could anchor it, a change that nearly negated the "efficiency savings" that rollers supposedly offered. The instability caused by rollers proved disastrous for Charlie Love, whose attempt in the 1980s to move a replica Easter Island *moai* upright resulted in it tumbling over and breaking. Other Easter Island experiments encountered similar problems, with rollers jamming and wandering into one another, as has been seen in further experiments with bluestones. Jean-Pierre Mohen had 200 people drag a 32-tonne concrete block in Bougon, directly over rollers themselves balanced on wooden rails. It was an impressive feat: but his team dared not drag the stone over even slightly uneven ground.

Sledges and slipways

Ultimately, such experiments demonstrated the limited uses of rollers and highlighted Charleton's error, some 400 years earlier, in assuming that what worked for Fontana would also work in conditions likely to have been experienced by prehistoric megalith builders. Fontana's rollers ran on an even track of rammed earth that he had constructed, a luxury afforded by the comparatively short distance – some 250m – that he was required to move the obelisk. In contrast, the builders of megalithic monuments regularly had to extricate enormous monoliths from inaccessible quarries and transport them much further, often over very uneven terrain. The builders of Stonehenge, for example, needed to transport about 80 sarsen stones some 30km over rolling hills from their probable source on the Marlborough Downs. Away from Stonehenge, it is generally accepted that monoliths had to been moved up to 5km to create chambered tombs and stone circles.

Most recently thought has focussed on the dangers of assuming that all that mattered in megalith transport in the distant past was being "cost-effective". Social arrangements, it is said, were probably as important as engineering, especially if the very processes of transport and erection were half the reason for creating a megalithic monument in the first place. Organisers of traditional megalith-pulling ceremonies on the Indonesian island of Sumba, for example, would often seek to involve as many individuals as possible as part of a competitive display of wealth.

Social context aside, ethnographically documented methods of megalith transport are probably more analogous to those used in prehistory than modern-era European techniques, simply because the material conditions are more likely to be comparable. In more mountainous regions, such as the Himalayas, groups lashed their megaliths to a timber lattice or litter and carried them. In the vast majority of documented cases, however, large stones were secured on timber sledges which were hauled across the ground.

In many such accounts rollers are not mentioned. One report in the 1940s described 525 people on the island of Nias using wooden rollers to haul an enormous stone.

The original photos of this event, published in 1917, show a track of closely spaced, differently sized logs laid across the path of an advancing sledge. But vertical stakes between the logs would have prevented them from rolling. They in fact acted as the sleepers or cross-pieces of a static slipway, that prevented the runners of the advancing sledge from biting into the soft ground. A similar slipway comprising warped branches, logs and brush has been identified on another early 20th-century photo from the nearby island of Sumba.

Ethnographers' inaccurate shorthand use of the term "roller" may also account for its appearance in some 19th-century accounts of megalith transportation around Assam. In several cases, the so-called "rollers" probably formed static slipways. My own experiment in the garden opposite UCL Institute of Archaeology in 2016 showed the efficacy of slipways: it took only ten people to move a ¾-tonne concrete "bluestone" with some speed on a simple sledge over static logs. In Denmark, boulders of up to 9 tonnes have been hauled uphill using the same techniques. While no archaeological evidence has been found for such slipways, many prehistoric wooden tracks built with the same principle have been recorded; described by archaeologists as "corrugated", the tracks are made from timbers laid adjacent to each other at right angles to the direction of the path. Alternatively, a slipway of longitudinal timbers can be just as effective if sledge runners are fixed transversely.

Generations of antiquarians and archaeologists have argued that prehistoric megaliths were probably moved on rollers, despite an almost total absence of hard evidence. Many experiments have showed rollers to be unsuited for moving heavy loads over long distances, and rollers are either dubiously identified or conspicuously absent from ethnographic accounts of megalith transport. On the other hand, both ethnography and experiments support the idea that sledges and slipways are simple, effective means of moving stones that are both participatory and reliable. Will we continue to accept rollers as the self-evident 'best way' to move megaliths or can the false dichotomy between intelligent, roller-using megalith builders and the "savagery" of people who did not use them now finally be abandoned?

See the original, open-access article "Roll me a great stone: a brief historiography of megalithic construction & the genesis of the roller hypothesis," by B. Harris, Oxford Journal of Archaeology 37 (2018), 267–81. Barney Harris is a doctoral student at the UCL Institute of Archaeology. https://doi.org/10.1111/ojoa.12142

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