Teeth of our ancestors

Discovery of a lower jaw in Malawi and what happened next

By Markus Bernards

The rich fossil deposits in northern Malawi have revealed traces of the oldest humans – after almost ten years of searching. Palaeontologists Friedemann Schrenk and Ottmar Kullmer tell the story of their sensational find, the role that pigs' teeth played in it, and how a museum in Northern Malawi Province came into existence.

Members of the excavation team show their finds at the Malema excavation site in the Karonga District. Front: Tyson Mskika with the 2.5-million-year-old lower jaw of a *Homo rudolfensis*. Photo: http://www.warmheartof-malawi.org

Anyone wishing to visit palaeobiologist Friedemann Schrenk can meet him at the Senckenberg Museum in Frankfurt where he picks them up at the ticket office. Although his face is hidden by a mask due to the COVID-19 pandemic and his clothes are unprepossessing – black jeans, black T-shirt – his high forehead and white, slightly tousled hair are unmistakable: he has achieved a certain degree of fame since he found a fossil in 1991 of what is presumably the oldest *Homo* species, the 2.5-million-year-old lower jaw of *Homo rudolfensis*, in Malawi in south-east Africa.

Schrenk leads his guest through small groups of museum visitors, past dinosaur skeletons and mammal dioramas, and through an inconspicuous door into the museum's research and administration wing, where the hubbub dies away and the manifold shapes and colours of the museum exhibits give way to the sober objectivity of the office. In a small library with metal shelves under neon lights, they are joined by Schrenk's colleague Ottmar Kullmer, who also played an important role in the discovery of the lower jaw. That was in 1992, one year after Schrenk's spectacular find.

The story of the discovery of the pre-human began in the early 1980s. While still a geology student, Friedemann Schrenk had obtained a scholarship to study fossils in South Africa. It was there that he met his American colleague Timothy Bromage, and together they started the Hominid Corridor Research Project in Malawi in south-east Africa. The two researchers wanted to find fossil evidence for their hypothesis that pre-humans and early humans had moved along Africa's Great African Rift Valley, that is, to cor-

IN A NUTSHELL

- Northern Malawi harbours many mammal fossils that allow palaeontologists to reconstruct the habitat of pre-humans and early humans and determine their age.
- One spectacular find was that of a toothed lower jaw of the oldest human species *Homo rudolfensis*.
- In the years following the find, a local museum and cultural centre were built, with an exhibition spanning the period from the origins of humankind in Malawi to the present day.

roborate that there is a connection between the fossil sites thousands of kilometres apart in South Africa on the one hand and Kenya and Ethiopia on the other. Schrenk and Bromage had to endure a lot of ridicule for the ambitious title "Hominid Corridor Research Project" because although the researchers, supported by many local helpers, recovered plenty of animal fossils over the course of almost a decade, of antelopes, for example, or pigs, they didn't unearth any hominin finds. Not really surprising, according to Schrenk, as these are rare: "You can't be sure whether you'll find anything at all, in fact." At a meeting in 1990, a fellow researcher sneered (Schrenk mimics his high-pitched voice): "That's not a hominid corridor,

Perfect fit: Ottmar Kullmer has inserted the broken tooth fragment into the fossilised lower jaw. Photo: Markus Bernards

that's a pig corridor, an elephant corridor, an antelope corridor. Where are your hominins?"

Then, one year later, the big moment came after all: the practised eyes of team member Tyson Mskika discovered the two halves of the lower jaw. The excavation camp celebrated with a big party; the great scientific goal was in the bag. At this point, Schrenk briefly interrupts his narration, leaves the library, and returns shortly afterwards with a silver-coloured metal case. He takes something out of it and places it in front of the visitor, on a small brown cushion: the lower jaw of a human being turned to stone, 2.5 million years old, at a broken edge on one side even the root of a tooth is recognisable. Even in 2022, this is still an almost auspicious moment.

The lower jaw is incomplete, incisors are missing and the posterior molar on the left, on the right an almost square piece of the second molar has broken off. That was a bit of bad news in the euphoria after the find – in the media too – because the number of cusps on the second molar could have revealed whether it was the lower jaw of a representative of the genus *Homo* or of an older pre-human (*Australopithecus*).

Ottmar Kullmer, in 1991 a graduate geologist who writes geological reports as a freelancer, read about the missing piece in the newspaper and, together with two friends, wrote a letter to Schrenk, who then invited them to Darmstadt. Kullmer: "It was a long letter about how great we are and whether we could tag along to Malawi at some time. We tended to brag a bit back then, and evidently our letter was so impressive that he wanted to meet us." During the conversation in Darmstadt, Schrenk then said that they could accompany him to Malawi if they could find the missing piece of the tooth. "We were quick as a shot and said, 'We'll find it'," says Kullmer. "Then we walked out and thought, 'For God's sake, what did he just say? This is total madness!'"

Just a few months later, this "madness" consisted of building a track in Malawi to the site where the lower jaw had been found, coordinating the camp with 50 helpers (Schrenk had already travelled on to Tanzania), and clearing away the top few centimetres of earth from an entire slope, 15 tons of material, filling it into rice sacks and transporting it by Land Rover to Lake Malawi. There, the sediment was first of all spread out to dry on grass mats, then the fine sand was sifted out with water from the lake and what remained – grains and fragments

Friedemann Schrenk and Ottmar Kullmer (right) present the 2.5-million-year-old lower jaw of an early human of the species *Homo rudolfensis* found in Malawi. Photo: Markus Bernards

ranging from centimetres to just millimetres in size – were picked over by hand. The whole thing took the entire excavation season – eight weeks. Finally, in the last sack, the missing piece of tooth from the lower jaw was indeed found, confirming: the lower jaw once belonged to one of our ancestors of the genus *"Homo"*.

Kullmer did not write any more geological reports after that; he completed his doctoral

Photo: http://www.warmheartofmalawi.org

Radio Dinosaur and the Cultural & Museum Centre in Karonga, Malawi

Malawi stretches along Lake Malawi for about 1,000 kilometres, creating large distances within the country. For a long time, the sparsely populated north of the country was considered politically and economically isolated – even when the capital was moved from the south to the centre of the country. But the northern district of Karonga is rich in fossils; petrified dinosaur bones were discovered there back in 1924, which in the 1980s could be attributed, along with other finds, to *Malawisaurus*.

In the 1990s, three gentlemen from Karonga, Oliver Mwenifumbo, Lawrence Mwamlima and Archibald Mwakasungula, set themselves the goal of making their district's history accessible to the local people. This is how the first idea of the Cultural & Museum Centre in Karonga was born. Under the motto "From Dinosaurs to Democracy", the museum's exhibition today spans the period from the geological prehistory of the Karonga region, the time of the dinosaurs (with a spectacular *Malawisaurus* skeleton), the first hominins (including a cast of the lower jaw of *Homo rudolfensis*), the settlement of the Ngonde people and the time of slave traders and missionaries to Malawi's independence, dictatorship and today's democracy. Many exhibits were donated by the people of Karonga for their museum. Attached to the museum are workshops and a large stage for events.

Malawisaurus was also the "godparent" of the local station "Radio Dinosaur", a community radio (free radio) with a regional licence. Twelve people meanwhile produce a daily programme from 6.00 a.m. to 8.00 p.m. Raymond Mwenifumbo, who is responsible for project management and fundraising at the station, explains: "Radio Dinosaur is an educational station. Our topics include, for example, health, agriculture and news from different parts of the district, and we broadcast – unlike the national radio stations – mainly in the local languages Kyangonde and Chitumbuka. Sixty percent of our listeners can neither read nor write, so some people send us letters they don't understand, which we then read out on the radio."

The District Commissioner has also used Radio Dinosaur to disseminate important information, for example about COVID-19 or flooding, and with the help of Radio Dinosaur Karonga Police Station has organised community policing exercises with citizens on two occasions to prevent crime and improve relations with the police. The Chiefs, especially traditional leaders, and the community radio's youth and radio clubs also work closely with the station.

Very often, of course, the programme is about Malawi's early history, for example when Friedemann Schrenk or Timothy Bromage are on the programme or when Harrison Simfukwe, palaeontologist and senior curator at the Cultural & Museum Centre, discusses the origins of life with a priest from the African Church.

From the beginning, high expectations were attached to the start of Radio Dinosaur's broadcasting operations. The views of some traditional leaders:

"The idea of a community radio station for Karonga is great. It will complement and accelerate socio-economic development activities in the district; including cultural life and heritage. I want this to succeed. You have our support," said **Paramount Chief Ntemi Waba-Temi Kyungu**.

"I welcome the idea of a community radio for Karonga District. It is long overdue. For a long time, I have been wondering why we people in Karonga do not have a community radio station to broadcast in the Ngonde and Tumbuka languages, as is done elsewhere. This is a welcome development. We need this radio station," said **Senior Traditional Authority Ntemi Kalonga**.

"The museum is about dead history, the community radio is about live history: the two complement each other. Right now, we are preparing a week of cultural events that will also include traditional music and dances. You are free to make recordings for our radio station," said **Senior Traditional Authority Themba Wasambo**.

"I welcome the community radio station. It will help us in promoting development activities in Karonga District," said **Traditional Authority, Themba Mwilang'ombe**.

Radio Dinosaur broadcast on the origins of life:
https://tinyurl.com/RadioDinosaurShow

Links

Hominid Corridor Research Project
http://paleobiomics.org/hcrp.html

Tyson Mskika and Timothy Bromage report on discovering the lower jaw
https://tinyurl.com/LowerJaw

URAHA Foundation
www.uraha.de

Weaning phase in Neanderthals
https://tinygu.de/NeanderthalMilkTeeth

degree on the developmental history of prehistoric bushpigs and giant hogs (suids), which had experienced a relatively rapid evolution. For this reason they are important as index fossils because they make it possible to date fossil layers, such as that containing the lower jaw of *Homo rudolfensis*, quite accurately to 2.5 million years.

But is it really worthwhile searching for hominin fossils for so many years if there are ultimately so few finds? If there are more hominin researchers than hominin finds, as Schrenk once mocked in "Der Spiegel" magazine? "Hold on a minute, not so fast," says Schrenk. "After all, we're not just hunting for these human remains, our goal has always been to understand the whole environment, the ecology, food resources, metabolic exchange, all the organisms in a habitat." The two scientists call this approach "palaeobiomics", the holistic analysis of a biome system millions of years ago.

The many fossils have helped to draw this overall picture, and new methods today facilitate, for example, the analysis of the fine structure of fossil teeth and bones. Kullmer explains: "Tooth enamel grows in crystallites, in prismatic structures with daily growth lines, over two to four years. If you study the composition of the chemical elements, you can observe cycles, perhaps rainy seasons in which food resources change. When children are weaned, that's also reflected in their teeth."

Out of the distant past arise exciting questions for the present, think the two palaeontologists: they are planning research projects on the

ABOUT FRIEDEMANN SCHRENK

Friedemann Schrenk, born in 1956, studied geology, palaeontology, mineralogy, zoology and anthropology in Darmstadt and Johannesburg, earned his doctoral degree in biology at University Hospital Frankfurt and his postdoctoral degree (habilitation) in palaeontology in 1994 at the Technical University of Darmstadt. From 1988 to 2000, he worked at the Hessian State Museum Darmstadt and was its director from 1993 to 2000. He then moved to Goethe University Frankfurt as Professor for Palaeobiology of Vertebrates. In the same year, he additionally became head of the Palaeoanthropology Section at Senckenberg – Leibniz Institution for Biodiversity and Earth System Research. From 2008 to 2010, he was in charge of the Centre for Interdisciplinary African Studies. Friedemann Schrenk has curated numerous exhibitions, including "From Dinosaurs to Democracy" at the Cultural & Museum Centre Karonga. He has received many awards, for example the Communicator Prize of the German Research Foundation in 2006, which he was awarded for his school project on hominins. In this project, which was also funded by the Uraha Foundation initiated by Schrenk, schools in Europe and Africa are given castings of hominin finds and corresponding teaching materials.

schrenk@bio.uni-frankfurt.de

ABOUT OTTMAR KULLMER

Ottmar Kullmer, born in 1964, studied geology, palaeontology, zoology and anthropology at the University of Mainz, earned his doctoral degree there in 1997 in palaeontology and geology and his postdoctoral degree (habilitation) in 2014 in zoology at Goethe University Frankfurt, where he has since worked as a private lecturer and since 2022 as an adjunct professor. Ottmar Kullmer worked at the Hessian State Museum Darmstadt and at the University of Mainz and was visiting professor at the University of Vienna before moving to the Senckenberg – Leibniz Institution for Biodiversity and Earth System Research, where he is head of the Tertiary Mammals and Morphometrics Section. Since 2016, he has also been in charge of its Palaeoanthropology Department. He has designed and supervised numerous exhibitions, including the travelling exhibition "Humans in 3D – in the focus digital techniques", which was shown in Germany, Austria and France, and the exhibition "Caveman Safari" ("Safari zum Urmenschen") at the Senckenberg Museum.

ottmar.kullmer@senckenberg.de

Searching for fossils: palaeontologist Harrison Simfukwe, Senior Curator at the Cultural & Museum Centre Karonga, Alick Malema, Friedemann Schrenk and Ipyana Mwalwanda (from left). Photo: Stefan Schmid

ageing of teeth, where they will examine how a set of teeth reacts biologically when the teeth are worn down – by pushing them out of the jaw, for example, or pushing them forward – and how dental treatments try to intervene in this process. They also want to explore the long-term effects of repeated C-sections. Today, according to Schrenk, the evolutionary process described by Darwin, according to which the organism best adapted to its environment has the highest chance of reproduction, has been replaced in many parts of the world by cultural evolution: the first stone tools made by *Homo rudolfensis* have evolved into countless instruments and machines without which we could not survive today. To feed the growing population, we have switched to mass-produced carbohydrates. And we now spend most of our days sitting, which has an impact on our bodies.

Research will, however, continue to centre on the fossils in Malawi, which has become a second home for Schrenk and to where the lower jaw will return (once again) as soon as the new National Museum in Malawi's capital Lilongwe opens its doors. And where Schrenk is also involved in many ways beyond his palaeontological research work: in the education of schoolchildren, students and doctoral candidates, as an adviser to the Malawian government on mining and the use of hydropower, in the shape of popular science lectures in the region and in the founding of an association in Germany, which – as the association itself says – "wants to tell the history of humankind where it originated – in Africa". The Uraha Foundation, named after the village close to where the lower jaw was found, campaigned with numerous supporters for the construction of a museum in the district capital Karonga, where the "Cultural & Museum Centre" opened in 2004. Ten years later, the community radio station "Radio Dinosaur" started broadcasting (see box) – once a month, Friedemann Schrenk is on air in the station's educational programme: by telephone from Germany or – preferably – on site in the studio in Karonga. ●

The author

Markus Bernards, born in 1968, holds a doctoral degree in molecular biology. He is a science journalist and editor of Forschung Frankfurt.

bernards@em.uni-frankfurt.de