

Interview with Prof. Zofia Kielan-Jaworowska

Paleontology Instills Humility



Mikołaj Grynberg

Zofia Kielan-Jaworowska at her home in Konstancin, outside of Warsaw (from a series of portraits portraying Foundation for Polish Science award winners)

Academia: What were the oldest mammals like?

Zofia Kielan-Jaworowska: *When I began to study the mammals of the Mesozoic era, which was more than 40 years ago, mammals from the age of dinosaurs were thought to have been not very numerous and poorly differentiated. But nowadays we know that the morganucodonts (the mammals most closely related to our reptile ancestors, known to have lived as far back as the late Triassic, or nearly 225 million years ago) were quite a numerous group. The same thing goes for other groups of mammals, especially those that lived in the Cretaceous pe-*

riod (145–65 million years ago). The dinosaurs had appeared on the Earth a few million years before the mammals and soon attained large size. The mammals, on the other hand, remained small for millions of years and it became customary to describe them as “living in the shadow of the dinosaurs.” Most of the mammals of the Mesozoic era (251 to 65 million years ago) were the size of a mouse or rat; mammals the size of a fox have only recently been discovered from back in the Cretaceous. The Mesozoic mammals led nocturnal lives, which was conducive to the development of their senses and brains. The mammal-like reptiles, from which mammals

evolved, were the dominant group of vertebrates in the second half of the Carboniferous and Permian (323 to 248 million year ago). The cynodonts (advanced mammal-like reptiles) probably already managed to develop warm-bloodedness, but not yet mechanisms for quick heat disposal. In the late Permian and in the Triassic the climate began to grow warmer and then small body size (conducive to rapid cooling) proved to be more advantageous. That is how we can explain why the Mesozoic mammals had remained small and led nocturnal lives.

And what were the dinosaur-age mammals like?

My friend Zhe-Xi Luo, a Chinese-American paleontologist with whom I wrote a book on Mesozoic mammals, published a paper in 2007 showing that the Mesozoic mammals were very diverse ecomorphologically. Luo concluded that many early mammals exhibited the same characteristics as certain mammals of today, although they are unrelated. Over the past two decades, several hitherto unknown types of mammal structure have been discovered, especially in China. The order Castorocauda, part of the extinct group of mammals known as the docodonts had a tail built like that of today's beavers. Castorocauda and its relatives died out and today's beavers evolved independently many millions of years later. Another group whose existence was not expected in the Cretaceous period consists of mammals that developed gliding flight. They include the genus Volaticotherium, recently described by Chinese and Mongolian paleontologists from deposits in China's province of Inner Mongolia. Volaticotherium had a fur-covered body. Its fossil skeleton has preserved an imprint of a gliding membrane, similar to the ones found in today's mammals capable of gliding flight. Lastly, in April 2005, Dr. Luo and his colleague Dr. John Wible described in Nature an extraordinary mammal from the late-Jurassic Morrison formation in the US, which unlike other mammals known from the Mesozoic era had enamel-less teeth akin to those of modern-day anteaters and armadillos; it also had massive front limbs indicating a rummaging lifestyle.

What led to the emergence of mankind?

Some early primates adapted to life in the treetops, and that is where our ancestors evolved. This treetop lifestyle influenced the development of the early primates' senses – giving them excellent sight and hearing, as well as a good sense of balance – and this in turn spurred their brain development.

Was it always clear to you that you wanted to study mammals?

I first took an interest in paleontology back in secondary school. In 1943 I graduated from a Warsaw secondary school that was clandestine in view of the Nazi occupation, and began studying biology at the underground Warsaw University, also attending clandestine classes there. Moreover, I worked as a volunteer at the Zoological Museum. I then bought myself a thick zoology textbook from a used bookstore, but did not have much time to study it before the Warsaw Uprising erupted – I took part as an orderly for the Grey Ranks. After the Warsaw Uprising the city was devastated. My parents' apartment in the district of Żoliborz was nearly completely razed, so I lived at the Zoological Museum at the address of Wilcza 64.

When my elder colleagues at the Museum reminisced about studying at Warsaw University before the war, they spoke about the classes taught by outstanding Polish paleontologist Prof. Roman Kozłowski, whom they revered. In the 1946/47 academic year, the war-ravaged Warsaw University began to operate again. I started to attend various lectures, including paleontology taught by Prof. Kozłowski. I once went to talk to him and told him I was interested in paleontology, especially the origins of mankind. He responded that there were no materials for studying human origins in Poland, saying: "You would have to travel abroad, perhaps to Africa." That was in 1947 and there was no chance of traveling anywhere abroad. Prof. Kozłowski told me that for my master's thesis I should work on some of the Devonian trilobites from Poland's own Świętokrzyskie Mountains. I found fieldwork much to my liking. So I decided that if there were no human remains to be studied, I would just have to work on something else. So I spent the first 15 years of my research career dealing with Paleozoic marine invertebrates.

Specifically trilobites?

First I spent a few years collecting trilobites from Devonian deposits in the Świętokrzyskie Mountains, based on which I wrote my master's and then doctorate thesis. Next I collected Ordovician trilobites from the same mountains and received a large trilobite collection to systematize from Jan Czarnocki, director of the State Geological Institute, which he had collected in those mountains before WWII. So I had a collection of tens of thousands of specimens. I then received a stipend from the Polish Academy of Sciences to travel to Sweden, where there were large trilobite collections, and after coming back I wrote an extensive monograph on upper Ordovician trilobites from Poland, Scandinavia, and Czechoslovakia, published in Paleontologia Polonica in 1959. After publishing that work I talked to Prof. Kozłowski again, saying that I would prefer to study vertebrates. But the professor nevertheless proposed for me to study the complete jaws of polychaetes, which are rarely preserved in fossilized form but which he had discovered in Poland in erratic Ordovician and Silurian boulders. So I spent the next two years visiting cement plants around Warsaw and in the Masurian region, where I could inspect polychaete-con-



This 70-million-year-old skull of *Asioryctes*, one of the earliest placental mammals, was discovered in 1970 by the Polish-Mongolian Paleontological Expedition to the Gobi Desert (shown here on the finger of Dr. Jorn Hurum from the University of Oslo)

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taining limestone boulders that had been glaciated in from Scandinavia.

How did you finally end up in the Gobi Desert?

Prof. Kozłowski retired in 1959 and I took the helm of the research center that would later become the Institute of Paleobiology. In 1960, the Mongolian Academy of Sciences was finally established. As a member of the Presidium of the Polish Academy of Sciences, Prof. Kozłowski informed his students that a research cooperation agreement was to be signed with the Mongolian Academy. He also asked me to prepare a three-year project for Polish-Mongolian expeditions in Mongolia. I began to read up on Mongolian dinosaurs and mammals. The authorities of the Academy chose me to organize the expedition and to lead the research.

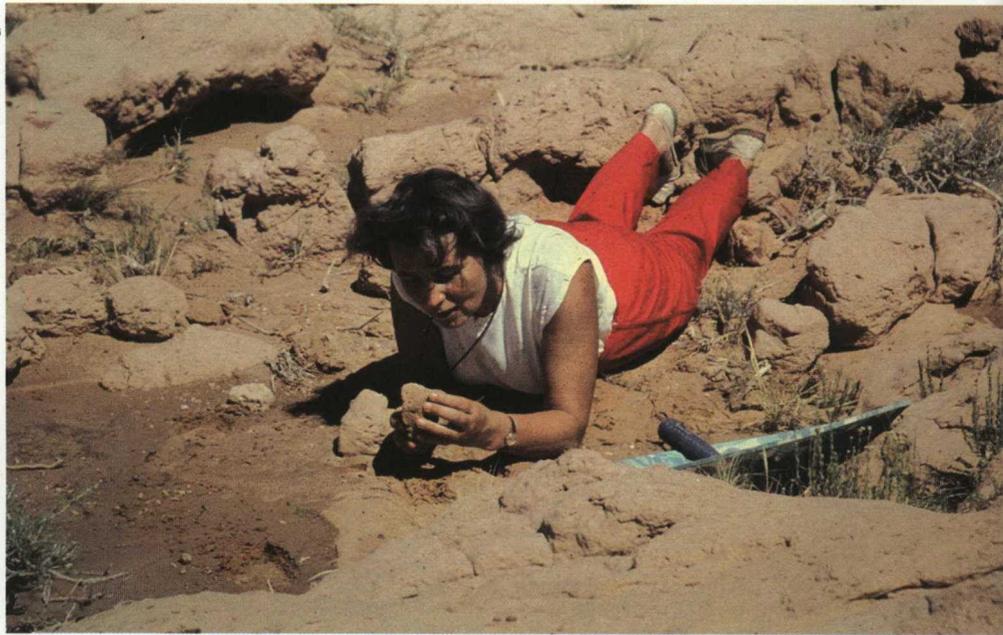
You were Poland's first and then only woman to lead a field expedition.

I suppose so. In the US, where paleontologists had been digging for years and studying dinosaurs and early mammals, work was mostly done by men. No one had ever dreamed that a woman could lead a field expedition. Now things have changed. Women are doing research around the world, and many women are working in paleontology.

The team you then led also included other women.

My dear friend, the late Prof. Halszka Osmólska, and Assoc. Prof. Teresa Maryńska mainly dealt with dinosaurs. Prof. Magdalena Borsuk-Białynicka first worked on rhinoceroses and dinosaurs, but then she and Andrzej Sulimski systematized a unique collection of Cretaceous lizards from Mongolia. I dealt with the collection of dinosaur-era mammals, whereas our colleagues from Kraków worked on Tertiary mammals. We published the results of the expeditions in 10 volumes of the "Results of the

Archives of the Institute of Paleobiology PAS



Zofia Kielan-Jaworowska out in the field in Mongolia's Gobi Desert, during the Polish-Mongolian Paleontological Expedition in 1969, which unearthed numerous mammal skulls and skeletons, dinosaur eggs and skeletons

Polish-Mongolian Palaeontological Expeditions" series in *Palaeontologia Polonica*. We published the major findings in *Nature* and other foreign and Polish research journals.

You preferred working with mammals than dinosaurs?

I believe that there was more to be done with the mammals. Besides, it was easier for me to work on the smaller mammals than the larger dinosaurs. Soviet paleontologists who organized expeditions to Mongolia in the 1940s discovered a cemetery of large dinosaurs in the Gobi Desert's Nemegt Basin. These skeletons were very hard to excavate. Caught up in the hard work of unearthing these several-ton giants, they did not have the time to look for small mammals. Aside from that, they found numerous Tertiary mammals. From the outset, we were looking for not just dinosaurs but also mammals from the Cretaceous period, and we amassed a sizable collection of them.

Nowadays you are one of the world's top specialists on Mesozoic mammals. You

received what is known as the "Polish Nobel Prize" for your book on *Mammals from the Age of Dinosaurs*.

I was involved in editing and writing the first-ever book on Mesozoic mammals, published back in 1979 by California University Press. That first book was initiated by my colleague Prof. Jason A. Lillegraven from the University of Wyoming, Laramie. It was a book by many authors, edited by three people: Lillegraven, A.W. Clemens, and myself. Twenty five years after its publication, so much had changed in our understanding of the Mesozoic mammals that a new book was sorely needed. For several years I had been planning to write such a book, but I knew it was too daunting a task for one person. I invited two younger colleagues from the US to collaborate: Dr. Zhe-Xi Luo and Prof. Richard L. Cifelli. Both of them are very busy with lectures, seminars, fieldwork, and organizational affairs at their respective universities and museums. Over the five years of work on the book, my coauthors repeatedly came to stay with us in Konstancin - that was the only time

they could tear themselves away from their day-to-day activities and focus on the project. Writing this book was a huge effort.

But the first book on Mesozoic mammals was also important?

Yes, but it quickly became outdated. Our understanding of the Mesozoic mammals progressed very rapidly in the 1980s. In the US, the method of washing soft deposits through screens and then drying out the remaining material began to be used on a large scale. Prof. Lillegraven perfected this washing and screening method, building a kind of raft with scaffolding instead of a base. He positioned these rafts in the river perpendicular to the current, then placed crates with bronze mesh bottoms into the scaffolding. The crates were half full of excavated material. After the river current washed away at the material overnight, the crates and remaining deposits were dried out in the sun and the specimens examined.

Both of your books were written right here in your Konstancin home. I gather that quite a number of coauthored papers were, as well. You frequently host scientists from around the world. There is always a lot going on in your home; you have two charming dogs and a very warm atmosphere in general.

Our son, who graduated with a degree in English studies in Poznań and translates American films, is now working as the Central and Eastern Europe representative of a large film production company. He travels around Europe checking on dubbing work, helping choose actors, etc. He and his family live right next to us, sharing the same backyard. We have two grandchildren, both of them already in college. My husband (Zbigniew Jaworowski, professor of radiobiology and a medical doctor by education – editor's note) and we frequently give one other our papers to check. We are therefore aware of each

other's research and frequently talk about our projects.

Many of the scientists who have had the opportunity to work with you point out your extraordinary passion, a desire to understand the whole world and everything that comprises it, its history and the evolution of life. Mankind is just one of many pieces in this grander puzzle.

If it were not for various random events that occurred during the first 160 million years of mammalian history, mankind might never have evolved. Comparing the evolution of life on Earth, stretching back billions of years, to human history, so brief on the geological scale, gives one a good sense of perspective about mankind's true place in the universe.

Yet most philosophical systems put mankind firmly at the center of the universe...

That has unfortunately had tragic consequences in history. Paleontological research helps us to better understand our place in nature. We humans are related to millions of other organisms now living on the Earth, as well as to billions of others that have died out. We are not some exceptional beings, created as the image and likeness of some imagined supernatural entity.

Yet we would like to be...

My husband and I are atheists and we view the sources of religion in terms of human development. The need for religion arose out of early humans' inability to comprehend the Universe and their fear of the unknown. Unable to grasp the complexity of the infinite world, primitive man devised the notion of an infinite God and ascribed him with a protective force that determines all and governs all in quasi-magical fashion. Today, too, it is easier for many people to live with the conviction that there is such a force. This is a substitute for knowledge, it alleviates the need

to investigate the incomprehensible. Our current knowledge is a mere tiny fraction of a drop in the whole ocean of information just waiting to be discovered and understood. Since the universe is infinite in time and space, we will never attain full knowledge; there will always be something to discover, something will remain mysterious. This awareness may itself be a source of rapture and humility, something that is often described as spirituality. But it is hard for us to understand that so many people still accept an interpretation of the Universe according to what people imagined 5,000 years ago. What they knew was many orders of magnitude smaller than what an ordinary secondary school student knows nowadays, but in arrogance they equated themselves with God's image.

Interviewed by
Patrycja Dołowy
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Prof. Zofia Kielan-Jaworowska

– world-famous Polish paleobiologist, a retired professor at the Institute of Paleobiology, Polish Academy of Sciences, a member of the Polish and Norwegian Academies of Sciences, *Academia Europaea*, and many other scientific societies. Her name and surname appear in dozens of species and orders of prehistoric animals (e.g. *Kielanodon*, *Kielantherium*, *Zofiabaatar*). In 1963–1971 she was the organizer/director of the Polish-Mongolian Paleontological Expedition, which discovered many new vertebrate species in the Gobi Desert. She is the initiator and main author of the book *Mammals from the Age of Dinosaurs* (2004), for which she earned the Prize of the Foundation for Polish Science, known colloquially as the “Polish Nobel Prize.”