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The First Beer

Humans invented agriculture in different parts of the world, each group presumably independently of the others. The indigenous peoples of South and Central America cultivated various types of squash as early as 10,000 years ago. People in South-east Asia domesticated pigs at least 8,500 years ago. But the world's oldest traces of agriculture are to be found in the Middle East.

Searching the scientific literature for the cradle of early agriculture, I discovered a curious fact. To my surprise, I ended up just where this book begins – in the region where anatomically modern humans interbred with Neanderthals.

Sex with Neanderthals may appear to be an anomaly, a mere detail of our prehistoric past. Yet that was how our life outside Africa began. A tiny amount of genetic material from the Neanderthals probably made it easier to live in the cool climate of Europe. The traits passed on by the Neanderthals enabled our immune defence, digestion, skin and hair to adjust, helping us to cope with a new and harsher environment.

We know we must have received this Neanderthal input somewhere along the way while modern humans were migrating from Africa to Asia and Europe. However, all that DNA researchers can say – rather vaguely – is that this happened about 54,000 years ago, ‘somewhere in the Middle East’.

This prompted me to turn to Ofer Bar-Yosef from Israel – a veteran of Middle Eastern archaeology – and ask him to suggest a more specific location. He proposed Galilee as the most reasonable possibility. The region was rich in resources that would have supported both a Neanderthal population and the newly arrived modern humans. There was drinking water, plenty of gazelles and other animals to hunt, and fruit, nuts, herbs and nutritious grasses to round off people's diet.

After our conversation, the discovery of a skull confirmed that modern humans really did live there 55,000 years ago, a mere 40 kilometres (25 miles) away from the Neanderthals.

Having grown up in a Christian country, there are few places I have heard more about than Galilee. My first two years at school were devoted almost exclusively to the deeds of Christ in the region. The Annunciation, when the Angel Gabriel told Mary that she would conceive through the Holy Spirit, was set in the Galilean town of Nazareth. It was on the shores of the Sea of Galilee that Jesus called his first disciples to him. There, too, they witnessed the miracle of an extraordinary catch of fish in the fishermen's nets.

A fishermen's camp on the shores of the Sea of Galilee has also provided the earliest evidence of people living on wheat, barley and oats – the cereals that laid the foundations for European agriculture and civilisation. The archaeological site at Ohalo is so well preserved that it constitutes a small miracle in itself. This fishing settlement, inhabited some 23,000 years ago, comprised a number of oval huts built simply and rapidly from branches, foliage and grass, with a few fireplaces in between.

One day, the hamlet was struck by a large fire that razed the huts. Almost immediately after that, the burnt remains were engulfed by the rising waters of the lake. Naturally, these two events were catastrophic for the hut-dwellers. But 23,000 years later, the fire and the rapid flooding proved to be an almost incredible stroke of luck. Fire and clay have preserved the contents of the settlement, providing archaeologists with almost ideal conditions for reconstructing life as it was lived at Ohalo.

As a result, we know that the settlement's inhabitants lived largely on fish from the lake, but also hunted gazelles, deer and a wide variety of birds. They gathered pistachio nuts, almonds and olives from the trees, as well as wild grapes and a wide range of herbs. In total, archaeologists have identified the remains of over 150 species in the settlement.

The most significant find of all is a large, flat stone held down by smaller stones. This is the world's earliest known millstone, on which the people of Ohalo ground the seeds of starchy grasses by moving a smaller stone back and forth.

Israeli researchers have examined microscopic traces of starch from the stone, enabling them to establish that it was used for grinding emmer wheat, barley and oats. They have also identified traces of these grasses on the ground around the millstone, in the huts and around the fireplaces.

Although archaeologists have found small, simple mortars from even earlier times in Italy, Russia and the Czech Republic, the Ohalo millstone shows that milled grains accounted for a far larger share of the Ohalo people's diet.

The people of Ohalo lived from fishing and as hunter-gatherers. They cannot by any stretch of the imagination be described as farmers. Yet here we see the first large-scale use of the crops that would eventually change humankind's living conditions in so radical a way.

The fact that Ohalo has remained so well preserved is the result of extraordinary circumstances. Wild grains may have been part of people's staple diet over a wider area, without any remains having been preserved for posterity. Yet just as we can say that we must have acquired our Neanderthal genes in the Middle East, we can be quite certain that agriculture made its first appearance in that region.

A number of researchers claim that this was a drawn-out and geographically diffuse process involving the whole region known as the Fertile Crescent. The region stretches from the Jordan Valley to northern Syria and south-eastern Turkey, down the valleys of the Euphrates and the Tigris, and towards the Zagros Mountains of Iran.

Other researchers believe that agriculture developed in a far more concentrated way, in terms of both time and place. They contend that the whole package emerged in the course of just a few centuries, in the border regions of Syria and Turkey. In my view, DNA and other clues now point more in this direction.

The first clear signs of agriculture in the Middle East appear at the end of the Ice Age, some 11,500 years ago. This may

of course be a coincidence. Some archaeologists strongly disapprove of attempts to explain human behaviour in terms of climate change; they prefer to emphasise internal psychological and social motives.

However, many of those studying the issue perceive a close link between the altered climate and the first signs of agriculture. That link emerges very clearly with the hunting people known as the Natufians, who lived in Jordan, Israel, Palestine, Lebanon and Syria for millennia before any trace of agriculture appeared.

The Natufians seem to have been at least partially sedentary, and their villages contain vestiges of small, round houses constructed on brick-built foundations. However, the Natufians' houses were a great deal simpler than those we see in Cyprus and in other early farming settlements. They were more like sophisticated huts, with simple stone foundations, but without brick walls. The roofs were conical structures made of branches, foliage and grass, rather than the flat timber roofs covered in peat that emerged a few thousand years later.

Natufian culture first blossomed between 14,500 and 12,700 years before our time, which corresponds exactly to the first warm period after the Ice Age. This was the time when the first known dog was buried at Bonn-Oberkassel together with two of my forebears from group U5b1, as I described earlier. And it was at exactly the same time that warmth drove the reindeer northwards, followed by their human hunters. People visited the region now known as Sweden for the first time, and life thrived in Doggerland, which now lies beneath the sea.

The world's first farmers had exactly the same origins as the hunters who were the first to people Europe. They were descended from the same small group of people who had left Africa and interbred with the Neanderthals some 54,000 years ago. But while my maternal grandmother's female forebears continued their journey to Siberia and Europe, my paternal grandmother's foremothers – who were to become farmers – stopped somewhere in the Caucasus or the Middle

East. The two groups lived separate lives for over 30,000 years, after which they met again.

Before the farmers became farmers, they hunted gazelles and picked almonds, figs and pistachio nuts. They gathered grain – of slightly different types, depending on where they happened to live – using sharp flint tools. Stone mortars 14,000 years old, which the Natufians used to crush grain and other foodstuffs, have been found in the Jordan Valley. They look just like the marble mortar on my kitchen shelves at home.

Twelve thousand seven hundred years ago, the Natufians suffered major setbacks. The Ice Age returned with a vengeance for a thousand years as the period of cold called the Younger Dryas. The climate became both much colder and much drier. The cold was so severe in northern Europe that people were forced to leave the region that is now Sweden. In the Middle East, it was not so much the cold that was the problem as the dry climate. The Natufians' main prey, gazelles, dwindled – as did nuts, fruit and other vegetable products.

The Israeli archaeologist Ofer Bar-Yosef has studied this period for over half a century. He believes the Natufians reacted in three ways when conditions grew harsher during the Younger Dryas. Some migrated, leaving the regions where life had become too hard. Others actually became more sedentary than they had been in the past and began to build walls and defensive structures to keep out rival groups. And some started to cultivate grain and legumes, which they had previously gathered in the wild.

Eleven thousand six hundred years ago, the Ice Age came to a definite end. Precipitation increased considerably in parts of the Middle East, particularly in northern areas such as northern Syria and south-eastern Turkey. The winters became mild and rainy, and the climate became considerably more stable. This was a boon to those who had begun to experiment with cultivating grain. The new climate provided an ideal environment for an early farmer.

It was at just this time that a completely new type of jewellery appeared – perforated greenstone beads. Ofer Bar-Yosef has suggested that these green beads may indicate a new kind of cult; they may represent and bear homage to cultivation and budding green plants. Though that may be a trifle far-fetched and hard to prove scientifically, it's a poetic thought.

Evidence of early barley growing can also be found in the most south-easterly extremes of the Fertile Crescent in Jordan and the Zagros Mountains of Iran. However, the archaeological sites that are particularly significant in terms of the transitional phase lie in northern Syria and south-eastern Turkey. Researchers are sure there were networks in these regions that extended over very long distances: over 12,000 years ago they stretched from south-eastern Turkey to the Euphrates Valley in Syria, and a few thousand years later, they extended as far as Jericho in the Jordan Valley and Cyprus. The researchers concerned can identify the provenance of the obsidian – a type of volcanic rock – found in the various settlements. Obsidian is a hard, glassy stone that was sometimes used to make tools. Thanks to isotopic analysis, individual pieces of obsidian can be matched with the volcanoes they came from.

A Franco-Polish research team led by the botanist George Wilcox has published the results of some of the most recent investigations of the Tell Qaramel settlement in northern Syria. This was inhabited when the cold period known as the Younger Dryas came to an end and the subsequent warm period began.

The people of Tell Qaramel ate almonds, pistachios and a type of cherry. There are many traces of einkorn wheat, lentils and peas. Researchers have also found a number of species that they interpret as being weeds. Such plants flourish on open land, which is very probably the result of hoeing by Tell Qaramel's inhabitants.

Interestingly, the meticulous methods of various research teams have revealed large numbers of mouse droppings. Mice

clearly flourished in a setting where people accumulated extensive grain stores. They must have been a real nuisance. They were a threat to people's food and – not least – a threat to beer.

It was 1997. I had been working for just under a year as science editor at *Dagens Nyheter* when *Science* published a groundbreaking study on the origins of wheat. To this day I still feel a certain pride in the science page we produced that Sunday. It was unusually decorative, with an attractive watercolour of a wild wheat plant by Sweden's top botanic artist, Bo Mossberg. 'The wild origins of wheat' was the headline. It was one of the studies from 1997 that opened my eyes to DNA technology's potential for unravelling the early history of humankind.

A team of German and Italian researchers had taken DNA samples of einkorn wheat, one of the two types of wheat grown by the first farmers. They tested numerous samples of both cultivated and wild varieties from a region extending from Turkey all the way to Iran. When they compared cultivated varieties with wild wheat, everything pointed towards a small area in south-eastern Turkey, lying on the western slopes of Mount Karacadağ, a few dozen kilometres west of Diyarbakır.

The study's first author was the biologist Manfred Heun, German by birth but employed by the Norwegian Agricultural University in Ås. Heun is among the scientists who believe that the first plants to be cultivated must have developed very rapidly, possibly over as short a period as 30 years. He also argues that this development began at one location. Over the years, Heun's hypothesis has been heavily criticised, notably by French researchers who believe the transition took much longer and that individual hunting populations over a large area – extending from southern Jordan and Israel to Iran – experimented with cultivation. But later, more sophisticated DNA analyses support Heun's hypothesis.

American and Chinese researchers have also studied emmer wheat, the other type of wheat grown by the first farmers. Its origins have also been traced to the area around Diyarbakır in south-eastern Turkey.

The early farmers' 'starter package' is generally thought to include seven crops. Three of these – einkorn wheat, emmer wheat and barley – were cereals. Three were legumes: lentils, peas and chickpeas. The seventh crop was flax, grown both for its fibres and for its seeds, which are rich in linseed oil. Fig trees also appeared very early on, as did vetch, another leguminous plant.

A notable feature of chickpeas is that the subspecies first cultivated grew in a more restricted area than the other species in the 'starter package'. It was found only in a small area. This implies that cultivation must have begun in the areas around the Syrian–Turkish border.

Current findings thus suggest that early cultivation of at least emmer wheat, einkorn wheat and chickpeas began in the same area. The seed then spread to fertile areas throughout the Middle East. In many cases, these crops were later mixed with wild local species.

The area identified by DNA studies is very close to the Euphrates and the Tigris. It is only a few dozen kilometres away from the Turkish archaeological site of Nevalı Çori, where archaeologists have found early traces of cultivated grain. And you do not have to follow the Euphrates very far before reaching sites in Syria that have even earlier traces of agriculture, such as Mureybit, Abu Hureyra, Jerf el-Ahmar and Dja'de.

But what has struck Manfred Heun most in recent years is these sites' proximity to Göbekli Tepe in Turkey. He and many other archaeologists believe that the excavation at Göbekli Tepe is one of the most important events in archaeology for decades.

Göbekli Tepe was a place of worship high up on a mountain peak, which could be seen from a long distance. Bands of hunters met here to hold celebrations. This began about 11,600 years ago. Layers of crushed bones from wild animals

show that the visitors feasted on aurochs, gazelles and wild asses, and that they crushed the bones to extract the rich bone marrow.

These hunters devoted a huge amount of effort to building their place of worship. They constructed large, round limestone buildings, whose inner walls were lined with benches. In the walls and inside the rooms they erected enormous T-shaped stones. They decorated these stone pillars with carved figures of people and animals including serpents, scorpions, wild boar, birds, aurochs, bears and foxes. They also used small drinking vessels of stone bearing similar motifs.

The remains of other sites with similar round buildings and huge pillars have been found in nearby areas. But Göbekli Tepe was the largest. Unlike the other sites, Göbekli Tepe had no dwellings, nor was there any nearby spring. No one can have lived there; this was a place where people met on special occasions. Scaling the mountain was hard, and it was an impractical business. However, the advantage of the site's elevated location was that it could be seen for miles around.

Archaeologists have also found the same type of small, skilfully fashioned stone drinking vessels, similarly decorated with snakes, scorpions, birds, wild boar, aurochs, bears and foxes, at several other local sites. They have been found both in Turkey, at archaeological sites such as Çayönü and Nevalı Çori, and in Syria, at places including Jerf el-Ahmar, Tell Abr and Tell Qaramel. Tools and small stone plaques decorated in a similar style have also been found on both sides of the border.

And the people who gathered at Göbekli Tepe were in contact with people even further away. This can be seen from finds of the volcanic rock obsidian, which came from a number of different places. Some stones come from the region of Cappadocia in central Turkey, about 500 kilometres (310 miles) to the west. Others are from the area around Lake Van, over 200 kilometres (125 miles) to the east. And some are from volcanoes around 500 kilometres (310 miles) to the north.

This spectacular place of worship with its round temples and gigantic stone pillars thus appears to have been the nerve centre of a far-flung network. The German archaeologists concerned believe that Göbekli Tepe was at the heart of an emerging cult.

The largest T-shaped stones weigh up to 50 tonnes (110,000 pounds) – as much as a lorry loaded with timber. It may seem inconceivable that Stone Age hunters could have dragged such huge blocks of stone from cliffs hundreds of metres away and then raised them. The question is: what motivated them? The German archaeologists have a hypothesis. They are convinced that the workers fortified themselves with beer.

There is sound evidence from written sources that the slaves who built the Egyptian pyramids several thousand years later were given special rations of beer. The evidence from Göbekli Tepe is more uncertain at the moment. Apart from the finely worked small drinking vessels, the archaeologists have found about 10 large limestone vessels that they believe were used to add malt to grain and brew beer. The vessels, which resemble casks or bathtubs made of limestone, are set in the middle of the rooms. The most capacious is large enough to hold 240 litres (420 pints). Chemists have looked for traces of a salt called oxalate that is formed during brewing. They have found a few such traces. However, it has not proven possible to reproduce the results, and they need to be confirmed by further, more sensitive analyses.

Manfred Heun and his colleagues may well be correct in hypothesising that beer, brewed from einkorn wheat and barley, drove not only Göbekli Tepe, but all early agriculture. Personally, I think it seems very reasonable to see alcohol as a strong motive force. After all, extraordinary circumstances must have been needed for a handful of pioneers to abandon hunting as a way of life, when it had kept humankind alive for hundreds of thousands of years. Providing the ingredients for beer and wine in order to hold great ritual celebrations may very well have been the necessary motive.

We can only speculate about the possible content of these rites. We know nothing of these people's songs, dances and

myths, even though the scorpions, serpents, birds and wild quadrupeds depicted on the stone drinking vessels and pillars provide a few clues. However, we do know quite a lot about the outer forms of the cult today, thanks to Göbekli Tepe and other nearby sites. The people who met here apparently enjoyed grilled pork. They probably drank beer or other alcoholic beverages made by blending honey, grapes and grain.

Somewhere and somehow, alcohol entered our lives as a source of pleasure and a way of enhancing celebrations. But at the same time, the curses of alcohol – abuse, violence and addiction – made their appearance. Ten thousand years later, both aspects continue to play a very prominent role in life in Europe.

On the European mainland, it is hard to distinguish between domesticated and wild pigs or between cultivated and wild wheat. On Cyprus, however, the picture of early agriculture emerges far more clearly. Here we can watch the film frame by frame. We can definitely say when and how the first domestic animals arrived on the island. The story began with the pigs that turned up a good 12,000 years ago. They came by boat.

During the Ice Age there were no people living on Cyprus. The largest animals among the island's original fauna were dwarf elephants and dwarf hippos. Both species had shrunk to miniature versions of themselves, the result of a biological mechanism that often affects species on isolated islands.

The hippos and elephants died out towards the end of the Ice Age. Human hunters were very probably involved. Inside a British military base, amateur archaeologists have found the remains of elephant bones immediately under a steep cliff. Their conclusion is that the people of the time drove the elephants over the cliffs – an effective hunting technique.

These remains, which are some 12,500 years old, come from an archaeological site called Aetokremnos. The site was a storage space protected by a cliff, which, at the end of the

Ice Age, lay a few hundred metres from the shores of the Mediterranean. Archaeologists have found a number of flint tools and large quantities of food waste at Aetokremnos: seashells, fish bones and bones from birds.

They have also found 18 teeth and pieces of bone from small pigs. Their interpretation is that hunters from the mainland sometimes went to Cyprus by boat to hunt birds. They ended up taking piglets with them, which they left to return to the wild on the island so as to supplement the meat they obtained from birds. Since the dwarf elephants and dwarf hippos – which were about the same size and had roughly the same dietary habits as pigs – had recently died out, there was an ideal ecological niche for the pigs to occupy.

A number of researchers have already suggested that the pig farmers' ancestors in south-east Turkey kept herds of half-wild pigs, just as today's Sami in northern Scandinavia herd reindeer. The animals could roam about quite freely with a minimum of control by human beings. People knew where they were, but basically left them to fend for themselves. At appropriate times, when the people wanted some meat, they would herd the animals together and shoot them with bow and arrow. The finds of pigs' bones on Cyprus supports the theory that there was a half-wild transitional stage before pigs became fully domesticated.

The first people to settle permanently on Cyprus were early farmers. They came to the island by boat, bringing emmer wheat, cats, dogs and their typical greenstone beads. They built round buildings like their relatives on the mainland, including a large, round meeting house in the middle of the village with stone benches lining the walls. The bricks to build the walls of their houses were made by adding large quantities of chaff from emmer wheat and barley.

They may have found the barley locally, as it grows wild on Cyprus. But they must have brought emmer wheat seed with them from the mainland. They used small, oval millstones to grind the grain. The flint in their sickles shows the typical shiny surfaces that come from frequent use to cut

cereal stalks, which contain silica. There can be no doubt that the inhabitants of the oldest settlement, Klimonas, grew some of their food. To obtain meat, they hunted the feral pigs that their ancestors had released on the island several hundred years previously.

In the mountains 30 kilometres (20 miles) north of Klimonas lay another village, Asprokremnos, which was inhabited almost as early and had the same type of flint tools. Its inhabitants seem to have made fewer efforts to grow cereals; they apparently focused even more on hunting pigs. Asprokremnos may have been a hunting camp used by the same group of people who lived in Klimonas. Alternatively, it may have been inhabited by another group who had not taken up farming to the same extent.

The next animals to arrive on Cyprus were goats and cattle – and, unfortunately, mice, which the boatmen from the mainland must have taken with them involuntarily in their cargoes of grain. The goats were released and left to their own devices so they could be hunted in due course like the pigs. There are traces of goats, cattle and mice from two settlements that both came into being about 10,400 years ago: Shillourokambos, where the first cat burial was discovered, and Mylouthkia, the site of the world's oldest known wells.

I visit Mylouthkia, which lies on the west coast of Cyprus, together with the archaeologist Carole McCartney. She was born in the US, but has lived and worked in Cyprus for many years. The house where she lives with her Cypriot husband and her children is just a few kilometres from Mylouthkia. The location is well chosen; streams of pure water run through the limestone hills, and to the west you can watch the sun sink into the shimmering sea.

To our disappointment, the world's oldest wells turn out to be in a poor state. Builders have broken them while widening a road up to a new hotel. I can still see from the remains how meticulously fashioned they once were: up to 11 metres (36 feet) deep, lined with stone, and with a little set of steps made of jutting stones on the inside.

In one of Mylouthkia's wells, archaeologists have found the bones of pigs, goats and mice, and even the skeleton of a young woman.

The layers representing the first stages of settlement in Mylouthkia and Shillourokambos are largely dominated by the feral pigs. While cattle and goats do occur, they are rare. In the following centuries, goats become much more common, and there is a new addition – sheep.

About 10,000 years ago, new boatloads of cargo seem to have arrived from the mainland, including a new generation of pigs. These new animals seem to have been better adapted to a life alongside people, according to archaeologists' interpretations of their size and the shape of their legs and teeth. It looks as though the hunting of wild pigs came to an end. Instead, the villagers began to keep domesticated pigs. The island's wildlife was enriched by two new species from the mainland: fallow deer and foxes. The deer were hunted for their meat. The skins of both deer and foxes would certainly also have been used to make clothes.

The relative numbers of ewes and rams and of young and old animals suggest that the sheep were initially kept for both milk and meat. After a few centuries, however – about 9,500 years ago – the first generation of Cypriot sheep seems to have died out. Presumably they became too inbred in their isolated island existence, as the poor state of their teeth and skeletons suggests. After this, new boatloads of domestic sheep from the mainland arrived on Cyprus. They looked slightly different and seem to have been kept essentially for their meat.

There are clear signs that people took a stronger grip on the flocks of feral goats at the same time. They killed the male kids, but kept the nanny goats for milking. It looks as if the goats replaced the sheep as a source of milk when the latter began to be used more for their meat and wool. Cattle appeared from time to time, but they were rare. They are more difficult to breed, and they must have been too large and ungainly to get into boats easily. Moreover, they are not particularly well suited to Cyprus's dry climate.

Nine thousand five hundred years ago, the island's inhabitants had settled down into an annual rhythm that seems oddly familiar. It is not hugely different from the way people lived in rural areas well into the twentieth century. In the autumn they hunted fallow deer in the mountains. In winter they slaughtered their pigs. In spring and in the early summer, they slaughtered their lambs and harvested grain and lentils in the fields.

The 'agricultural package' was nearly ready and was soon to conquer the whole of Europe. However, one important invention was missing. This arrived on the island about 7,500 years ago.