HOMO ERECTUS - Curated Transcript of BBC In Our Time podcast
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In Our Time is hosted by Melvyn Bragg. Melvyn's guests on this podcast are:

Peter Kjærgaard
Director of the Natural History Museum of Denmark and Professor of Evolutionary History at the University of Copenhagen

José Joordens
Senior Researcher in Human Evolution at Naturalis Biodiversity Centre and Professor of Human Evolution at Maastricht University

And

Mark Maslin
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Transcript:

[Melvyn Bragg] Hello. When we Homo sapiens emerged around 300,000 years ago, we followed an ancestor who had thrived on Earth for up to two 2 million years. This was Homo erectus, "upright man", who spread from Africa to Asia and whose fossilized remains were found in 1891 on the island of Java. These people adapted to different habitats, ate varied foods, lived in groups, had stamina to outrun their prey. And if we imagine ourselves superior to them so far, we could perhaps make a diary note to reassess that once we've been on the Earth as long as they were. With me to discuss Homo erectus are

Peter Kjærgaard, Director of the Natural History Museum of Denmark and Professor of Evolutionary History at the University of Copenhagen,

José Joordens, Senior Researcher in Human Evolution at Naturalis Biodiversity Centre and Professor of Human Evolution at Maastricht University,
and

Mark Maslin, Professor of Earth System Science at University College London.

[Melvyn Bragg] Mark Maslin, before we set off, could you give us a timeline from, say, 66 million years ago, when the meteorite landed in the Bay of Mexico and when Homo erectus appeared?

[Mark Maslin] Well, as you said, Melvyn, all of this started with a big bang. We had the meterite impact in Mexico, and what that did was wipe out the non avian dinosaurs. They'd ruled the Earth for 120 million years. And what it did was clear the way for mammals to evolve into all those niches that been left open. And that's when primates first evolved. But at first, we know that they were either solitary or they were in couples; they weren't social. And that happens another 10 million years later. So about 55 million years ago, with the Paleocene-Eocene Thermal Maximum, a super global warming event, suddenly primates become social, which is absolutely essential for us humans. And then basically nothing really happens until about, I would say, 10 million years ago in Africa, particularly in eastern northern Africa, when bipedalism, the ability to walk upright, appeared multiple times in different lineages of primates, and hominins actually started to evolve. We have these different sort-of like hominins moving around the landscape. Most famous, of course, is Australopithecus Afarensis, or Lucy as she's known, seen in the museum in Ethiopia. And they were very successful. They were in North Africa, East Africa and South Africa. But it's not until about 2 million years ago then encephalisation, or as you and I would call it, brain expansion, occurs. And this is when Homo erectus appears on the landscape for the first time with a brain capacity 80% bigger than those earlier ancestors. And that's really the start of the evolutionary trend to get to humans. A bit later, they've been around for a million years, they've spread out into Asia, and about 800,000 years ago we have Homo Heidelbergensis that evolves in Ethiopia and they spread out again, but they don't quite compete with Homo erectus. And actually we think that they evolved into the western and eastern Neanderthals. And then 300,000 years ago, as you said, Homo Sapien evolves and spreads out. And about 60,000 years ago, a new version of Homo Sapien evolves in East Africa, spreads out and actually outcompetes every other creature on the planet. And that's where we're at now.

[Melvyn Bragg] Thank you very much. Now talk about the whole thing originating in Africa. Is the Rift Valley important and if so, why?

[4:02]
[Mark Maslin] So the amazing thing about the Rift Valley is the changes that have occurred over 10 million years. So if we all went back to East Africa 10 million years ago, what we would find is a relatively flat landscape. It would have tropical or seasonal tropical rainforests very much like Amazonia today, and it would be dominated by rivers. What happens is there's a hot spot, some magma deep in the

Earth's crust that pushes up and that causes expansion. And this is why we have Ethiopian Plateau, because it's risen up due to that expansion and eventually it fragments or rips, and that's the Rift Valley. We end up with mountain ranges, sort of like running all the way from Ethiopia down to Madagascar. And these mountains are up to four kilometres high with a hanging valley, and this valley is a thousand meters above sea level. And what it does is it changes the landscape from this tropical forest to completely fragmented vegetation. If you go to Ethiopia today, you can go from cloud rainforests all the way down to arid desert in less than 50 km. It's that fragmentation of the environment and it making that chaos in the environment that really drove the evolution of hominins, but also other animals in Africa. But why in that place? You've given the variety of the landscape you've talked about the mountains, you've talked about only 50 km between one extreme terrain and another. Is that so particular, so unique to the Rift Valley?

[Mark Maslin] For us to evolve, we needed two things. One, social primates had to be in Africa. Tick, we got that. And then we had to have a forcing factor. We needed things to actually change. If you go to the Amazon, the Amazon rainforest has been almost the same for about 50 to 60 million years. It's been really calm in that sort of type of change. Whereas the Rift Valley - absolutely everything changed. Also, the interesting thing about the Rift Valley is it goes from being river dominated to lakes. And lakes are very sensitive to small changes in rainfall in the catchment area. So you have these huge Rift Valley lakes filling up and disappearing on short timescales that would have affected early humans.

[Melvyn Bragg] Josie, have you any idea what Homo erectus looked like?

[6:29]
[José Joordens] Yeah, for many years ..[scientists]... have been thinking that it was the first homonin that looked very much like us. We know this because in the 1970s-80s, a beautiful Homo erectus skeleton was found in East Africa by Kamoya Kimeu in Kenya. And this gave an almost complete image of what it looked like. And if you see the skeleton and compare it to ours, it looks very similar and much different from, for instance, like Mark said, Australopithecus Afarensis which was much more apelike and smaller. And this was somebody who had the same head, the same stature, the same body proportions, also quite big brains. So, yeah, I think we could say that it looked very much like us.

[Melvyn Bragg] Peter?

[Peter Kjærgaard] Mark has very neatly summarized everything that we've learned over the past 150 years ago. But it was a completely different story when scientists began to look for the first time in a scientific way, for human origins. A number of, but very few, fossil humans had occurred in Europe Neanderthals, some Homo sapiens. But people were thinking that the origin was somewhere in Asia, notably Ernst Haeckel, the leading German biologist at the time. He suggested a sunken continent, Limoria, between Africa and Asia, where humans originally came from, and suggested that if we want to find the missing link connecting humans with apes, we should go and look in Asia. It was picked up by a young Dutch physician, Eugène Dubois, who skipped his job and started looking for the missing link. That was his mission. He focused on Java and eventually he found a skull cap and a femur and tooth, and was

convinced that he had proven Haeckel right and found the missing link. It was the first Homo erectus that was found, but it was not the evidence of human origins in Asia, as Haeckel had predicted, and as Dubois thought.

[Melvyn Bragg] José Joordens, you've held one of the artifacts from Java, an engraved shell. Can you tell us about this and why it's important?

[José Joordens] This shell has been in the museum in Leiden for over 100 years, because what Dubois did when he went to what we now call Indonesia and did his excavation, it was quite special that he collected everything. So not only the hominin fossils he was after, the fossils of this transitional form between apes and humans, but also he noticed that it would be very important to understand something about the evolution of these species. ... For that, you need also to know the environment and to know what the other species of animals that were present would mean for this homonin. And that's why he collected every bone and every shell and shipped it to The Netherlands, where it's now still curated. And most of the collection is intensely studied, and, of course, especially the hominin bones but the shells had been more or less, well, shelved for a long time. No one really looking at them, until an Australian young researcher came and he asked if he could photograph all the shells for his PhD, so we said, sure, go ahead. So he did. And what he then noticed when he was back in Australia, that there was one shell that had a very strange marking, that we couldn't understand how it ended up there. And that was actually the start of almost a puzzle that took us seven years to solve.

[Melvyn Bragg] What was the distinction of the marking? What distinguished it, that made ...?

[José Joordens] It was geometric, like a "W". And this is, of course, something that animals don't produce. We had to conclude that it must have been made by Homo erectus and it must have been a very deliberate marking, because we did experimental research trying to replicate it, and then we actually found that it was quite hard to do because especially fresh shells, they have a kind of organic exterior and it's hard to push some sharp objects through and make those lines. So that was when we knew for sure that it must have been made by Homo erectus.

[Melvyn Bragg] And what date are you speaking about there?

[11:06]
[José Joordens] We managed to establish that the shell must have been around half a million years old. So that made it the oldest engraving known so far made by hominins. And that was quite an amazing discovery. It brings it very close to home. I've held the shell, of course, because I've been doing the studies, and at that time it was for me just a study object. And I even carried it around in my backpack and sat on the train going to different laboratories and to make special photographs and analysis and all that time, for us, it was just an object. But once you realize that it was actually held by a Homo erectus who made that engraving I remember stepping out of the central station in Amsterdam, having this thing in my backpack, and suddenly thinking to myself, seeing all the traffic and all the people, so what would this person, Homo erectus, who made that engraving, what would he or she feel right now if she or he would be

standing next to me? That was one of those goosebump moments when you feel very close suddenly.

[Melvyn Bragg] Mark Maslin there are so many ideas about what happened and why. Can you explain why our ancestors started to walk on their back legs?

[Mark Maslin] So I think walking on our back legs was so important because it does a lot of things. It frees up our hands, it allows us to move large distances. And what we're thinking now, I mean, originally it was the idea that we had gone from rainforest to the savannahs man, the hunter in the grasslands. But actually it seems to be much more interesting and complicated because, as I said, as the mountains fragmented, our sort of like food sources and the different vegetation types, then there was a need to either specialize for forests, which chimpanzees did, or you need to specialize to be able to move between different food sources. And that's why bipedalism occurred. We needed to be able to transport ourselves and our families large distances between different food sources.

[Melvyn Bragg] But why did they need to do it and not other ... species? Do we know why they had the urge to do this?

[Mark Maslin] So I think it's really about the environment. So the interesting thing is that our early ancestors, some were trapped within sort of like the rainforest of the Congo. So they specialized towards sort of the environment that they're in. So that's why chimpanzees are incredibly well adapted to the forest, whereas the hominins that were in East Africa, and remember as the Rift Valley was forming, it forms barriers, so it forms four kilometer high mountain ranges that stop you moving around as much as you would want to. So you have to adapt or die. And so there are lots of different adaptations that occurred as the environment changed, but actually being able to walk upright freed up our hands so we could actually carry things. And one of the amazing things about Homo erectus is not just the symbolism that Josie's talked about with the shells, but the stone tools. I mean, we know that stone tools, crude ones, have existed prior to 3 million years, but if you ever have the opportunity to pick up the Acheulean stone tools of Homo erectus, they are beautiful. You know that somebody like us made these, somebody really gifted. And they have such a toolkit that lasted them for almost one and a half million years that allowed them to actually dominate their landscape. And it's that you can see the way they were flaking. They can see the three dimensions of a rock and understand where all the fault lines are. They think like us.

[Melvyn Bragg] Peter, how did these, our ancestors, make the most of their ability, this new ability to walk, to run on two feet?

[Peter Kjærgaard] Well, one of the things that happens around 2 million years ago, it's also a transition where humans previously were prey, but they were becoming predators. So they were occupying new niches on the savanna that other predators could not use. For instance, all the big cats and all [their] prey...[need to] get rid of excess heat, which means that they can still only run for a certain amount of time. So they have to be very quick and get rid of their excess heat. They do that by panting. Also, the prey that the big cats are hunting, same thing. But this new super predator on the savannah, Homo erectus, could not just run in an upright position, but also had

more sweat glands. It had rid itself of fur, which meant that through sweating, it could get rid of all of that excess heat that the other competitors on the savannah had to stop for and regenerate before it could continue. So Homo erectus were evolving into long distance runner that could exhaust their prey in a new way and in a different way, and thus occupying a new niche among the predators of the savannah. Homo erectus was also adapted to throwing. When you look at chimpanzees, for instance, how they throw, and you compare it to modern humans. We are able to throw very precisely and very hard. Same thing with Homo erectus. So once they've exhausted their prey, they were able to kill them with just throwing stones and rocks at their prey. So it would take a longer time for them to kill their prey eventually, but they would be incredibly successful in killing their prey once they have exhausted them.

[Melvyn Bragg] José so what did they eat? Is that different, too? Do they change the nature of eating for the species?

[José Joordens] What we know for sure, because I think we should realize that there's many, many things that we don't know, but the food definitely was very important. The earliest primates and hominins probably were vegetarians. So subsisting like the modern day chimpanzees and gorillas, mostly on leaves, on plants. But Homo erectus clearly had a high quality diet because the gut was much smaller. So you don't need to digest so much when you have high quality, high protein food. But exactly what that is, that is still a question. Of course, butchering meat has been for a long time the story that that was their main food. But it has also been shown that about 2 million years ago, hominins must have started exploiting fish and turtles and, for instance, crocodiles, so more also taking resources from those lakes in the Rift Valley. And of course, it's good to appreciate that it wouldn't have been completely meat, but also still a lot of plant material. And the meat could be, I think, probably up to anything ... ranging from small creatures, maybe rats, shellfish, birds, up to the big game animals. But maybe the ... big guys were more rare occurrence, and the day-to-day food would have been more the diverse small stuff.

[Melvyn Bragg] Do we see over that one and a half million years that they existed, their bodies, their brains, growing bigger?

[José Joordens] Indeed, I think the expansion of our brains must be closely related to diet because our brains are exceptionally expensive organs. They take up to 20% of our energy that we take in. So you need a lot of calories and a lot of high quality food to feed your brain and to have this, this evolutionary expansion. And it's very much debated what spurred this brain growth. And you can say, okay, the bigger your brain, the more intelligent you become and the better you can survive. But that's in biology, not a good way of explaining such a development, of such a feature. So I think food was more a facilitator. It allowed this expansion because it could pay for it and the calories needed. But exactly what triggered the big brains? Personally, I'm very fond of the hypothesis that sexual selection may have been implicated because, of course, using your brains... we are using our brains to tell each other stories, to make art, to make beautiful things, to be clever, impress each other. And I think this is also something that was going on in this social life of our ancestors. Many of the things that we engage in that must have been parts of their lives as well.

[Melvyn Bragg] Mark, why did Homo erectus spread out from Africa? Were they forced out? ...What went on there?

[Mark Maslin] I don't think we really know why Homo erectus left, and I think we do have some ideas. So what we know about the Rift Valley is at the time that Homo erectus first evolves, the lakes are filling up the Rift Valley and then disappearing and filling it up and disappearing. And this is being driven by changes in the orbit of the Earth that [are] changing the monsoonal rains over East Africa and into Asia. And so you have these periods of very wet conditions which fills up the lake, which sounds great because that's a fantastic high energy environment for Homo erectus to evolve in and also to survive in. But if you think about it, what happens is your Rift's shoulders, the mountains, suddenly become forested, your actual valley fills up with a lake. And as the lakes build out, they're sort of like pumping the population to the north out of the Rift Valley and to the south to South Africa. And so you have these two things going on. Your population is expanding and you're being forced out of your homeland. The great thing is, we know that when it's green in East Africa, it's also green in the Lavante. It's almost like there's an open gate that says, "Hey, come through the Middle East, you're welcome here. It's all beautiful, it's all green." And so we can see how that's going to happen. It also ties in what José was saying about sort of like how social we were. We were probably living ... Homo erectus... probably living in groups that are about 100, and that's because we can keep track of that number of people at that stage. When your group starts to get to about 150, the tensions, the stresses, classic Cain and Able, splits the group. You get two tribes. Of course, the other tribe has to move on. So this is then... pushes the human sort of ancestor out of Africa into Asia and down into places as far as Indonesia.

[Melvyn Bragg] Peter, what use then did Homo erectus make of the newly liberated hands? They no longer had to walk on them....

[22:23]
[Peter Kjærgaard] They were spreading into the Middle East, and we know that they were doing that actually very early on. The earliest evidence we have for Homo erectus outside Africa is 1.8 million years old in Dmanisi in Georgia. So they were already, very quickly, after they evolved, moving out of Africa and and covering large distances. In the process of of that, they were using their hands to make stone tools, but also this highly sophisticated geometric pattern that we have on that shell that José was carrying in her backpack. So we know that they were extremely dexterous. They were a combination of that bigger brain and ability to use their hands, but also to communicate, pass on the knowledge of what others in the group have been doing. So that beginning of cumulative culture. They [were] also, we assume, the first human species that starts it producing fire and controlling fire. By controlling fire, Homo erectus could also start cooking. They were able to get more energy out of the foods that they have collected, which again was making it less expensive to get all the energy out of their foods, which again led to they could use their time to do other things.

[Melvyn Bragg] Do you have any information or any clue as to what their language was like?

[José Joordens] Yeah, it's a good question. Our speech... our way of just yabbering away and we can keep going like this for hours and ages. We love to speak and we love to talk. My guess is that the Homo erectus would be the same, but so far it has been very difficult to prove anything about it. I think what is very important is that you have the proper muscles in your face to make all the vowels and to make all the pronunciation to have this large range in sounds that you can make. So that is an important thing. And also, of course, the breath control, because if you don't breathe properly, you can't speak properly. So having control over your breathing is also an item and I don't know, that's quite difficult to find back in the fossil record. But I'm quite intrigued by the recent research finding by the group of Bastille et al. They found that before, we thought that Homo erectus looked, in terms of the ribcage, more like modern humans. But actually when they made the reconstruction anew, they found that it was more like Neanderthal. And actually Homo erectus had quite a big lung capacity and a big chest. So what that would mean for its breathing, they concluded that it would have had an enlarged aerobic capacity. Maybe that is an indication that it could have had speech like us.

[Melvyn Bragg] Mark Maslin how socialized would you say these people were?

[25:25]
[Mark Maslin] These were incredible social animals. These are part of the ultrasocial networks that we have nowadays and there's a really interesting piece of evidence for that because this is the first hominid species that has a growth plateau. So if we think of modern humans, we give birth, we have children, they grow for six or seven years at a linear rate. You can imagine putting the lines on the sort of like door as they grow higher and higher and then they stop growing. So for about five or six years, they stop growing and this is a growth plateau. And then suddenly they hit puberty and they shoot up. I remember going from being smaller than girls around me in the first year of secondary school to the end of that year. I was six foot tall and all gangly and sort of like arms and legs. And that is because we need that period of time. We need to extend childhood as long as possible, because we have to learn how to be social. And Homo erectus is the first creature we know from the growth lines in their teeth that had that extended childhood, had that plateau. And it's because the reason we have a big brain is not to use stone tools or know what a split infinitive is. It's because we need to understand the social dynamics around us. We need to know who's actually talking about us, behind our back, who's actually trying to steal some food. And so I think socialization and being able to manage food, manage your relationships so you get the good stuff. Managing your relationships so you get the really good mates, whether it happens to be female or male. And I also think there's another thing that's driving this, and Jose mentioned this, sexual selection. We know this socialization must have occurred because one of the biggest problems about being Homo erectus, and of course, Homo Sapiens, is that giving birth is incredibly dangerous and difficult, because you then have to look after these children for 14, 15, 16 years? So allomaternal care, so actually having other women in the group who are friends, not necessarily relatives, helping you with the birth, helping you with nursing, and helping you actually look after these children, is really important. So for me, Homo erectus is the first truly social hominin who's really actually interacting. And the things like the shell just show that we're having symbolism as well as food sharing. And think about it, we're hunting down big beasts on the actual African sort of like, landscape. And we

have to do that as a team. There's no way you can do it as individual. So I think there's a lot of evidence that Homo erectus was the first truly social creature on the planet.

[Melvyn Bragg] Peter, what was it that made Homo erectus so successful for so long? I mean, massively longer than we've been here and the way things are going, the odds are they'll still have the world record. ...

[Peter Kjærgaard] Quite so. But it is the right question, because we are looking at probably the most successful human species that has ever lived. Close to a 2 million year run - that's a pretty good run. And I think one of the reasons that they were so successful was their ability to adapt to changing environment. And if the environmental pressure was becoming too big, they were able to move. So they were in constant negotiations with their surroundings. So if either food supplies ... dried up, or water supplies or other conditions that made life difficult, they could move. And they could move large distances, they could communicate and find new places to go. And I think that's one of the reasons why we see them as the first almost global human species that they were able to hunt for better places to live. Mark and Jose have also given us some very important keys to understanding that success, how they were living in social groups, which also, of course, not just increased the success in gathering food, but also increased the success in protecting the group, in taking care of the group, as Mark rightly said, with that extended childhood. Then I think there's also another very important part of it. That's something that Homo erectus shared with our own species, Homo Sapiens, ... they were able to eat almost anything. So even though they moved to new places and the diet was different, the kinds of animals were different, maybe there were different plants and insects, they were able to adapt to their new diet. They were very omnivorous. And that gave them, as with the hunting, the competition for prey on the savannah, that gave Homo erectus an extra edge compared to some of the other humans that lived who lived on highly specialized diets. So that versatility that Homo erectus presented is the same kind of versatility that has made us Homo Sapiens truly global species.

[Melvyn Bragg] José, can we check that on a bit or just develop it a little? What other human like ancestors were around at this time? And how do they compare with Homo erectus? As I understand it from the 25 different varieties, ... there's now jus one "us". So were they just dropping like flies in this 2 million span?

[31:00]
[José Joordens] Yeah, well, around 2 million years ago, that was a very busy time period, meaning there were a lot of other hominin species around at the same time and even sharing the same landscape. For instance, in the Turkana Basin in the Rift Valley, which was one of those lake systems that Mark was talking about, there were actually no less than three Homo species living at the same time at the same place. So you would have Homo habilis, Homo rudolfensis and Homo erectus. Plus, there was another one which is a little bit more different, and it's called Paranthropus boisei, which had probably a very different diet and also a very different build, more massive jaws and more massive teeth. But you can imagine that each of those species must have had a different niche and a different way of life and a different diet in order to share that same space. So we think it's the normal state of affairs to have just one human species around. But in fact, 2 million years ago, and even quite a long time

afterwards, there were always many more species around. So, yeah, that's interesting to think, how they must have divided the resources.

[Mark Maslin] But, Melvyn, I think one of the interesting things about that period of time is we start off with a. Large number of species. And in East Africa, if you happen to be a splitter and like lots of species, there could be up to six species on the landscape. What's really interesting is after, say, about 100,000 years, there's only one species left, which is Homo erectus. So clearly they were sharing the landscape, but actually Homo erectus outcompeted them, might have actually sort of, like, used them for target practice, but we only end up with one species for about another million years before Homo heidelbergensis. So I think it's really interesting that sort of, like, Homo erectus is clearly the dominant hominin on the landscape, and it takes them only 100,000 years to actually outcompete everybody else.

[Peter Kjærgaard] The extraordinary thing after that transition, and Homo erectus being the single human species, other humans evolve, but despite other humans with bigger brains, advanced technologies, et cetera, they survive. So we have that super species that evolved on the African savannah that outcompetes other humans. And in the new scenario, with new human species coming along, they continue to be successful. And I think that is what really makes Homo erectus one of the most extraordinary human species that we have.

[José Joordens] Actually, Homo erectus has been surviving for a very long time. We think that in Indonesia, it may have been as recent as about 150,000 years ago. So at that time, there were other hominin species around. For instance, in South Africa, we have Homo naledi, who was living about 250,000 years ago. And of course, there were also the Neanderthals and the Denisovans. So there was a time not so long ago when Homo erectus was still living, but also other speeches were already around on the world. And I do agree that Homo erectus was, by far, as far as we know, the longest lived. But the evolution was not like ... one species...after the other, but almost all the time [there were several species of Homo in the world] except for now - except for in this last 100,000 years, there were always many more species around, but one more successful than the other, obviously.

[Melvyn Bragg] Well, Homo sapiens emerged, and now Homo sapiens is the only one, as it were. Mark, what advantages did they have, and why did the Homo erectus disappear?

[34:58]
[Mark Maslin] We have archaic Homo sapien evolving about 300,000 years ago, and Homo sapien that we recognize as being very modern about 200,000 years ago. And it spreads out again. And as we've heard, it sort of gets along. It doesn't actually wipe out Homo erectus or anything like that, and it just moves in. It just seems to be a slightly smarter, slightly more tooled-up Homo erectus, and then something happens. So about 60 to 70,000 years ago, a new version of Homo sapien, I call it Homo sapien 2.0, emerges in East Africa, which thinks and works very differently. Cumulative culture suddenly takes off. They work in large groups, and suddenly, wherever this group of Homo sapiens turns up, all the large megafauna suddenly disappear because they're basically hunted to extinction. We have all the other hominid species basically disappearing, which could be out competition or just simple straight murder. And they

also interbreed with the Neanderthals in the west and the east. And this is the super species that spreads out. So it's not the original Homo sapien, but it's a new version that comes out of East Africa about 60 to 70,000 years ago, which is really us: cumulative knowledge, huge amounts of sort of like teamwork. And that is where we come from.

[Melvyn Bragg] ...Do you know why? Why we suddenly turned that corner or changed nature... (but nature is not a bad word, is it?) ...at that time, 60 or 70,000 years ago?

[Mark Maslin] So there's lots of real subtle hints. The problem is we only have fossils to go on. What's really interesting is that we know that [in fossils of] the new Homo sapiens, the faces were slightly shorter, the difference in the digits on the fingers were similar in length, all suggesting that we had less testosterone. So therefore it meant that reactive violence, you know, sort of like violence between individual males and males to females could have reduced. So therefore we were coming domesticated almost. We were then therefore being much more collaborative, it meant that we could specialize more. You could have the artists, you could have the thinkers, you could have the doers, you could have the hunters. And I think that's really important because once you actually remove that sort of like conflict from within the group, then you can actually have a much more collaborative society, real ultrasocial materialistic, sort of like approach which allowed that species to hunt mammoth. I mean, remember our ancestors were walking up on Siberia and taking down giant mammoths. I mean, that's how much teamwork we were able to do.

[José Joordens] Yeah, it is a radical event, the birth of Homo sapiens, and especially if you look where we are now, and I'm not entirely sure that we have such a blessing for the planet, but it is quite a feat what our species managed to do.

[Melvyn Bragg] Let's go back to our topic for this morning, which is Homo erectus. There are unanswered questions. What would each of you most like to know, starting with you, José?

[José Joordens] That's a very good question. I think you are right. Still many unanswered questions. And what I try also to always convey to my students is that we should be always aware that we may be wrong in things that we think we know and also that we should keep always very open minds towards new ideas and new developments. What I would most like to know is whether Homo erectus really was a long distance runner because I've always been puzzled by its heavy bones and this is quite a significant characteristic in a species that doesn't, for my feeling, doesn't line up so well with running. So, yeah, this is something that I would like to know. Why the heavy bones? And this is something that I would like to research

[Melvyn Bragg] Mark?

[Mark Maslin] For my curiosity and my focus of my research is really about the cause. I want to know why Homo erectus evolved. And we have these really sort of like tantalizing hints about the lakes coming and going. And for me, it's really trying to understand how we brought all these traits together, because Homo erectus is not just a new species, it's a set of traits. I mean, we've heard from Peter, the shoulder changed so we could throw things. There are something like 50 to 100 little changes

that allows us to do long distance running. And I think the interesting thing about long distance running is if you ever watch anybody run, their eyes do not move. We are the perfect hunter. And so what our body does is concertina as we run. And that takes a lot of adaptations from achilles to the neck; everything has to change. We also then have sort of like hips having to change so we can give birth to much larger cranium. So all these changes are occurring and I want to really know why. Could just the drying out and the wetting of the landscape, could that actually drive that? Or is there some way that sexual selection, the choosing of the smartest mate because A) you know, they're going to look after the children brilliantly, or [B)] they're going to actually make sure that they share out the food so you get the best food sources. I'd really love to know what the mixture is. And my curiosity is then, how much did the environment actually play in our evolution?

[Melvyn Bragg] And finally, Peter?

[Peter Kjærgaard] Why are they no longer here? Why did they disappear? Why did they go extinct? And where did they go extinct? Gradually, we are losing evidence of Homo erectus presence and the latest evidence that we have is about 108 - 115 thousand years old, which is beginning to close in on the evidence of Homo sapiens arrival. We thought that they arrived later, but now we get more evidence of either Homo sapiens presence or presence of other humans. And I'm really interested in looking at those factors. Was it climate change that changed the conditions? When we look at the last known resident for Homo erectus, we know that the climate caused the open woodland to change to rainforest. Was it that or did our own species have saying that or perhaps another human species was a competition to harsh? I think that, to me, is a key question.

[Melvyn Bragg] Well, thank you all very much. That was fascinating. Thanks to José Joordens, Mark Maslin and Peter Kjærgaard. And to our studio engineer, Jackie Marjoram.

And the In Our Time podcast gets some extra time now with a few minutes of bonus material from Melvyn and his guests.

[Melvyn Bragg] What did you not say that you wish you'd had time to say? Can I start with you, Peter?

[Peter Kjærgaard] One of the things that I find incredibly fascinating is that progress of the science of human evolution just takes down a lot of barriers for our knowledge and has given us, just within the past ten years, complete new avenues of questions that we can ask. One of the things that we've learned is that all of our collections at museums around the world, that they hold evidence that we never thought of looking at. So we have lots of interesting fossils that were somehow cast aside. We didn't really look at them or that we simply interpreted wrong because we didn't have the scientific framework to understand what we were actually looking at. So we are now making a lot of exciting new discoveries in collections that we've had in our possession for more than 100 years. And I think the abalone shell that's in the collections at

Naturalis is a wonderful example of that. And we have many more lots of things in our collections, and so there's lots of new discoveries that just awaits.

[José Joordens] Yeah. The material in the collection, the find of the shell, that it's not an abalone. It's a fresh water mussel; it's called pseudodon, but that's just a detail.

[Peter Kjærgaard] But the fact that it's an important detail. Thank you.

[José Joordens] Yeah, it's not marine, it's freshwater. But the fact that it was found in a museum it was discovered in the museum shows how important it is to have these collections and to take good care of them, because I'm sure that there's major discoveries to be made there. Yeah, I think we haven't talked about DNA, and the reason for that is that so far, we have not been successful in retrieving ancient DNA from Homo erectus, and we have found it in Neanderthals and Denisovans and Homo sapiens. And it's so valuable in giving suddenly such an opening in knowledge. So my most sincere wish is that in the near future, that we will either get ancient DNA from Homo erectus or if that's not possible because it degrades so easily in tropical systems, that we get the ancient proteins from Homo erectus, because that will no doubt also tell us a lot.

[Mark Maslin] For me, I think one of the things we didn't really talk about is how Homo erectus and learning about them actually reflects on us. And I think this is really important because human evolution actually informs us about who we are and how we evolved and how we think. And so for many years, we were talking about technology, we're talking about stone tools, and that's what made us human. And actually, it turns out, when you look at Homo erectus, it's about that sociability, it's about the interaction of large groups of people, and that really is what makes us human. And I think that's a shift in our knowledge and understanding. What makes us human, is the ability to actually get on in a very, very passive way, very little violence in large cities and large conurbations. And the interesting thing is, we only need one person to be suddenly super smart. We only need one person to invent the mobile phone because we have that accumulative culture. We just absorb that knowledge, and everybody else can learn. And I think that's key. And I'd love to know if Homo erectus was actually teaching in the same way that we do, because it's that empathy, being able to understand the other person so you can actually teach them how to actually knapp stone tools. And, I mean, I can't see how you can do it by copying. So I think Homo erectus gives us an insight into our own lives, our own sort of like society. And how important it is that we are so social, and actually, that's what makes us human, the ability to work in incredibly large, complicated groups and do radio shows like this, you know. That came with Homo erectus.

[Peter Kjærgaard] Curiously, Ernst Haeckel, who inspired Dubois to go out and hunt for the missing link. He called the missing link Pithecanthropus alalus - speechless apeman. So his assumption was that they didn't have speech. But when we look at all the things that they did to me, it's unlikely that they wouldn't have had some form of advanced verbal communication. ...We, ourselves, identify this as language, but I think we've been too anthropomorphic about this. I think there could be several ways of having advanced communication that doesn't necessarily look like the language that we have. There's lots of other species that communicate at a very advanced level, and that was the same for Homo erectus.

[Mark Maslin] I cannot perceive Homo erectus not having some sort of spoken language because why have that extended childhood? Why have that very long childhood if you're not actually being social and you're trying to actually get young people to understand how to interact with each other and within that group of about 100 individuals? So I think ... it's the evidence of the extended childhood for me, sells it that we must have been communicating in quite complicated ways for those children to actually have that time to learn, to be social.

[Melvyn Bragg] They were managing their food supplies. We're talking about one, one and a half million years ago. Have you any evidence of how they did that?

[José Joordens] My guess is that they spread tasks. So I envisage the same that we see with still living hunter-gatherer groups, that you have groups foraging, for instance, in one area for a particular food item. Other groups go elsewhere. Maybe some groups go for hunting specific animals. So that's how I think that Homo erectus...

[Melvyn Bragg] That's quite complicated, isn't it, to organize?

[José Joordens] Well, no, I don't think it's so much organization. I think this is the kind of self organization that will occur, that will not have been maybe a chief who said, okay, you go and do this, you go and do this. Now, I think this was more or less a natural... same as other animals would manage their food supply. So I'm not sure that there was a lot of, how do you say, necessarily a human-like intelligence needed. Because maybe we tend to underestimate other animals, how sophisticated they are in their food management behavior and how they know that certain times of the year or even certain times of the day, there are good places to be. For instance, following fisher boats or following a farmer who is sewing on the fields. So, yeah, I think it's not so much a matter of having increased intelligence to do this.

[Melvyn Bragg] Well, thank you all very much.

In our time with Melvyn Bragg is produced by Simon Tillotson.