

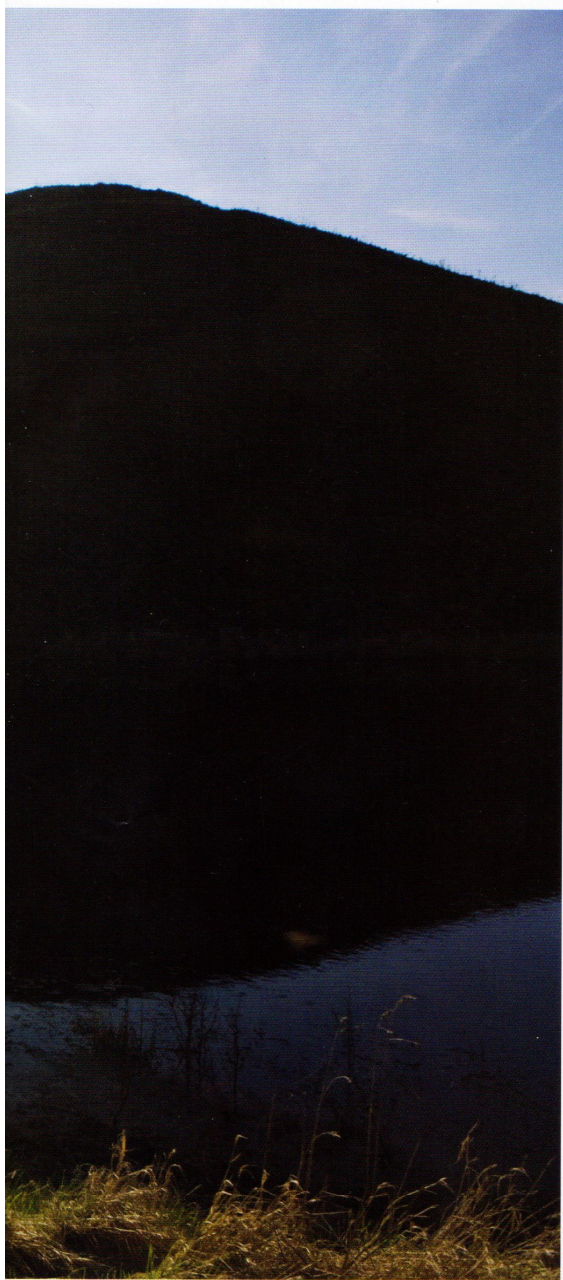


Silbury Spring

Record rainfall in 2012 caused problems across the UK – not least for archaeologists in the field. But for Steve Marshall, it brought a rare opportunity to explore ideas about Silbury Hill, an enigmatic mound raised in Wiltshire over 4,000 years ago

Silbury Hill is famous as Europe's largest prehistoric mound and part of the Avebury world heritage site. It has been intensively researched since 2000, when the top collapsed into old excavation tunnels (feature Jan/Feb 2005/80), concluding with new excavation and major repairs (feature Jan/Feb 2011/116). One of the latest

outcomes of this attention is a study supported by English Heritage of Silbury's palaeohydrology – how groundwater, springs and rivers might have looked around the time the mound was built in 2400BC. The research was conducted by Paul Whitehead and Mike Edmunds, of the School of Geography & the



A rare sight in modern times: Silbury Hill surrounded (almost) by water



Environment at Oxford University, and their full report was published last December (see endnote).

It has long been noted that Silbury stands near the source of the river Kennet, a major tributary of the Thames. Less clear was how it looked in the past. When Silbury was built, was the association with the river's source stronger than it is now, or barely apparent? The answer to that question has clear implications for current

Silbury seen from the north across a flooded stream, until recently a dry ditch

theories about how water might help to explain Silbury's religious purpose (feature Sep/Oct 2011/120).

Whitehead and Edmunds first concluded – while admitting that the data are uncertain – that in Wiltshire around 2500–2000BC it was wetter and slightly warmer than today (interestingly, matching predictions for future changes in the UK). Water in chalk rivers like the Kennet comes mostly from underground, rather than from immediate precipitation. Modelling ancient groundwater patterns, Whitehead and Edmunds found that the now seasonal Swallowhead spring – dry in summer, wet in winter – would have flown all year round. They suggest groundwater levels were 5m higher than today, which would have taken the main streamhead of the Kennet from a little south of Silbury at Swallowhead, to the centre of Avebury itself. Working with different data, archaeologists favour levels 2m higher. Either way, Silbury would have been reflected in the very headwaters of the Kennet.

It had become difficult to imagine this. After many years of abnormally low rainfall and growing extraction by water companies, Wiltshire's chalk aquifers were depleted: springs and rivers that should flow each winter were failing. That all changed at the end of 2012. The Kennet burst dramatically into life, and springs that had not run for many years began to flow once more. The ditch around Silbury filled with water as it has in winters past. I was able to monitor the process and identify the water's sources for the first time. The results were surprising, and may alter how we regard the monument and its location.

Bubbling beautifully

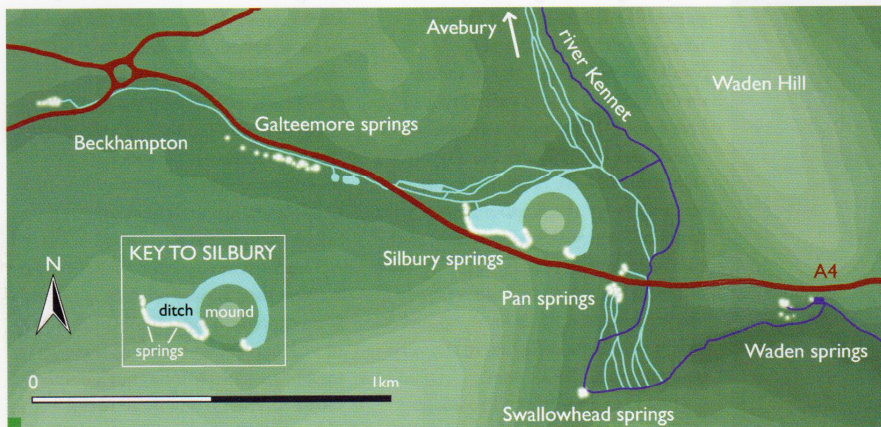
Today there are around 50 springs within a five mile radius (10km) of the Avebury henge. During the exceptionally dry winter of 2011–12, the Kennet failed to flow and many springs thought to be perennial stopped running altogether. The following summer saw continual rain, which slowly charged the depleted aquifers. Then on the night of October 31, Halloween celebrations in Avebury were swamped by a near-Biblical deluge. The river Kennet burst its banks; around Silbury Hill the meadow became a sheet of water. Over the following weeks much of the floodwater ran off into the Kennet, then on to the Thames and ultimately the sea. However, a great deal of it must have seeped down into the chalk: this inundation was the trigger for Silbury's ditch to begin to fill.

The present southerly course of the Kennet past Silbury is artificial – it has been canalised, most likely in the 16th or 17th century to create water meadows. The river has moved uphill into a narrow, probably artificial channel at the base of Waden Hill, about 100m north-east of where it would naturally flow. In early November 2012, in the weeks following the deluge, the original Kennet returned: a wide, braided river, flowing alongside its modern counterpart. Today the Kennet supplies no water at all to the Silbury ditch, but an ancient southerly route across the meadow may once have done so.

Like so many other henge monuments, Avebury is sited close to a confluence of two rivers, one flowing south and the other east. Silbury is exactly on such a confluence, between



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Seen from the east, a setting sun highlights water in Silbury meadow flowing in relatively modern artificial channels

the Winterbourne stream flowing south into the Kennet, and the Beckhampton stream flowing east. The latter only partly feeds the Silbury ditch; its course across the Silbury meadow has been engineered to divert water into the Kennet. The Beckhampton stream also forms a braided river as it crosses the meadow, expanding at times to become a lake.

Most of the Beckhampton stream's water comes from springs that rise in a paddock, and flow into a pair of large ponds. Only when these are full does the stream move on, crossing under the A4 road and east to Silbury. As rain continued in early November 2012 puddles appeared in the Silbury ditch; two weeks later it was completely filled with water. In the last week of November there was serious flooding in Avebury. The Kennet expanded from its usual 3m width to over 200m, perhaps indicating what a significant barrier it may have been in prehistory.

In December the rain finally stopped and was followed by a cold snap. The Silbury meadow now had water from three distinct sources: pools of standing rainwater, overflow from the Kennet and water from underground springs. How could they be told apart?

Springs in chalkland emerge from the ground at an all-year-round temperature of 10°C (50°F), and rivers formed by them can sometimes be seen steaming on cold, frosty mornings. With an air temperature of 3°C the different sources could be quickly identified. I began to use an ordinary household thermometer to record water temperatures, plotting each reading with GPS and transferring the data to Google Earth.

Water flowing directly from springs was indeed at 10°C. Where it formed into streams, the temperature fell with distance: the Beckhampton stream, for instance, cooled from 10° to 7°C in its 500m eastward run to the Silbury meadow. The Kennet was running at 6°C where it passes by Silbury – rather cool, because it was still carrying away floodwater, and its nearest spring source was about two miles to the north. Water that had spread from the Kennet into the meadow was also at 6°C, in contrast to the pools of rainwater that measured 3°C and were covered with ice. Silbury's ditch was also partly iced over, but only to the east and north, where I recorded 2°C. The west ditch was at 7°C, the same temperature as the Beckhampton

Springs around Silbury Hill, mapped by the author by taking water temperatures

stream. However, in one small area of its southern bank I recorded 10°C. It seemed that a spring was flowing into the ditch.

The cold snap ended. With a higher air temperature the thermometer was now less useful, as the temperature differences were minimal. Still, on December 14 I took readings around the entire Silbury ditch, finding that all of its water, even on the previously cold eastern side, was at 10°C, suggesting that it was now completely full of spring water. At the point where I suspected a spring flowed into the western ditch, I recorded 11°C.

Flooding around Avebury continued into the new year, when canoeists were



Snow close to English Heritage's interpretation board has been melted by spring water

seen paddling round Silbury and out into the meadow. The most exciting discovery came in early January. There had been no rain for several days, yet as I took my usual route into the Silbury meadow from the viewing point car park, the ground just beyond the fence was wet and muddy. Water was flowing from the ground at 10°C; the



Beckhampton stream ran close by and it measured only 7°C. Springs were running just 2m from the car park interpretation board. I continued round the ditch – springs were flowing along the entire length of its western and southern banks. Some were almost level with the surface of the ditch water, others up to a metre or so above it. I also found springs in the east ditch's south-west corner.

I returned with a group of archaeologists that included Silbury specialists David Field and Jim Leary. The springs were bubbling beautifully, and Field found several new ones flowing west from underneath the east side of the mound. It has long been suspected that there may be springs in the ditch, but this was the first time they had been seen in action.

On January 10 I recorded the positions of 82 springs around the western ditch, and seven in the eastern ditch. The area is effectively a sponge. No springs were evident anywhere else in the Silbury meadow.

Time for a new survey

It seems likely that the area around Silbury was first regarded as sacred or special because of its many springs, perhaps long before any monuments existed. The Swallowhead spring is the best known, but its flow is paltry compared to the Pan and Waden springs, both of which flow earlier and for longer each winter.

An unusually deep fall of snow came in mid January. Followed by frosts, it lay for a week and helped to show why the springs may have been regarded as special in prehistory. Within hours, holes began to appear in the snow, melted by the warm spring water. After a day or two all the areas of springs showed up as wide grassy patches: this was particularly evident at the Pan

Silbury's flooded western ditch, ringed by grass exposed by melting snow

springs. Round the perimeter of Silbury's western ditch, the springs etched a green strip a metre or more wide. After walking in thick snow, I followed my dog's example and warmed my frozen toes by standing in the water of the ditch: the temperature difference was apparent even through thick socks and boots.

Grass that should be dormant was growing actively in December and January, the springs showing as vibrant emerald patches. Artificial water meadows work in the same way – a controlled daily winter flooding of

ivers, it must have been a magical place – one of verdant fertility and perpetual springtime, even in the depths of winter.

There has never been a full hydrological survey of the Avebury area, even though archaeologists agree it is badly needed. Could it be a future university project? Growing evidence indicates a direct connection between neolithic monuments and moving water. Learning more about Avebury's prehistoric waterscape may eventually lead to a greater understanding of why the monuments were built.



The Swallowhead, sometimes taken to be the river Kennet's source, in spring 2007

spring water warms the soil, producing rich grazing a month or two early. Is it by accident that we use the word "spring" for the season of growth, as well for the underground water that can stimulate it? It is not hard to imagine why Silbury's location may have been regarded as special. With its springs and two steaming spring-fed

See Palaeohydrology of the Kennet, Swallowhead Springs & the Siting of Silbury Hill, by P Whitehead & M Edmunds (English Heritage 2012, available at services.english-heritage.org.uk/ResearchReports/Pdfs/012_2012 WEB.pdf). Steve Marshall is preparing The Avebury Book for publication later in 2013 ■