"In Search of Human Origins Part Two"

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ANNOUNCER: Tonight on NOVA, listen, plan, forage, steal. In a vicious struggle for survival, intelligence emerges as the weapon of choice. Join Don Johanson as he discovers first hand what life was like for our early ancestors. Part II of "In Search of Human Origins."

DON JOHANSON: Three million years ago in Africa a strange creature died. Her body sank into the mud, her flesh slowly decomposed. And over time, her bones turned to fossils. Three million years later, the process of erosion brought them to the surface. Time had transformed a swampy marshland into a desert. The desert located in Ethiopia became a key destination for fossil hunters. I'm Don Johanson, and along with my team from The Institute of Human Origins, we've been travelling to this region of Africa for over twenty years. It's a difficult place to get to, but worth the trip. We're looking for fossils that will tell us about our earliest origins, how our species began and how our ancestors lived. We made our first trip in the early '70s, setting up camp in a region called Hadar on the banks of the Awash River. That first year, we got to know the area, and in the second year, 1974, our persistence and patience paid off. It was a sensational find. We uncovered a skeleton of our earliest known ancestor, nearly everything but the skull. Affectionately we named the creature Lucy. She caused quite a stir in anthropological circles. She offered convincing evidence of something quite unexpected. We could tell right away from the shape of her bones that this creature walked upright. Lucy was the starting point for the human lineage. She had a small brain, but she walked like us. Here was the long sought after link between ape and human. But how did our tiny, small brained ancestor carve out an existence in such a wild and dangerous place? She lived among creatures much stronger and more powerful than she. Since we can't travel into the past and catch a glimpse of how our ancestors behaved, we must observe the world around us for clues that help us reconstruct their lives. In fact, parts of Africa today are not unlike the world our ancestors lived in millions of years ago. The African night is filled with hungry carnivores, so it's not the safest time to be out. Stay down, stay down. Those who can't defend themselves don't survive, so when you see a pride of lions devouring an impala they've just killed, you realize how vulnerable our ancestors were out here. Nightfall must

have been a terrifying time for our earliest ancestors. Without the safety of this car, I could easily become a meal for some hungry predator lurking out there in the dark. It was the same for our ancestors who had very little protection. Yet, somehow they were able to carve out a space for themselves and survive among these skilled African predators. Each and every animal that lives out here has its own unique, special survival strategy. And I suspect it was no different for our ancestors, because they had to survive to eat and not be eaten. In their daily search for food, Lucy and her kind, known to scientists as Australopithecines, probably covered a lot of ground. They walked upright so their hands were free to carry food. Roots, tubers, and even termites made up part of their diet. They were adept at making a living, yet with a brain no larger than an apes. They didn't have human intelligence, but how intelligent were they? On our most recent expedition, we dug up some intriguing clues. Finally, after twenty years of searching, we found fragments of a skull from Lucy's species. It took a month to clean the fragments and figure out how to put them together, and once we did, we were not disappointed. This image represents the oldest most complete skull of a human ancestor yet found. The original fossil, about three million years old, remains in Ethiopia. But we can tell from certain features of the skull and the projecting face that it belongs to the same species as Lucy. And from the large muscle attachments and large size of the skull, we can be certain that it was a male. We know that Lucy's species gave rise to the human lineage, yet this skull only possessed a brain a third the size of our own. So in order to understand the development of human intelligence, we have to study not only skulls like this, but also try to reconstruct early human behavior. Constantly on the look-out for dangerous animals, Lucy and her kind must have used whatever intelligence they possessed to find food and protect themselves. But some scientists thought they went beyond this, claiming our ancestors collected animal bones and used them as weapons. The picture they painted of these early creatures portrayed them as killer apes. The movie classic *2001* reinforced the idea of early man's killing instincts. Other movies followed like *Quest For Fire.* Vicious, blood thirsty conflict was seen as the core of our humanity, and some scientists thought they had the evidence to prove it. The killer ape hypothesis gained credibility with discoveries made in a South African cave called Makapansgat. During the 1950's, anatomy professor, Raymond Dart, excavated at this cave which he thought was once occupied by early human ancestors. He found ancient animal bones, weathered and broken up. It seemed clear that these were weapons stockpiled by our Australopithecine ancestors. There were also bashed-in skulls that seemed to Raymond Dart the murderous instincts of our ancestors were even directed at each other.

RAYMOND DART: The Australopithecines particularly liked the lower jaws of animals that had long canine teeth, because these could be used as formidable weapons. And you can see how, with a weapon like this, they could gouge out the eyes of any animal, and even this primitive hyena jaw could rip up a belly.

DON JOHANSON: But were the bones Dart found really weapons? Well, nearly every cave you explore in South Africa contains bones, some fossilized, some very recent. For many years, scientists believed that the bones which they found accumulated in these ancient cave sites were brought here by our early human ancestors. But this porcupine quill suggests the story might be different. Porcupines constantly collect bones. Like other rodents, their incisors never stop growing and they have to chew on hard object to keep their teeth the right length. They need a plentiful supply of bones which they store in their caves. The real turning point in this sort of research came when scientists began to regularly go out and study caves like this, collect the

bones that were being accumulated today, use that information to interpret the past. And the man who pioneered that approach here in Southern Africa was Bob Brain. Aware of these bone collecting habits, Brain questioned the killer ape idea, which never took into account that animals, other than our human ancestors might have had a use for bones.

BOB BRAIN: Yes, you know, there's no question that this kind of shallow scoop marks on a bone is normally only caused by porcupine gnawing.

DON JOHANSON: So Brain began tracking the habits of any animal that he thought might be accumulating bones. The African leopard which rarely goes into caves turned out to be a totally unexpected contributor. To protect their fresh kills from other predators, leopards often stash the carcasses in trees. Sometimes, as the leopard eats, bits of the carcass fall off onto the ground below. In dry areas of South Africa, trees are found beside cave openings where underground water feeds the roots. In that situation, bones wind up in the cave below, rather than just on the ground.

BOB BRAIN: And the curious thing is that wherever you get a clump of trees like this, there is an indication of a shaft going down to an underground cave. The tree's roots penetrate down into the damp earth, the tree grows up from the entrance, and this is actually an indication of where the caves are.

DON JOHANSON: And it may also indicate where to dig for fossil bones. Conditions here at Swartkrans seem to be just as they were two million years ago. Cave open to the surface, and a feeding spot for leopards in a tree above. A perfect place for bones to accumulate. Over the years, Brain excavated thousands of fossils from this cave. The fossils he found could be seen as more evidence for the killer instincts of our ancestors, but Brain was not convinced. He found other evidence in animal behavior that enabled him to solve a two million year old murder mystery.

BOB BRAIN: Perhaps the most spectacular example of that is this skull of a child from the cave and in the back of the skull are two puncture marks. And when we look on the inside of that skull, we find that the bone has been pushed inwards in a very characteristic way, suggesting that it was fresh and pliable at the time that the damage was done.

DON JOHANSON: What kind of an animal do you think was responsible for marks like that?

BOB BRAIN: Well, interestingly enough, the spacing of those two holes is matched almost exactly by the spacing of the lower canines of a fossil leopard from the same part of the cave.

DON JOHANSON: Oh yes, very clear. Yeah.

BOB BRAIN: Now there's no way of telling that this was the actual leopard that had caused that damage, but the evidence is very persuasive.

DON JOHANSON: Bob's detective work suggests that our early ancestors bore little resemblance to killer apes. These simple vegetarians used bones and horns to find food, not to

kill. In fact, microscopic wear on the tips of fossilized antelope horns indicates they were used as digging tools, not lethal weapons. The fossil evidence suggests that without protection, our ancestors were easy prey. They were not the hunters, they were the hunted. Around two million years ago, a new kind of ancestor was on the move. Although they were still small and faced many of the same dangers, they possessed a distinct advantage. More intelligent, they used that intelligence to develop a new set of skills that gave them a crucial edge in the battle for survival. In order to find the evidence for this new way of life, we have to travel some two thousand miles to the north. The Great Rift Valley runs for thousands of miles at Eastern Africa. It is so vast it could be seen from space. Here the Earth has been ripped apart, exposing ancient rock layers containing fossils and stone tools millions of years old. It was in the Northern regions of the Rift Valley that Ethiopian archeologist, Sileshi Semaw, uncovered the earliest stone tools. They represent a turning point in the lives of our ancestors.

SILESHI SEMAW: As an archaeologist, it's very exciting to me to work on very ancient deposits, knowing that millions of years ago our ancestors lived there. And it's also very inspiring to try to reconstruct how they lived just based on the tools they left behind. Early humans may have used a variety of simple tools such as digging sticks, clubs and even ordinary stones like this. The major breakthrough in early human evolution came about when some early human populations understood that by bashing one rock like this with another one, that they can produce very simple sharp edged flakes, which can be a very effective tool.

DON JOHANSON: Imagine what it was like for our ancestors when they struck upon this innovation. A few flakes removed from a piece of rock, and you've created a useful cutting tool.

SILESHI SEMAW: Hundreds of stone artifacts like these were found in the Hadar region of Ethiopia. They represent the oldest known tools. With new dating techniques, we know that they are at least two and half million years old. I believe this marked the dawn of human technology.

DON JOHANSON: Stone tools have been found throughout the Rift Valley and Ethiopia holds the record for the most ancient ones, but it is Olduvai Gorge in the heart of the Rift that has yielded the best studied collections. Tools were first recognized by fossil hunter Louis Leakey when he came to this remote corner of Tanzania in 1931. He was intrigued by the mystery of who made these artifacts and how they were used. Olduvai was like a powerful magnet. In the following decades, Louis and his wife, Mary, returned time and again.

MARY LEAKEY: As we went along over the years, we found plenty to satisfy ourselves and to make us realize that there was still a great deal to be discovered in East Africa.

DON JOHANSON: What the Leakey's really wanted to find was the tool maker. Louis had this idea that human beings, that man was unique, he was distinguished from all other animals because he made and used tools. And Louis felt that somewhere in these deposits there had to be the fossilized remains of the ancestor who made those tools. Today, some of the discoveries made by the Leakey's are kept in this store room at Olduvai. They searched for more than twenty years, but traces of the tool maker continued to elude them. All that changed one morning in 1959.

LOUIS LEAKEY: And Mary had gone out early in the morning, about eleven o'clock, near the time to give up because the sun was really hot. She suddenly saw a little fragment of bone on the surface of the scree of a slope.

DON JOHANSON: At last, it seemed Mary had found what they'd been looking for, the ancestors who made the stone tools. With great fanfare, they unveiled the find and gave it the scientific name, Zinjanthropus. The fossil skull put Olduvai Gorge on the map. Ever since, the place has been a kind of Mecca for fossil hunters. But despite the importance of the fossil find, there was something unsettling about the appearance of the skull. It possessed some unusual features that didn't seem to fit the human lineage. One of these was a bony ridge dominating the top of the skull. This crest must have anchored massive chewing muscles that powered a jaw bone several times the size of our own. The molars were equally massive and they were pitted and scratched from a lifetime spent chewing tough tubers and nuts. This creature was a hardcore vegetarian, a powerful chewing machine that had no need for stone tools. One year later, the Leakey's made a find that would relegate Zinjanthropus to the warehouse forever. The limelight shifted to a more advanced ancestor. Although not much taller than Lucy, it had what Zinjanthropus lacked: a bigger brain. The big brain convinced everyone that this time the Leakey's really had found our tool making ancestor. They named it Homo habilis, Latin for handyman. What fascinates me is the way stone tools give us an insight into how Homo habilis made use of resources in the world around him. This raw material is only available several kilometers away from an outcropping of ancient geological rock. So obviously these early hominids, with great purpose, went over there, picked up the raw material, brought it back to this lake margin and made these very simple tools. The Leakey team dug up hundreds of artifacts. But not just stone tools, there were also remains of hundreds of animals: elephants, rhinos, gazelles. What was the connection between the tools and the fossil animal bones? With great precision, Mary plotted the location of each bone and each tool. Over a period of years, she unearthed layer upon layer of tools and bones. They were densely concentrated in one area of about three hundred square feet which had once been on the edge of an ancient lake. With this evidence in hand, a picture of life along the shores of the lake margin began to take shape. Scientists were eager to fill in the details and to understand how Homo habilis lived. This film, shot in the 1960's, was shown at a conference called "Man the Hunter." Scientists saw in these pictures an image of Homo habilis living in a cooperative society in which women did the gathering while men hunted. As absurd as it seems now, contemporary hunter-gatherers were used as a model for how our ancestors lived two million years ago. What the scientists focused on was what men were doing, hunting, even though women and children gathered the plants and nuts that made up most of the Hadza diet. Everyone brought their food back to a home base to share. Based on these images, many archaeologists decided that the site at the lake near Olduvai Gorge had been a home base for hunters just like this. These are the Hadza hunters today, a compelling image of our ancestors embraced by a generation of scientists. Man is an intelligent hunter, not a vicious killer, became the new metaphor for how we became modern. Hunting has always been a very seductive explanation for how we became human. It explains so much about ourselves, our big brains, for example. It took intelligence to be a hunter. It took intelligence to make and use stone weapons. Anthropologists and archaeologists have seized upon every bit of evidence, no matter how slim, to justify that view. While it was a convincing argument for many scientists, the basic underlying question still remains: were our earliest ancestors really hunters?

LEWIS BINFORD: It seemed to me that Homo habilis, a tiny little guy, ninety pounds, armed with wonderful tools like this was an unlikely creature to be a predator and to be a major hunter. In fact, one could even say it was a ridiculous idea to imagine.

DON JOHANSON: Point by point, archaeologist, Lewis Binford, began dismantling the view of man the hunter. What is it about the evidence at Olduvai that has led you to such a different interpretation?

LEWIS BINFORD: Well, one of the first things is the same problem with the hunting, that is, it was assumed that they behaved like us, so they had to live in homebases and they had to behave like many modern hunters and gatherers do. If you make the assumption, then you never investigate the past. So let's investigate it.

DON JOHANSON: And that's what Binford did. He began by questioning the idea that our ancestors would have set up camp on a lakeshore like the one at Olduvai Gorge. Most animals spend as little time as possible near the water hole because of the danger of predators. At first glance, it looks safe, especially at midday when the sun is high and the lions are less active. But danger always lurks.

LEWIS BINFORD: It's hard to imagine this as a base camp where rational hominids would be sleeping. They would not last very long, I don't think.

DON JOHANSON: Well, how do you explain then, this concentration of stones and bones that some archaeologists have cited as evidence, as proof, for a hunter's base camp.

LEWIS BINFORD: Well, there's no question that the hominids produced this concentration, in my opinion. The issue is what were they doing? We can make, I think, a strong case that they were collecting bones from carcasses killed by other animals and bringing them here for processing. That would implicate that the hominids were scavenging. And scavenging is a very different strategy than hunting.

DON JOHANSON: But scavenging is not an unusual strategy on the African savanna. If you can find a carcass without having to hunt it down, you're one step ahead. For vultures, scavenging is the only way to find food. The sight of these feeding vultures alerts other hungry animals to the possibility of a free meal. Cunning and swift jackals provide a real match for the vultures. Like this fast disappearing carcass, the fossilized animal bones from Olduvai Gorge are scattered and crushed. This is one piece of evidence suggesting that Homo habilis was a scavenger. But why would Homo habilis expand it's mostly vegetarian diet by scavenging for meat? Rob Blumenschine from Rutgers University decided to put the scavenging idea to the test. Rob and I spent two weeks in South Africa seeing whether Homo habilis could have survived by scavenging, using only simple stone tools like the ones from Olduvai. We chose a twelve square mile area with a water hole, open grasslands and small clumps of forest, not unlike the environment where Homo habilis lived. You know, being out here in the dry season gives you a real appreciation for how little vegetable food there is available.

ROB BLUMENSCHINE: Well, if you take this Marula tree as an example of that, where during the right time of the year it produces a very fat rich, oily nut, we might find a few now.

DON JOHANSON: Yeah, here's one.

ROB BLUMENSCHINE: Yeah, here we go. You see, now, the kernels are gone and they're all dried out. There's nothing to eat here.

DON JOHANSON: Yeah, it's my sense that it's this time of year when there's so little food available, vegetation is essentially dried up, that the real push is on to look for some different food source. Just like today, Homo habilis faced long dry seasons when for months on end there was virtually no rain. And water holes became near puddles. Many animals died providing rich pickings for scavengers. Everyone is on the look-out, including Rob and I, as would-be scavengers. Listening to the sounds of the night, we began to put together a picture of what was happening around us. Hearing the deep-throated growl of a lion told us some animal was about to meet its death. The sound of the lion kill was followed by the sinister call of scavenging hyenas. Had Rob and I been looking for meat, the presence of hyenas meant there was very little chance we would find much left on the carcass. It wouldn't have been any different for Homo habilis. In the morning, after what sounded like a busy night for the lions and hyenas, we prepared to leave camp and track down the remains of their meal. Circling vultures were an important clue to the whereabouts of the carcass. Vultures always get there first and in the greatest numbers. By the time we arrived, these efficient scavengers had removed every scrap of meat. We couldn't help thinking what would Homo habilis have done faced with a predicament like this. Well, the stone tools from Olduvai Gorge suggest a way Homo habilis could have survived as a scavenger even if he arrived at a carcass after the other animals had eaten their fill. There's not a lot of flesh left on here, except for a little meat on the forelimb and some on the face.

ROB BLUMENSCHINE: Yeah, but most of the marrow bones seem to be intact. This one, the hind leg, has been broken. It must have been a larger carnivore. But it's clear that the vultures took most of the flesh off. There may be a meal inside the marrow bones if the marrow is still fat rich.

DON JOHANSON: Using a stone tool like the ones Homo habilis made, the bone is quickly cracked open. Boy, there really is quite a bit of marrow in those long bones.

ROB BLUMENSCHINE: Yes, and it's color shows that it's still very fat rich. In fact, in an animal of this size, the leg bones alone would have provided about fifteen hundred calories from the marrow. That's about enough for a meal for two individuals.

DON JOHANSON: But can we be sure whether Homo habilis actually scavenged this way? The only hard evidence we have is the collection of fossilized bones and stone tools from Olduvai Gorge. Rob's experiment tells us what to look for. After cleaning the bones we had cracked open, we could see two distinct kinds of arcs, one gouged out by the hyena's sharp teeth, the other made by using the stone tool.

ROB BLUMENSCHINE: The cut marks, themselves, they are very much narrower and deeper. You don't get the crushing that you get with the carnivore tooth marks.

DON JOHANSON: The two kinds of damage are clearly different. These marks are made by a stone tool. Knowing what stone tool cut marks look like on fresh bones, we can go back to the fossil bones from Olduvai Gorge and look for similar damage. Casts of the original fossils are coated with a thin layer of gold to highlight whatever marks remain. Archaeologist, Pat Shipman, sorted through hundreds of fossils before she found just the right one.

PAT SHIPMAN: Early on in the study, I found a bone that had marks on it that really surprised me. It was a piece of the muzzle of an antelope, and it had a set of marks where we had overlapping tooth marks, like this one here, and cut marks, as well, on the same bone, in the same spot. Both a hominid with a stone tool and a carnivore with sharp teeth, something like a hyena or a lion, perhaps, processed this individual spot on that particular antelope. Not only did they overlap on the same spot, but microscopically, I could see that one of them came first.

DON JOHANSON: And it was the hyena. It came first. And Homo habilis was left with the scraps. It's by combining the observations from experimental studies on contemporary bones like these with observations of fossil bones from sites like Olduvai that we can be fairly certain that Homo habilis was probably a scavenger. But what really interests me is when I go back and look at the bone collections from the site where Lucy was found, the bones are virtually complete and unbroken. But as soon as stone tools enter the fossil record, the character of those bone assemblages changes dramatically. The bones are bashed up, broken, marrow is extracted, cut marks appear on the bones. And this suggests to me that there was a major behavioral change. Perhaps it was during this time that early hominids obtained a taste for meat. And more than that, a need for meat to provide essential nutrients and calories to support a larger brain. The world around Homo habilis was changing. A drier climate was turning nearly all the forest to grasslands, providing new challenges and new opportunities for our ancestors. The grasslands became home to grazing animals, among them, gazelles and huge herds of wildebeest. This was good news for an ancestor with the taste for meat. A bountiful feast was everywhere to be found. But our ancestors also faced new competitors. One of them was the hunting dog. The dogs begin the hunt by sending their prey into a panic. Working together, they single out the most vulnerable member of the herd. Usually it's a young or weak animal. Effective as the hunting dogs are, their fortunes can change quickly. Armed only with stone tools, our ancestors were for the first time in direct competition with animals like these that were faster and more deadly. More than ever, intelligence was becoming the key to survival. In 1984, a remarkable discovery was made. It revealed, as never before, how the human story would unfold. A skeleton was found near the shores of Lake Turkana by Kenyan fossil hunter, Kamoya Kimeu. It belonged to a species called Homo erectus, an ancestor who appeared more than a million and a half years ago. The excavation team methodically uncovered ribs, arm and leg bones, the entire lower jaw, and even a complete pelvis. The first remains of Homo erectus had been found nearly a century earlier. But until this discovery, scientists had only fragments to work with. This individual had been a young boy, about twelve years old when he died. His leg bones were not fully formed and the wisdom teeth hadn't erupted yet. And he was smarter than any earlier ancestor. His skull held a brain more than twice the size of Lucy's. Anatomist, Alan Walker, helped to excavate the skeleton and has studied it ever since. In this Homo erectus ancestor, he saw features entirely

new in the history of human evolution. One obvious advancement was the enlarged brain, but Walker was particularly fascinated by the body build, which provides clues as to how this ancestor competed on the African plain. The arms and legs were slim, but strong, the kind of bone structure you only get with strenuous physical activity.

ALAN WALKER: Oh sure, put it all together now and what you've got is an individual that was tall as a youth, he'd grow up to be very tall. I mean much taller than most modern people, and he's got this long, skinny build. He's rushing around all day, sweating. And we can tell that he was much more active than any modern human being. And if you put all that together, you know he was going eating veggies.

DON JOHANSON: Propelled by a need for meat, Homo erectus with his big brain and powerful body was now on an even playing field with other carnivores. He was an intelligent and active scavenger. Unlike Homo habilis, he could get to a carcass quickly, and what's more, exploit it effectively using a new kind of stone tool. There was nothing accidental about how this tool was made. The mental ability to take a piece of unshaped stone and create a specific tool was a far cry from earlier efforts. The stones were flaked along both sides creating a razor sharp edge. Thousands of these hand axes have been found, all with the same skillful design. In a situation where timing counts, another scavenger could be here in seconds. Homo erectus was well-served with an effective butchery tool. With tools like these and the ability to cover ground quickly, Homo erectus was better off than earlier ancestors, but survival still depended on the luck of getting their first. There was a better living to be made, even in this harsh landscape. But our ancestors would have to learn to apply their intelligence in a new way. To explore what this means, Rob and I put ourselves in the place of a clever Homo erectus. One thing became immediately clear. To survive as a scavenger, Homo erectus had to understand both his environment and the habits of other animals well enough to out-wit the competition. Although it could be dangerous, most animals visit a water hole some time during the day. Homo erectus would have come here to drink as well. And I think, you know, water must have been one of the great limiting factors and during the dry season like this, anything would have been welcome for water.

ROB BLUMENSCHINE: Yeah, whether you like it or not, I think you have to come back—

DON JOHANSON: The water hole is full of clues about the movements of animals. Rob and I were tracking the leopard. Homo erectus might have done the same thing as well.

ROB BLUMENSCHINE: It certainly, those trees on the opposite side of the bank is a likely place for her to hang out. I've, in the past couple of days, I've seen her around there and we might just get lucky and find a kill up there, perhaps, and something to scavenge.

DON JOHANSON: Perhaps Homo erectus had the same idea we did, to see if the leopard had stashed a fresh kill in a tree. Well, she's been spotted several times this week just in this drainage, right Rob?

ROB BLUMENSCHINE: Yeah, this is her favorite area and in fact this is one of her favorite trees.

DON JOHANSON: By following the daily movements of the leopard, Rob knew which tree to look in. Homo erectus must have relied on the same clues, as well as their sense of smell and sharp vision. Oh yeah, but there's still an enormous amount of meat left on this carcass.

ROB BLUMENSCHINE: Well, that's one of the things that makes this such a good scavenging opportunity. It's a small animal, but the fact that the leopard stashes it up in the tree means that the flesh is not going to be scavenged by hyenas on the ground, vultures won't see it through the canopy of the tree, and also this is a highly predictable scavenging opportunity. The leopards have a small range and they have these preferred feeding trees.

DON JOHANSON: So a clever hominid who was aware of a leopard's activities like this would really be able to capitalize on a kill. So at this time in our evolution, about a million years ago, Homo erectus was the most intelligent animal around. But there was a price to pay for having such a large brain, bringing us to an unexpected turning point in the human story. Getting a big Homo erectus brain through a pelvis, still only a little larger than Lucy's, would have made giving birth impossible. The solution for Erectus was no different than for modern humans. In the first year of life, the brains of these babies nearly triple in size. The brain of a newborn is just small enough to make the birth process possible, but gestation continues for another year outside the womb as the brain continues to grow. Other animals, such as these baboons, have quite a different pattern of brain growth. Their newborn have almost fully developed brains. With most of their brain growth behind them, they're soon very active and independent. But human infants, because their brains have so much more growing to do in their first year, are almost as helpless as if they were still inside the womb. This demands around the clock care to protect the infant, keep it warm and provide it with nourishment. In the first year of life, because the human brain almost triples in size, it consumes lots of calories. This also implies a family organization to support a long period of total dependency. By the time of Homo erectus, this family pattern must have been firmly established. Because of their large brains, Homo erectus gave birth to helpless, defenseless infants, much as we do today. Even with their ability to scavenge well, Homo erectus parents must have been pushed to the limit to provide for themselves and their offspring. With this insight into the life of Homo erectus, we catch a glimpse of an ancestor that was very human-like. They had substantially enlarged brains, they had a body build very much like our own, and they made sophisticated tools. And soon, they would unleash a new very different sort of tool. One that would effect every part of their lives, the way they prepared their food, the way they altered the world around themselves, even the way they interacted with each other, and this would be a powerful new force, one that would be feared by all other animals. Storms like this and the fires ignited by lightning must have been terrifying. But a million years ago, our ancestors saw fire in a new way. The realized that unlike other animals, they didn't have to run, and this fearsome force of nature could be used to their advantage. Fire provided warmth, a light in the darkness and a way to cook food for the first time. It scared predators away and was a place to gather round. Fire changed the course of human history and allowed our ancestors to leave Africa and roam the rest of the world. Homo erectus was so incredibly successful as a species, its basic way of life remained essentially unchanged for over a million years. But soon that was to change, and to change abruptly with the appearance of people who looked and acted like us.

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