

## THE BUNCH OF PREHUMANS AND THE EMERGENCE OF THE GENUS *HOMO*<sup>1</sup>

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Firstly, I want to thank the Pontifical Academy of Sciences for inviting me to this very important, very interesting, quite exceptional meeting that I am enjoying very much. As you know, I am a paleontologist and, more precisely, a field paleontologist, so I will try, through the fossil record, to tell you what I think could have been the history of man, which means the history of the last 10 million years.

It is well known today, especially today, as you have seen, that Bonobos, *Pan paniscus* and chimpanzees, *trogodytes*, are the creatures closest to us in nature. In an evolutionary way of thinking, it means that they, and we, have common ancestors. Because all primates are tropical, and because Bonobos and chimpanzees are African, there is some probability that those ancestors would have been tropical and African. Moreover, the morphological, anatomical, physiological, genetic, molecular and even ethological distance between these cousins and ourselves allows to situate our last common ancestor somewhere in the upper Miocene, which means about 10 million years ago. So we have the place, Africa, and we have the time of existence, 10 million years ago, of our last common ancestor. We will travel through these ten million years in a chronological order in four parts: first part, 10 million years ago, the time of the last common ancestors; second part, the prehuman, before man on our side; third part, the emergence of man; and fourth part, the evolution and expansion of man.

First part, what do we know about the apes in Africa at these late Miocene times and who do we know could pretend to be the last common ancestors to man and chimpanzee? We have three main candidates to

<sup>1</sup> Transcript unrevised by author.

answer this question: *Chororapithecus abyssinicus* from Ethiopia, 0.7 to 0.1 million years old; *Nakalipithecus nakayamai* from Kenya, 8.99 to 8.80 million years old; and *Samburupithecus kiptalami* from Kenya, 9.6 million years old. This very modest fossil record does not allow, of course, to tell who, among these candidates, is the closest to the last common ancestor of chimpanzee and human. Let us say that we have just started to find some remains of African great apes of the right geological age, which are giving us an idea of what these famous grandparents would have looked like. As a matter of fact, we don't know either where they are really standing in the phylogeny, *Chororapithecus*, *Nakalipithecus* and *Samburupithecus* respectively. We don't really know even if they are preceding the divergence *Homo/Pan* or if they are already engaged in one of the two lines, or if they are engaged in another independent branch, having nothing to do with the *Pan* or with the *Homo* branches.

Second part, let us forget this common ancestor, let us forget, as well, the slice of 10 million years of pre-chimpanzees and chimpanzee to focus our attention on our side, the prehuman and the human side of the divergence. We will divide the ten million years of our affiliation into two major episodes: the prehuman one, from ten million years ago to one million years ago, and the human one, from three million years ago to the present, which immediately shows that the last prehumans coexisted with the first humans. The prehumans are magnificently documented by seven genera and fourteen species. I called this diversity, which is reflecting a diversity of ecological niches, a bunch, instead of a bush, because a bunch seems to me clearer than a bush and it is not a political statement.

The seven genera and fourteen species originated from Central, Eastern and Southern Africa: Chad, Ethiopia, Kenya, Tanzania, Malawi and South Africa. Chronologically they can be organized in three steps: the earliest from seven million to four million years ago, with *Sahelantropus toumai*, *Orrorin* and *Ardipithecus*, a second step between four million to three million, lasting just one million years, and a third step between three million and one million years ago. The second step, between four million to three million years ago, is emerging after an opening of the landscape. The third step, between three million and one million years ago, is also emerging after drought and because of this drought it is more dramatic than the four-million-years-old opening. In order to try to appreciate the bunch of the fourteen prehumans as a group, we will examine the traits that they shared and the few ones that are dividing them. 1) All the prehumans were tropical without exception; 2) All the prehumans were African, without excep-

tion; 3) All of them, as far as we know, were upright, permanently upright; 4) All the earliest ones, as far as we know, were both bipedal and arboreal (it is the case of *Orrorin*, *Ardipithecus*, *Australopithecus afarensis* – Lucy); 5) All of them, but at different speeds, seem to become exclusively biped (*Australopithecus anamensis*, from Kenya and Ethiopia, 4 million years old, seems to have been the first not to climb anymore, so the first true exclusive biped); 6) All of them have a slowly increasing endocrinal capacity as well as a slowly more complex organization of the brain: more complex convolution, more complex irrigation; 7) All of them show a tendency of the face to reduce its prognathism, its projection, to reach a sort of orthognathism, flat face. *Kenyanthropus platyops* (flat face) and *Australopithecus bahrelghazali*, 3.5 million years old, seem to have been the first and the best in that reduction. But, as far as the teeth are concerned, we can follow two trends: a tendency to a reduction in the site of the cheek teeth, molars and premolars, and a tendency to an increased size, which means two clear adaptations to two different diets. In summary, the prehumans are tropical, African, upright. They seem to have been arboreal and bipedal before adopting, for ecological reasons, an exclusively bipedal locomotion. They all show a brain of increasing size and complexity. They all show a trend to reduce prognathism at different speeds according to their *phylum*. Some of them, at least and at last, show a trend to a reduced size of cheek teeth, while others show the reverse tendency.

Third part: as I just told you, in describing the third step of prehumans, an important drought happened between three million years and two million years ago. The global cooling of the earth appeared, for instance, in the study of oxygen isotopes ratio, oxygen 16, oxygen 18, in the test of microorganisms collected in deep-sea cores. This climatic change is also particularly well visualized in the sediments of the lower Omo River basin in Ethiopia, because the sediments of this lower Omo River are the only ones in tropical Africa to offer a clear, continuous deposit of these times. I worked there ten years, and during those ten years I collected fifty tons of bones. The Omo sedimentary sequence is a superb stratigraphical column more than 1 km thick, particularly well exposed because of tectonic reasons, particularly rich in fossils, including hominids, and particularly well calibrated by biostratigraphic, paleomagnetic and radioisotopic cross-checking dates. And all the fossils collected – I tell you, as far as I am concerned, fifty tons of them – are showing this cooling. I can give you the example, but I will not, of the evolution of elephants, rhinos, pigs, horses, bovines, primates and rodents, during that time, as well as the example of

the evolution of the frequencies of certain plants. All the animals are showing adaptation to a more open and drier environment, grass-eating adaptation, for instance. And all the plants are showing the same tendency towards a less and less humid climate, and a real drier and drier one. I will give you just an example, not to be too long. Having collected pollens in all these levels, I tried to do a ratio with the number of pollen of trees on the number of pollen of grasses and this ratio gave the result of 0.4 for three million years, and 0.01 for two million years, so I think this is clear enough. Well, the answers of the prehumans have been done in just the same direction, and they have been good enough to have given two answers. First answer, one prehuman, probably *Australopithecus afarensis*, but we are not sure, had chosen a larger size of the body and larger cheek teeth, the so-called *Robust Australopithecus*. Second answer, another prehuman, maybe *Kenyanthropus platyops*, maybe *Australopithecus bahrelghazali*, maybe *Australopithecus anamensis*, we don't know very well which one, maybe another one that we have not collected yet, had chosen a larger size of brain and teeth to eat a wider diet, meat included. It is man. The consequence of a larger brain is, of course, the emergence of more reflection and of something like consciousness. And consciousness is starting to build a new environment, the cultural environment, for the first time after four billion years of life, in its natural environment. Well, let me tell you that, for prehistorians, for me, culture is everything that is not nature. So, cultural environment for us means a technical, new environment, of course, but also an intellectual, spiritual, ethical, esthetic one and so on, so it is probably one of the Big Bangs of Prof. Antonino Zichichi, who told about the living matter with reason, and I called this event the '(H)Omo event', 'H' in brackets, because it was on the shore of the Omo river, which is amazing, that we collected this information and to remind of the pioneer role of the Omo area in this demonstration.

In summary, around 3 million years ago an important cooling appeared in the whole world, becoming an important drought in tropical areas, especially tropical Africa, and the whole ecosystem tried, of course, to adapt itself to this climatic change, to this new climatic environment. The prehumans were then part of this ecosystem, and one of these successful adaptations again is called 'man'. To answer Cardinal Christoph Schönborn, who unfortunately is not here, I would say *Homo* looks like a product of nature, a necessary adaptation to a climatic change but is a human being with, for the first time, this capacity of knowing that he knows, he is human since this beginning. So it is a sort of discontinuity in a continuum.

Fourth part: for biological and cultural reasons, the very first species of the genus *Homo* was more mobile than his ancestors because of his diet. He became a carnivore and had to run behind game. This very first species of *Homo* was more curious, also because of his better brain and the beginning of consciousness. He was more equipped because of his new manufactured tools. He was more numerous because of his successful adaptation to the climatic change we talked about. Therefore, he was more mobile, more curious, more equipped, and more numerous. I guess that it is the very first species, and not the second or the third, which moved out of its tropical birthplace and out of its ecological niche. And some environmental reasons can be added at that time to push *Homo* out of Africa, around 2.5 and 2 million years. For the moment we know stone tools in Israel, in one site, which could be, it is not sure but 2.2 to 2.3 million years old, and stone tools in China in three sites, which could be a little more than 2 million years old as well. We know stone tools in Algeria, around 1.8 million years old, stone tools and hominid remains, 1.8 million years old, in Georgia, in Java 1.8 million years old, in Italy 1.6 million years old. So, theoretically, I would think that it is this first *Homo* who had moved as soon as 2.5/2 million years ago, which means that I would not be surprised to meet this very first species of our genus anywhere and everywhere in the old world, in Africa, in Europe and in Asia, at dates between 2.5 and 2 million years ago.

The technical problem is that there are two first species of the genus *Homo*, *Homo habilis* and *Homo rudolfensis*, and I don't think that both moved. Because of a certain number of reasons I cannot develop here, I think finally it was *Homo rudolfensis* who moved. That means that, 2 million years ago, man was everywhere in Africa and almost everywhere in Eurasia, except maybe in the extreme north. And, as he was not demographically numerous enough to exchange genes everywhere and all the time, he first became *Homo erectus* where and everywhere he was, but this *Homo erectus* became *Homo neanderthalensis* in Europe, *Homo soloensis* in Java, *Homo floresiensis* in Flores and *Homo sapiens* in Africa and in Asia or in Africa only. And he probably became several other *Homo* in several other isolated places, isolated by sea or by ice, that we haven't yet discovered. So, at least, and it is a minimum, four humanities have been coexisting during several hundred thousand years, in some places maybe a million years without, of course, knowing that they were not alone: in Africa and in continental Asia, or in Africa only, as I told you before, in Europe for sure, in Java and in Flores. And, at last, *Homo sapiens* expanded his territory again

around 200 thousand years ago, starting from Africa, or around 50 to 60 thousand years ago if we took the date of the Middle East. He reached America on foot, and peopled the Americas and Greenland without any problem, without any competition; he reached Australia by boat and peopled Australia without any problem as well; and reached Europe, Java and Flores and met there the previous inhabitants. In the three places, after thousands of years, thousands of years of coexistence, without real fights, without any active competition, *Homo sapiens* won. *Homo neanderthalensis* disappeared around 30 thousand years ago, *Homo soloensis*, Java man, disappeared around the same time, *Homo floresiensis* disappeared a bit later, 15 to 20 thousand years ago, maybe because of his more important isolation. And since that time there is only one hominid genus, *Homo*, one hominid species, *Homo sapiens* and one hominid race, *Homo sapiens sapiens*, on the earth, so we can very well become racist, because being racist means being humanist in a way.

Thank you very much.