Ifa lemvelo

The newsletter of the Natural History Museum of Zimbabwe
Volume 3, Issue 4:December 2022

Some of the stories in this issue

Mushroom party at the Museum

The party was held on the 17th and 18th of August.
The holiday activity proved to be very successful with 13 children on the first day and 16 on the second day.
The aim was to tap into the creativity of children using junk and to make them aware of the diverse fungi in Zimbabwe

Did you know?

...the first Victoria Cross award was awarded on the 30th March in 1896

Wishing ya'll a Merry Christmas and a Prosperous 2023

Mbiresaurus, Africa's oldest dinosaur found in Zimbabwe

Chris Griffin, Postdoctoral fellow at the department of Earth and Planetary Sciences at Yale University led the teamthat discovered this specimen

Natural History Museum of Zimbabwe is home to valuable research collections and is the best museum in Southern Africa, ranked fourth in size among the museums in Africa.

Ifa Lemvelo is published by the Natural History Museum of Zimbabwe
Box 240 Bulawayo
Corner Park Road & Leopold Takawira Avenue
Tel: 263 29 2250045
Web: www.naturalhistorymuseumzimbabwe.com
Email: natmuse@netconnect.co.zw
Facebook: Natural History Museum of Zimbabwe
Edited by Dr M. J Fitzpatrick & P. N Tshabangu
Design & layout by P. N Tshabangu

OPENING HOURS

Open everyday from 9am-5pm

Entrance fees

Locals
Adults $3
Children (5-14 years)$1

SADC Countries
Adults $7
Children $5

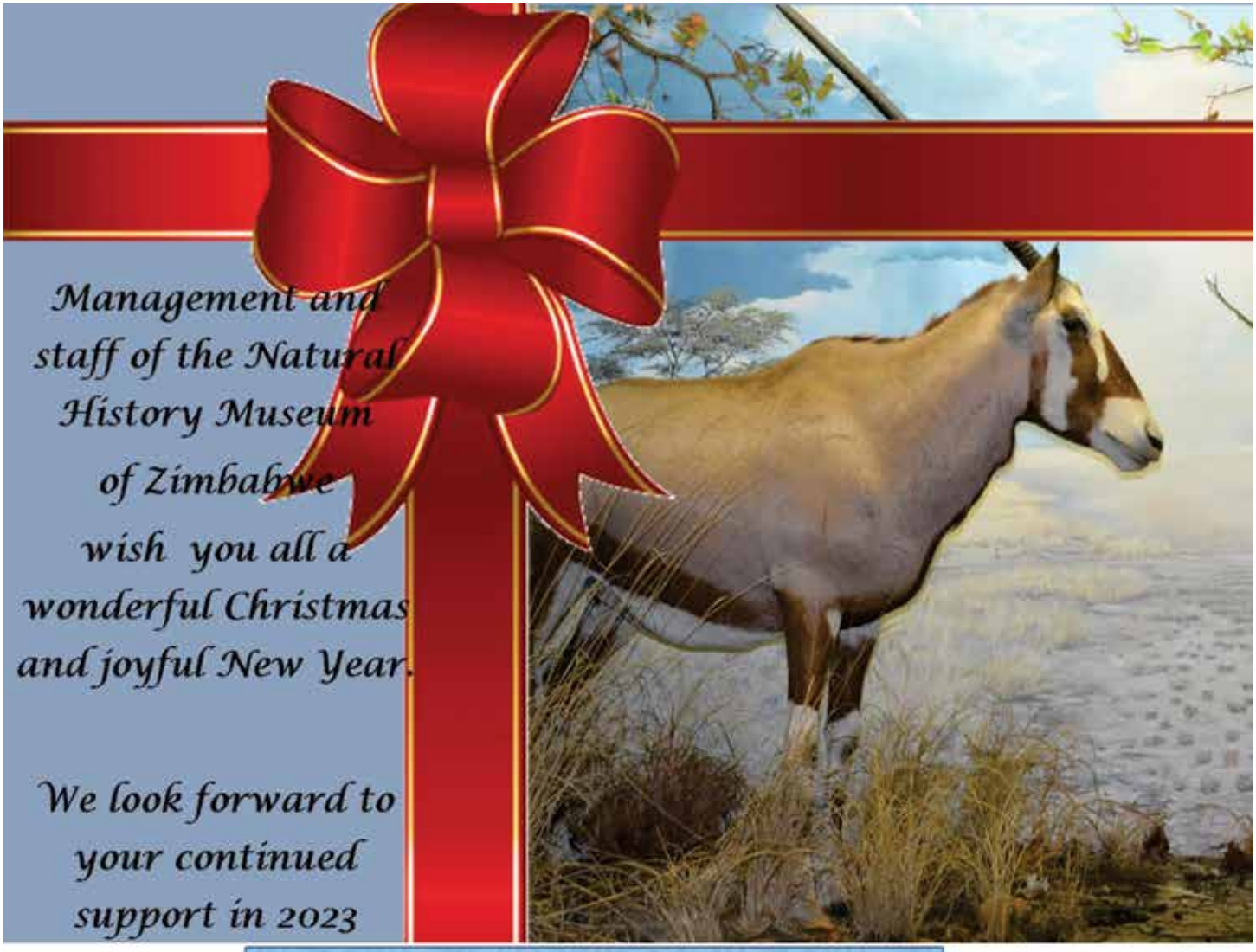
International
Adults $10
Children $5

All prices in US$, local currency accepted, calculated at prevailing official rate.

Message from the Regional Director

Hello and welcome to this issue!

It is hard to believe that we are almost at the end of the another year. Much has happened this year and we have been really excited about the much anticipated release of the Africa,s oldest dinosaur *Mbiresaurus raathi*.
Please join the Friends of the Museum as we have a number of outings planned for next year and we would like you to join us!
Thank you for all the support given over the past year as we recover from the pandemic and we wish you all a family filled holiday and don't forget to bring them all to visit our Wonderful museum!



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Did you know ?

…….that the First Victoria Cross awarded in this country was to Herbert Stephen Henderson on 30th March 1896. A copy of this Victoria Cross is in the Museum. Herbert was born in Glasgow in 1870 and died in Bulawayo in 1942 and is buried at Athone Cemetery. His grave was pointed out in a recent outing to Athone Cemetery organised by the Friends of the Museum with speaker Bryan Orford on 5 November.

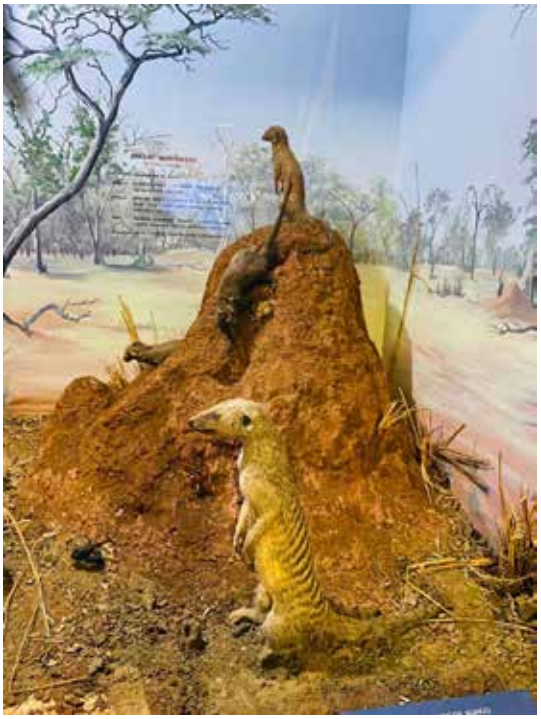
Animal Adaptations to Beat the Summer Heat

By Viola Makuvaza

Animals have evolved many adaptions to ensure that they can survive during periods of environmental stress. They have i) the ability to maintain the body temperature within the physiologically determined limits in spite of the high ambient temperatures, ii) the ability to remain in water balance when free drinking water is scarce or absent and iii) the ability to survive the seasons when food is in short supply or when food is low in calories and protein. When the ambient temperature increases some animal species shelter in a more equable microclimate such as caves, burrows or under vegetation. Most animals have evolved to regulate their body temperature in all kinds of different ways, including panting, rolling around in the mud, swimming in the water, lounging in shade, and some animals also have exceptionally long ears with a lot of blood vessels that release excess heat into the air. The mechanisms of these adaptations vary according to the size, volume and phylogeny of each species.

Reptiles and amphibians cannot control their own body temperature; they are cold blooded. They rely on the temperature of their surroundings to be warm or cool depending on their needs. When a snake, turtle, frog, or lizard gets too hot, it has to find shade, water, or bury itself underground where it is cooler. Reptiles such as lizards and snakes are especially susceptible to heat and can die after only a few hours' exposure to hot summer sun; these animals seek shelter under rocks and in burrows. Turtles will go into deeper water during heat waves. Freshwater fish such as bass also seek cooler, deeper waters during summer heat.

During dry hot seasons, snails retreat into their shells and earthworms hide under ground, surviving for weeks a process called "estivating", which is the opposite of hibernating. They will re emerge when the rain comes, making their environment wet enough and providing adequate vegetation to eat. Termites have a way to construct their own "air conditioning" system in the mounds they build for their homes. When building these mounds they construct air pockets that create ventilation through convection. These allow the interior of the mound to remain remarkably cool even when it's hot on the outside. Small mammals such as the dwarf mongoose are often found living comfortably in old termite mounds where the temperature remain constant all year round.



Birds have an elaborate breathing system that includes air sacs in addition to lungs and that helps them get rid of excess heat by panting. As warm-blooded creatures that lack sweat glands, birds have to find unique ways to regulate their body temperature by "gular fluttering", or vibrating muscles and bones in the throat. Gular fluttering helps regulate temperature by increasing evaporation through the membranes in the throat—the more a bird vibrates them, the more the moist throat membranes are exposed to air, allowing for better evaporation. Because the process involves only a small amount of muscle and bone, it doesn't require a lot of energy, making it a fairly efficient mode of cooling. Types of birds that employ gular fluttering include pelicans, herons, doves, owls, quail and nighthawks Many birds will take baths or stand in water to stay cool. They have very few feathers and lots of veins in their legs that pump blood close to the surface to cool it down. Birds will also spend their time in shady trees where the sun is not so harsh.

Many species suffer shortages of free water drinking water and water in the food during the dry season. Body fluids have to be conserved because a reduction of body fluids below about 80% of normal is lethal for most species. A way to cool the body is by evaporation of water from the body surface which can only happen if the individual is able to spare body fluids for this purpose. Water conservation and maintenance of a stable body temperature are conflicting demands in hot environments but animals have a way of balancing the two demands.

In the ungulates when it is summer and hot during the day individuals may lose considerable quantities of water due to evaporative cooling. The Waterbuck require more water than other species of similar size as it exhibits a great dependence on water and consequently this species must always remain close to water sources as implied by its name. It cannot tolerate dehydration in hot weather.

Ungulates reduce their food intake in summer, which reduces the volume of available preformed water taken in with the food but it also conserves water because of the smaller amount of metabolic waste products concentrated urine and faeces. The Eland can produce urine which is twice as concentrated and reduced to half in volume as the normal. Under some circumstances the kidney of the ruminants reabsorb urea which is then resynthesized into protein by bacteria in the rumen and this serves the double purpose of conserving water and supplying additional protein. Some rodents have been found to have the ability to withstand desiccation and can survive long periods without drinking water.

Water is also lost from the body through evaporation by panting and sweating which depends on the species, the amount of available water and the level of heat stress during the day. Large carnivores such as the hunting dogs and cheetahs have body temperatures rise to as high as 44 degree Celcius when running. After running the body temperature returns to normal due to evaporative heat loss. True sweating is mostly limited to primates and equines. Horses sweat heavily when they are working hard, they have the ability to produce a type of foam or lather over their bodies, particularly around the hind legs and neck, when exercising or working in hot environments. This foam contains a unique protein called latherin that gives the sweat a foamy appearance when it is in an area where friction occurs, such as between the thighs. The latherin allows the perspiration to work

through the entire surface of the waterproof hair, from the base to the tip. This in turn increases its exposure to air so it will eventually evaporate from the body. Zebras, just like horses and donkeys, are a member of the genus Equus and therefore, have the ability to create the same foamy latherin that helps to facilitate evaporation and cooling around the hair. In ungulates evaporative heat loss is either cutaneous through the sweat glands or respiratory through the respiratory tract and nasal passages and often associated with deep breathing or panting.

Monkeys, apes, and hippos sweat. The hippopotamus secretes a red sticky mucus-filled liquid that functions as a kind of moisturizer, sunscreen, and antibiotic. This perspiration is initially colorless, but it actually turns red and brown when reacting with certain pigments. The hippopotamus's skin is extremely sensitive and prone to drying out, they therefore mostly stay in the water or roll around in the mud to keep their delicate skin moisturized. As the moisture from mud evaporates, it carries away body heat in the same way sweat evaporates from a human body to help us cool down. The evaporation is at a rate much slower than evaporating water, meaning animals who do mud bath stay cooler for longer. The mud also offers additional sun protection from hot damaging rays functioning as sweat and as sunscreen for the hippos. Hippos are also very territorial creatures and they will sometimes venture onto land to chase predators or other intruders out of their domain where, their mucus acts as further protection and lubrication for their skin until they can return to the water.

Dogs and cats do sweat a little through their paws, Because of their thick fur, dogs cannot sweat over most of their bodies so they must still pant to remain cool. Breath is hot, so when animals want to cool down, they try to get their hot breath away from them as quickly as possible and drawing in cooler air this is known as panting. When the cool air comes in contact with the moist lining of the lungs and throat, it helps the animal reduce its body temperature. Many animals, including canines, will also seek shade and water to cool off their bodies.

Elephants, hares and rabbits all have big ears, which are used in to keep them cool. Hares and rabbits regulate their entire body temperature through their ears, dilating or constricting blood vessels depending on the external temperature. Elephants get even more of a cooling effect by flapping their ears like fans to cool the blood flowing through them, and even spray water on to them. Elephants often seek water to cool down in a pond, stream or river.

It is important that animals have access to water especially during the hot summer period to avoid high mortality rates which are usually associated with water scarcity. Wildlife in the Hwange National park and other protected areas benefit from the provision of supplementary water and creation of additional waterholes. In the summer animals especially herbivores spend less time foraging in open areas where they are not protected from solar radiation and also the fear of predators. They usually visit the waterholes at dusk when the sun is getting down and this is a good time for tourists to do game viewing. A water bath is also an important outdoor facility for tourists to enjoy bird watching of birds which would be dipping themselves in the water in order to cool off.

The Makuru Hills Excavations

By Sithembiso Ncube

Makuru Hills

Makuru is a small hill in the Runde Communal Land about 16km west of Zvishavane. The hill forms part of a green stone ridge that dissects the Pfumwe Valley 2.5 km upstream from the stream's confluence with the Zvegona, a tributary of the Shavi. Mr J White discovered the remains of a village during the construction of a new road near the hill, and during the process of grading a small ash lens was exposed, and pole- impressed daga, as well as daga features in the surface which could be remain of grain bins were found scattered over a large area between Makuru and small vlei to the west.

During field work and excavations in the 1970 six 3m squares excavation pits were dug along the edge of the road next to the exposed ash lens as well as closer to the hill. Copper wire, iron rings, part of an iron needle and slag confirm that metal was smelted in or near the village. Shell and glass beads were found, the shell beads made form fresh water mussels. In addition to the above several artifacts were found such as bones (domestic animals), figurines, and pottery.

Excavations at Makuru Hills

The decorated pottery fragments found during excavation consisted of three shapes which include the Jar (a dependent restricted vessel with an inflected contour and the height as the largest dimensions), neck bowl or pot (an unrestricted vessel with an inflected contour and the mouth diameter as the largest dimensions), Open bowl (an unrestricted vessel with a simple contour it includes two forms thus internal thickened lip and simple lip).

The distribution and internal consistency of the pottery showed that Makuru is a single component site, and the slag, daga and domestic animal bones confirm it was a typical Iron Age Village. The Pfumwe River, although no longer permanent was undoubtedly a source of water in the past, and its small valley would have provided arable land. The decorations on the pottery and the Carbon dating suggest it is from the Early Iron Age Stamped-Ware Tradition (about seventh century), although the combination of red and black pottery suggests a new development. The present of the glass beads suggest trade activities with the east coast, although these did not begin until the ninth or tenth century AD. The presence of animal bones at Makuru demonstrates that cattle were kept during the Early Iron Age, although this is not a common practice at this time.

Mushroom Party at Natural History Museum, Bulawayo – 17th and 18th August 2022.

By Cathy Sharp

The Mushroom Parties, as a holiday activity, proved to be very successful. Thirteen children attended the first party and sixteen the second, some children coming to both and asking for another day! Some parents stayed to enjoy the fun and encourage their children and help the others when needed.

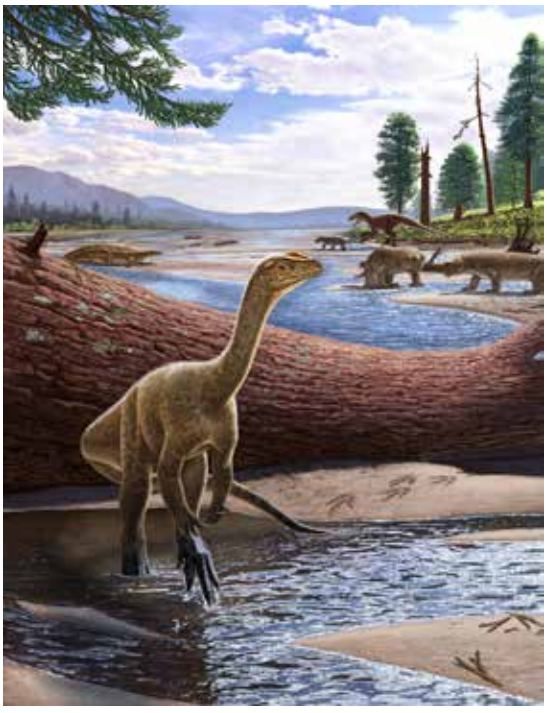
The aim of the exercise was two-fold. Firstly, to tap into the child's creativity in turning 'junk' into something meaningful – a 'mushroom' or other fungus. Secondly, to make the children aware of the incredible diversity of fungi in all their shapes, sizes, colours and life-styles. The Pocket-guides to Fungi in Zimbabwe were on hand for reference, inspiration and guidance. Casual education about different fungi was through conversation and explanations. I did not want the children to think that this was 'school work'.

Once started, the children became self-motivated, selecting items from the heap of household 'junk', and after looking at the books, designed their own mushroom. Mixing primary colours to their requirements they painted their models and once dry, these were put on the display table. It was encouraging to see the children working steadily at their own pace with focused intent. Some children weren't satisfied with making just one model and they managed to create several different 'species' of fungi. Other children went further and started drawing, then painting mushrooms on sheets of paper. All in all, a great time was had by everyone.

Some children donated their creations towards the Fungi Display for which I am very grateful. Thanks are also extended to Mthandazo (Mtha) Majikijela, Martin Sanderson, David Waters, and David Watson for supervising and encouraging the children and to Judy Ross for ensuring we were all 'fed and watered' throughout the day. I am grateful for the many donations towards the pizzas and to Halsteds for their donation of some materials.

Mbiresaurus, Africa's oldest Dinosaur found in Zimbabwe.

WE have been incredibility fortunate to be part of the discovery of this oldest Africa dinosaur. Chris Griffin,Postdoctoral Fellow at Department of Earth & Planetary Sciences, Yale University lead the team that discovered this and the specimen belongs to the Natural History Museum of Zimbabwe and will be returned when all research is completed.



This is what Chris has written about this exciting discovery

Summary

The origin and early evolution of dinosaurs has been a topic of great scientific interest since their discovery. The earliest known dinosaurs (from ~230 million years ago, Carnian Stage of the Late Triassic period) are extremely rare, and have been recovered from only a few places worldwide—northern Argentina, southern Brazil, and India. During this time, all supercontinents were combined into a single massive supercontinent, called Pangea. The climate across this supercontinent is thought to have been divided into strong humid and arid latitudinal bands, with more temperate bands spanning higher latitudes, and intense deserts across the lower tropics of Pangea. These climate bands have been hypothesized to influence and constrain animal distribution across the supercontinent, and because dinosaurs initially dispersed under this climatic pattern, this dispersal should therefore have been controlled by latitude. The earliest dinosaurs are known from roughly the same ancient latitude along the southern temperate climate belt (what was, at the time, ~50° South). Increased sampling can test this prediction: we used this climatic hypothesis to conduct targeted fieldwork in northern Zimbabwe, which during the Late Triassic fell along this same climate belt, bridging the geographic gap between southern Brazil and India.

We recovered a new Carnian-aged animal assemblage strikingly similar to those along the same ancient climate band in South America and India, including a herrerasaurid dinosaur and a nearly complete skeleton of a new sauropodomorph dinosaur (which we name and describe here—*Mbiresaurus raathi*). These are Africa's oldest-known definitive dinosaurs, roughly equivalent in age to the oldest dinosaurs found anywhere in the world. The assemblage also includes early mammal relatives (cynodonts), armored crocodylian relatives (aetosaurs) and bizarre, archaic reptiles (rhynchosaurs), all similar to those found in South America and India from this same time. This suggests that the earliest dinosaurs were restricted by climatic bands to southern Pangea, and only later in their history dispersed worldwide. To bolster this claim, we developed a novel method of testing this hypothesis of climatic dispersal barriers using a model of dispersal based on geography and the dinosaurian family tree. We found strong evidence for barriers to dispersal for the earliest dinosaurs, restricting them to southern Pangea. The breakdown of these barriers, and a wave of northward dispersal, coincided with a period of intense worldwide humidity (the Carnian Pluvial Event). After this, barriers returned, mooring the now-worldwide dinosaurs in their distinct provinces across Pangea for the remainder of the Triassic Period. This two-pronged approach combines hypothesis-driven predictive fieldwork with statistical methods to independently support the hypothesis that the earliest dinosaurs were restricted by climate to just a few areas of the globe.

The Dinosaur discovery team

Major Points

- The discovery of *Mbiresaurus* fills in a critical geographic gap in the fossil record of dinosaurs and shows the power of hypothesis-driven fieldwork for testing predictions about the ancient past.
- We also recovered another kind of dinosaur (hererasaurid, large carnivore), as well as mammal relatives (cynodonts), armored crocodylian relatives (aetosaurs) and archaic reptiles (rhynchosaurs), all similar to assemblages found along this same climate belt in South America and India.
- That the first dinosaurs are found along this southern climate band—and to date, nowhere else—suggests that the first dinosaurs were constrained to this particular climate at the earliest part of their evolution and dispersal.
- Our model of dinosaurian dispersal suggests that dinosaurs did not spread worldwide until a period of global humidity (the Carnian Pluvial Event).

Facts/Background

Name

- '*Mbiresaurus'* is derived from Shona and ancient Greek roots. 'Mbire' is the name of the district where the animal was found, and is also the name of an historic Shona dynasty that ruled the region. The specific name, '*raathi*', is named in honor of paleontologist Michael Raath, who first reported fossils in this region, to honor his contribution to Zimbabwean paleontology.

Size

- We estimate that *Mbiresaurus* was ~2 meters (6 feet) long with a long tail and was about 0.5 meters (1.5 feet) tall at the hip.
- 10–30 kilograms in weight (20–65 pounds).

Relationships

- Crocodylians and birds are each other's closest living relatives and are part of the reptile group Archosauria. All dinosaurs are archosaurs.
- Sauropodomorpha is the lineage that includes the giant long-necked dinosaurs (the sauropods) and their closest relatives. *Mbiresaurus* is one of the earliest known sauropodomorphs.
- Herrerasauridae is a group of early dinosaurs that were carnivorous, bipedal, and were the largest of the early dinosaurs. The as-yet unnamed herrerasaurid from Zimbabwe was roughly 2 meters (6 feet) tall at the hip.

Anatomy

- *Mbiresaurus* stood on two legs with its limbs positioned directly underneath its body.
- *Mbiresaurus* had a relatively small head like other early sauropodomorphs.
- *Mbiresaurus* had small, serrated, triangle-shaped teeth, suggesting that it had an herbivorous or potentially omnivorous diet.
- Much of the skeleton of *Mbiresaurus* is represented (~90%), and the only major bones missing are some of the hand and portions of the skull.
- *Mbiresaurus* is one of the most complete early dinosaurs even found.

Age & Geography

- The Mesozoic Era includes the Triassic, Jurassic, and Cretaceous periods.
- The Triassic Period lasted from 252 to 201 million years ago, and the following animals arose during this time: dinosaurs, crocodile relatives, mammals, pterosaurs, turtles, frogs, and lizards.
- *Mbiresaurus* is from the Carnian Stage (Late Triassic, ~230 million years old) and is roughly the same age as the oldest dinosaurs found anywhere in the world.
- *Mbiresaurus* fossils were excavated from the Pebbly Arkose Formation within the Upper Karoo sequence of northern Zimbabwe.
- During the Triassic, the continents were coalesced into a single landmass named Pangea. Zimbabwe was located ~50° south of the equator (i.e., much farther south than today).
- The southern portion of Pangea included what is now South America, Africa, Madagascar,

Antarctica, Australia, and India.

- The world was much hotter in the Triassic Period than it is today.
- The Carnian Pluvial Event was a ~1–2 million-year-long period of global humidity, "when it rained for a million years". This event coincides with dinosaurs spreading worldwide from their southern origins.

Discovery and history of the specimens

- The first fossils from this area were reported in a paper 1992 by Michael Raath, with coauthors Philip Oesterlen and James Kitching.
- Philip Oesterlen of the Zimbabwe Geological Survey recovered fossils from this area while conducting a geological mapping survey. Oesterlen sought the advice of Michael Raath and James Kitchen, paleontologists based in South Africa. On visiting the discovery site with Oesterlen, Raath recognized the association between rhynchosaur and what he identified as probable sauropodomorph remains.
- The remains of *Mbiresaurus*, including the nearly complete skeletons for which the species was named, were collected in 2017 by an international team from Zimbabwe, Zambia, and the United States including many of the authors. Further excavations by this team in 2019 revealed more remains of this animal assemblage, including more material of *Mbiresaurus*.
- All specimens of *Mbiresaurus* are from a rock unit called the Pebbly Arkose Formation that was deposited in the Cabora Bassa Basin of northern Zimbabwe, Africa.
- *Mbiresaurus* was found with other reptiles and early relatives of mammals in the Pebbly Arkose Formation, which represent Triassic-aged river and overbank flood sedimentary deposits.
- All specimens are reposited in the Natural History Museum of Zimbabwe, in Bulawayo, Zimbabwe.

Other

- The skeleton of *Mbiresaurus* was found partially articulated—some of the bones were still connected as they would have been in life.
- This fieldwork came from a collaboration between the Natural History Museum of Zimbabwe, National Museums and Monuments of Zimbabwe, and Virginia Tech.
- The oldest unambiguous dinosaur remains are about 230 million years old and are found in Argentina, Brazil, and India. *Mbiresaurus* and the herrerasaurid dinosaur reported in our paper increase this range to Zimbabwe as well.
- The examination of cross sections of the bone of *Mbiresaurus* suggests that it grew fairly rapidly, similar to other early dinosaurs.

Funding

National Science Foundation

National Geographic Society

Geological Society of America

Paleontological Society

Virginia Tech Graduate School

Virginia Tech Department of Geosciences

Mushroom party in pictures