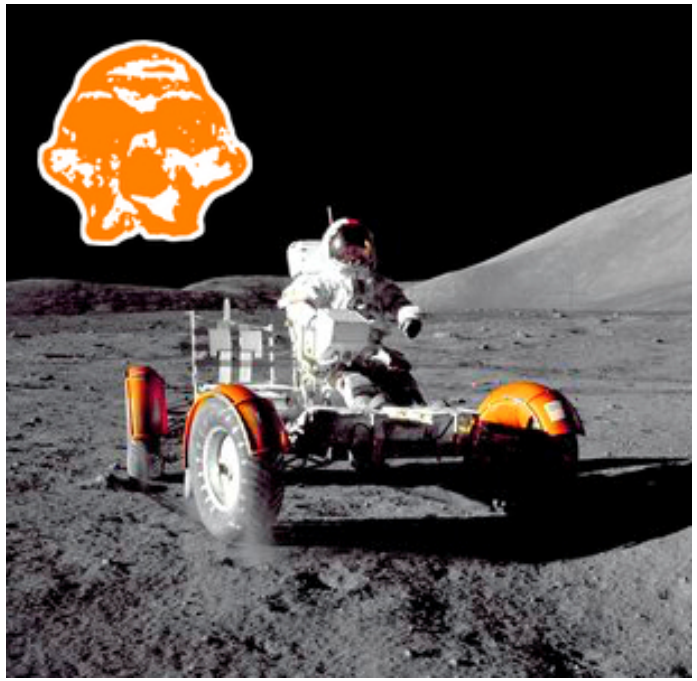


FROM APEMEN TO SPACEMEN:

THE STORY OF HUMAN EVOLUTION

PART 2.2: THE HOMININS - ENVIRONMENTAL BACKGROUND

PART 2.2: THE HOMININS - ENVIRONMENTAL BACKGROUND

In part 2.1 we looked at the anatomical background to early hominin evolution. Before moving on in part 2.3 to the earliest hominins we will first look at some environmental background to hominin evolution.

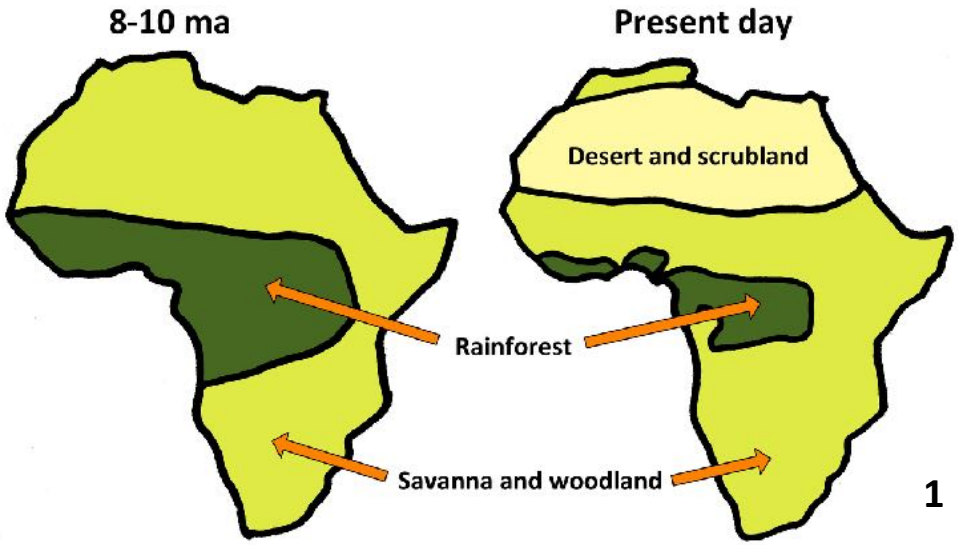
In part 2.2 you will learn about:

- African climate in the past
- Global tectonics and its influence on climate
- Global climate change
- Reconstructing past environments

AFRICAN CLIMATE IN THE PAST

Before we look at the earliest hominins in part 2.3 we need to look at the environmental context of human evolution in order to better understand the lives of our extinct relatives.

At around the time of the human/chimp common ancestor, Africa had more woodland and rainforest and little desert and scrubland (fig. 1). From 10 ma (million years ago), the global climate became cooler. East Africa became much drier, the forests became more fragmented and a mosaic of different vegetation types formed. Around 7-8 ma, tropical grass-dominated habitats began to emerge. The rainforests also began to contract.

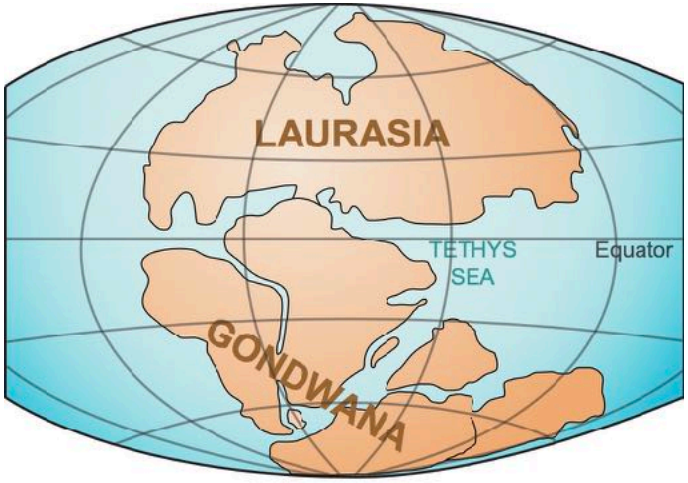


1

In addition to climate, also important was the East African Rift Valley, which started forming 20-15 ma. Here, the Earth's crust gradually bulged and moved apart, and the centre later sank forming the valley. Different environments emerged on either side of the rift valley. The hominins seemed to have evolved mostly inside the rift valley, chimpanzees outside. For more details on the East African Rift Valley see the following presentation video.

GLOBAL TECTONICS

There are a number of factors that led to the climatic conditions at the start of and during the course of hominin evolution. Global tectonics have played a large role. The Earth's tectonic plates are constantly moving at about the rate that our finger nails grow. This determines the shape and position of the continental land masses but also that of the oceans and seas. This has a profound effect on global climate.



TRIASSIC
200 million years ago

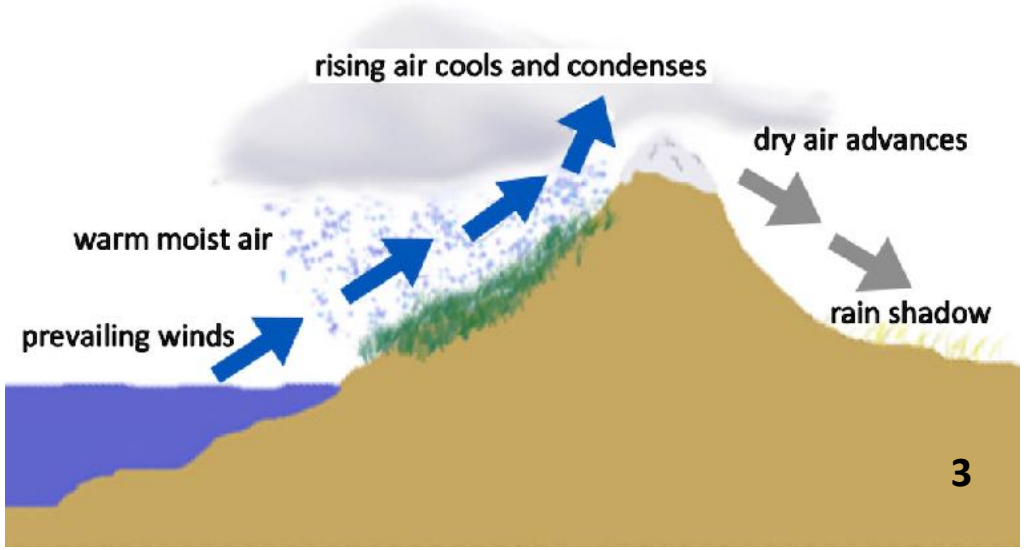
2

The Tethys Sea was a sea during much of the Mesozoic Era (252-66 ma), which was located during the ancient continents of Laurasia and Gondwana (fig. 2). The linkage between the remains of the Tethys Sea (the Mediterranean) and the Indian Ocean finally closed between 11 and 7 million years ago (before this Africa was actually an island). This changed the circulation of ocean currents which in turn altered the wind patterns and the water transported by the winds. The effect of all this seems to have been the drying of parts of Africa. The first sand dune deposits from the Sahara date to this time. It is likely that the shrinking of the Tethys Sea weakened the African summer monsoon, leading to a spread of desert conditions across North Africa and consequently a split between the flora and fauna of Africa and Asia.

At around 5.5 million years ago plate tectonics closed off the link between the Mediterranean and the Atlantic Ocean (which today is again of course open). The Mediterranean dried out and this also had a profound effect on the climate of North Africa.

The effect of plate tectonics can often be felt far afield. Around 20 million years ago the Tibetan Plateau began to be uplifted (the uplift was caused by the collision of the Indian tectonic plate into Eurasia, which began around 70 million years ago). The uplift intensified the South East Asian monsoon, which had the effect of drawing moisture away from East Africa.

The formation of the East African Rift Valley mountains further deflected moisture-rich air away from the African continent (fig. 3). Thus all of the above led to East Africa becoming drier and with a mosaic of different vegetation types. Rain forests were no longer able to survive in much of East Africa.



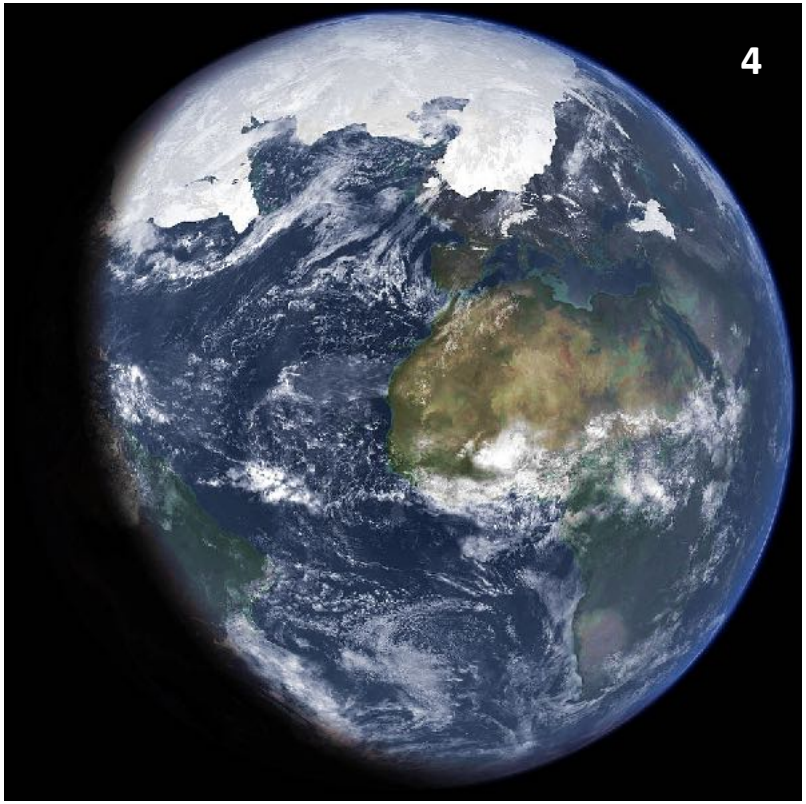
However, it is not just a matter of the African climate becoming drier. Every 20 000 years or so, the African climates swings from drier to wetter conditions. Especially over the last 5 million years it is thought that the drier periods have become very much harsher. Such conditions usually lead to higher speciation and extinction.

GLOBAL CLIMATE CHANGE

We have seen how tectonics changes have effects Africa, making the African climate drier and more variable. However, there were additional global changes that also had a great effect on the African climate and which no doubt greatly shaped hominin evolution.

The Earth of the last few million years has been dominated by ice ages but this is, geologically speaking, relatively recent. Around 50 million years ago the Earth was very different, being both wetter and warmer. Rain forests covered almost the entire span of the Americas, from Canada to Patagonia. This was also a period of rapid extinction and evolutionary change and many of the major groups of modern mammals appeared at this time.

Starting from around 10 million years ago global atmospheric carbon dioxide levels significantly decreased perhaps caused by the massive erosion of silicate minerals after the uplift of the Himalayas. Global temperatures dropped and ice sheets began to form in the northern hemisphere (fig. 4).



The northern hemisphere ice sheets

However, it was between 3 and 2.5 million years ago that the recent ice age really began. The ice sheets in the northern hemisphere grew significantly. Changes in the tilt of the Earth's axis of rotation around the sun at this time caused a greater difference between summer and winter. On an already cool planet, the especially cool summers in the northern hemisphere allowed ice to survive through the summer and develop into ice sheets.

But how does the build up of ice sheets in Europe and North America affect Africa? While ice sheets did not develop in Africa, the climate did become cooler and drier. From 3 million years ago there was a trend towards more open habitats and major shift to open grasslands occurred shortly after 2 million years ago.

It is interesting to note that the first hominins appear about 7 million years ago when the Tethys Sea was closed, drying out North Africa. As we shall later on the course, many new hominins appeared around 3 to 2.5 million years ago when the ice age started to have an effect on Africa. And the major shift to open grasslands shortly after 2 million years ago coincides with hominins with a significantly more modern appearance and lifestyle.

In sum, it can be seen that hominins evolved in a diverse and changing environment, the perfect conditions for speciation. The ancestral chimpanzees and humans seem to have evolved in quite different environments. The link between environmental change and hominin evolution is something that we will return throughout the course.

RECONSTRUCTING PAST ENVIRONMENTS

I will often mention what sort of environments the various hominin species lived in. To fully understand the lives of extinct species we need to know in what ecological setting they lived.

The environments in which fossils and archaeological remains are found are usually very different from how they would have been in the past. For example, Olduvai Gorge (fig. 5) has yielded many hominin remains but is today very arid. In the past it contained a great lake and was far more wooded.

Past environments can be reconstructed by examining the geological deposits for the animal and plant remains they contain. We can easily distinguish, for example, wooded environments from grasslands. Many early hominins may have lived in a habitat somewhat like figure 6, wooded but with open spaces.

Olduvai Gorge, Tanzania

Modern woodland

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