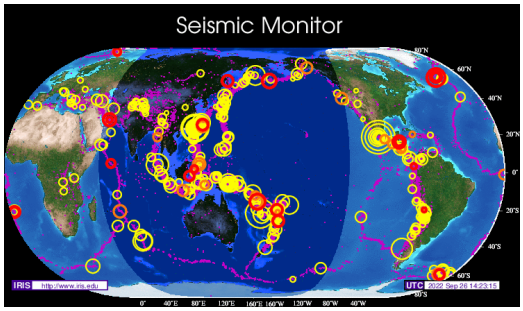
September 26, 2022

News and notes

Before going on to look at fossils of more fantastic mammals from the Paleogene Period, here are some news items that I thought were interesting.

Volcanoes, Earthquakes and Geohazards



Seismic Monitor Link

- From Reuters: Powerful earthquake hits Mexico on fateful anniversary, killing at least 2; from the United States Geological Survey (USGS), M6.8 Earthquake - Michoachan, Mexico; related, Mexico earthquake triggers 'desert tsunami' 1,500 miles away in Death Valley cave.
- Latest earthquakes from the USGS.
- Earthquake News and Global Seismic Reports.
- Researching volcanoes: We can use drones to get inside and learn more about active, gassy volcanoes.
- More volcano research: A 5-km-thick reservoir with > 380,000 km3 of magma within the ancient Earth's crust; Phys.org summary here.
- All shook up: Harmonic tremor from the deep part of Hakone volcano.
- Tonga volcano blast was unusual, could even warm the Earth; report based on two research papers, here and here.
- More on the Tonga volcano: First Detection of the Pekeris Internal Global Atmospheric Resonance: Evidence from the 2022 Tonga Eruption and from Global Reanalysis Data; Phys.org summary here.
- Yet more on Tonga, on YouTube: Simulation of the global atmosphere after the Tonga eruption (JAMSTEC).
- Alert Level Raised at New Zealand's Taupo Volcano for 1st Time.
- Ancient volcanic eruptions and society: The 852/3 CE Mount Churchill eruption: examining the potential climatic and societal impacts and the timing of the Medieval Climate Anomaly in the North Atlantic region.
- Worldwide Volcano News And Updates.

Research

- Plate tectonics: Evidence for a developing plate boundary in the western Mediterranean; Phys.org summary here.
- More plate tectonics: Accretion of the cratonic mantle lithosphere via massive regional relamination.
- Deep drilling: Direct constraints on in situ stress state from deep drilling into the Nankai subduction zone, Japan; Phys.org summary here.
- South African climate research: The Late-Eighteenth-Century Climate of Cape Town, South Africa, Based on the Dutch East India Company "Day Registers" (1773–91); Phys.org summary here.
- More climate research, biases in climate models: Compensating Errors in Cloud Radiative and Physical Properties over the Southern Ocean in the CMIP6 Climate Models; Phys.org summary here.
- Petrology research, melting minerals and making new rocks: Targeted Crystallization of Rare Earth Carbonate Polymorphs at Hydrothermal Conditions via Mineral Replacement Reactions; Phys.org summary here.
- Planetary-scale change to the biosphere signalled by global species translocations can be used to identify the Anthropocene.
- Improving geological mapping: A simplified GIS and google-earth-based approach for lineaments and terrain attributes mapping in a basement complex terrain.

Paleontology

- Dinosaur evolution: Taxonomic, palaeobiological and evolutionary implications of a phylogenetic hypothesis for Ornithischia (Archosauria: Dinosauria); Phys.org summary here.
- More dinosaurs: Calibrating the zenith of dinosaur diversity in the Campanian of the Western Interior Basin by CA-ID-TIMS U–Pb geochronology.
- Plant evolution: A stem group *Codium* alga from the latest Ediacaran of South China provides taxonomic insight into the early diversification of the plant kingdom; Eureka Alert summary here.

Mining and Energy

- Deep sea mining research: An in situ study of abyssal turbidity-current sediment plumes generated by a deep seabed polymetallic nodule mining preprototype collector vehicle; Phys.org summary here.
- The people who make your comfortable life possible: David Yager: Visit Rural Alberta and Learn First-Hand Where the Necessities of Life Come From.
- U.S. Drillers Add Oil and Gas Rigs for Second Week in a Row – Baker Hughes and Canada Weekly Rig Count Up 4 for Week Ending September 23, 2022.

Environmental Geology and Hydrogeology

- Groundwater resource modelling: Coupling a large-scale hydrological model (CWatM v1.1) with a high-resolution groundwater flow model (MODFLOW 6) to assess the impact of irrigation at regional scale; Phys.org summary here.
- Aquifer research: Likelihood of offshore freshened groundwater in New Zealand; Phys.org summary here.

Upcoming Events

University of Manitoba **Department of Earth Sciences**
Clayton H. Riddell Faculty of Environment, Earth, and Resources

The hydrologic and geomorphic drivers of flood hazard on the Assiniboine River

Claire Morrow
Department of Earth Sciences
University of Manitoba

September 27, 2022
223 Wallace Building
1:00 PM

Flooding is the most common natural disaster in Canada, particularly in the prairies, and causes billions of dollars in damage to infrastructure and agriculture while posing a risk to human lives and wildlife. Floods occur when the discharge exceeds the capacity of the channel. Since 1995, five of the ten largest floods on record have occurred on the two largest rivers in Manitoba – the Red River and the Assiniboine River. The seemingly recent increase in flooding in recent decades prompted investigation into whether recent flooding events on the Red River are the result of climate change. These studies were inconclusive, focused on the Red River, and only accounted for changes in flow frequency contributing to an increase in flooding. The Assiniboine River is the largest tributary to the Red River and has the potential to contribute to flooding on the Red River while posing its own flood risks. The majority of flood infrastructure in Manitoba is constructed on the Assiniboine River, a meandering river with a long history of avulsion. The purpose of this study is to investigate whether the recent flooding events on the Assiniboine River are the result of an increase in discharge related to hydroclimatic shifts or a reduction in channel capacity from aggradation. This is done by using daily mean streamflow values to determine the effect of flow frequency on flooding and by using field measurements to determine the channel capacity effect on flooding. It was determined that the flow frequency effect had increased 18% per decade from 1967 to 2020 and the channel capacity had decreased flow frequency by 3% from 1995 to 2020. In terms of channel capacity, the velocity at flood stage increased 0.2% while the area at flood stage had decrease 0.03% from 1995 to 2020. While the greatest contribution to the changes in the flood regime come from increased discharge, it has been proven difficult to alter the hydroclimatic factors that control discharge (i.e. temperature and precipitation) whereas altering channel capacity is more feasible. Dredging increases the capacity of the channel, allowing it to convey larger discharges, while reducing the risk of avulsion.

September 26, 2022

Terrestrial Animals of the Paleogene - Even More Mammals

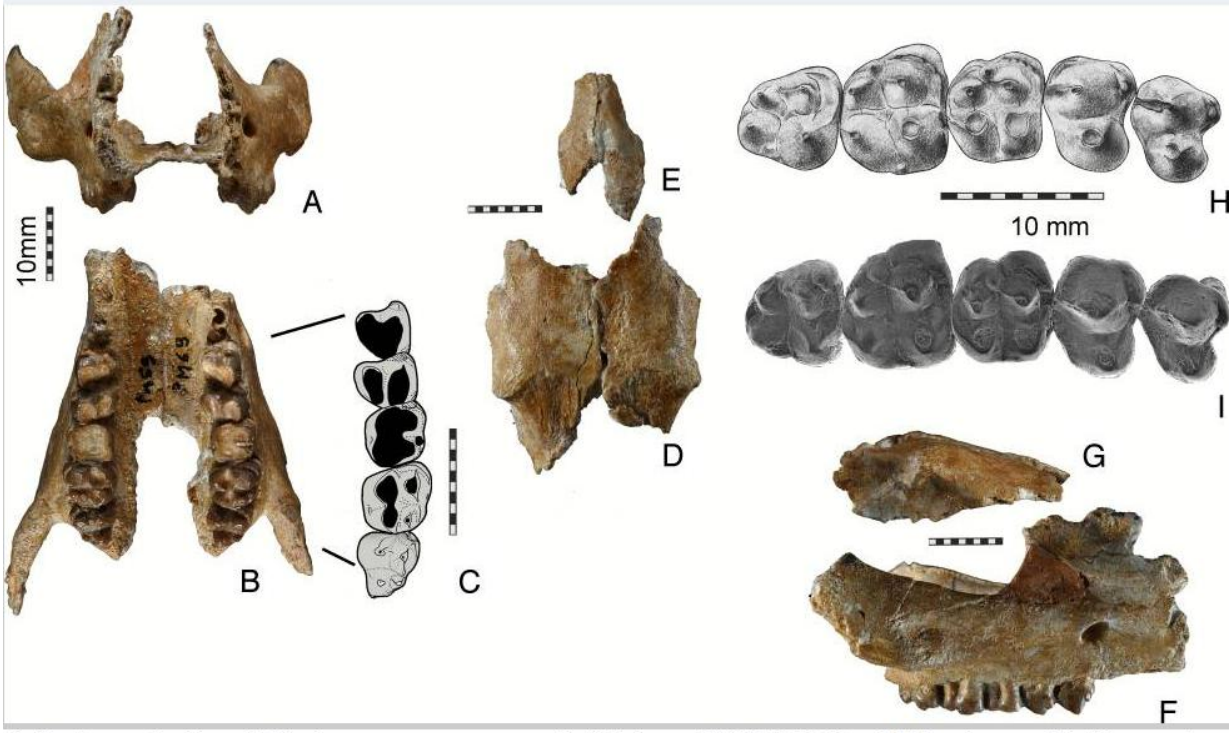
Figure 1 - Paleogene Clays, Eastern Kazakhstan
Credit: Alexandr Babkin, Creative Commons Attribution-Share Alike 4.0 International license

There are many, many fossils of mammals from the Paleogene Period, we'll look at a few more examples this week. Let's look at a few more.

Proboscideans - *Eritherium*

A possible ancestor of modern elephants, *Eritherium* (not to be confused with the cryptocurrency Ethereum) was the earliest known member of the Proboscidea. Fossils of *Eritherium* come from deposits dated to the latest part (Thanetian Age) of the Paleocene.

Eritherium was small for a proboscidean, about 20 cm tall at the shoulder and weighing in at about 5 to 6 kg - about the size of a large rabbit. Its teeth resemble those of modern hyraxes and sirenians , to which it appears to be distantly related. It's interesting to consider that a common ancestor can eventually led to giant elephants, marine mammals like sirenians and little burrowing hyraxes.



Skull and upper dentition of Eritherium azzouzorum n.g., n.sp. (A–G) Holotype, MNHN PM69. (A and B) Anterior part of skull (rostrum) with maxilla and jugals in mesial and ventral views and showing nasal cavity, zygomatic arches and jugal dentition. (C) Left P3–4, M1–3, occlusal sketch. (D and E) Frontals and nasals in dorsal view, specimen MHNT PAL 2006.0.18–20 (Museum National d'Histoire Naturelle de Toulouse). (F and G) Frontal and rostrum (jugal and right maxillary with P3–4, M1–3) in lateral view (G is reversed for reconstruction). (H and I) Right P3–4, M1–3 in occlusal view (H is SEM view of I). (Scale bar, 10 mm.)

Figure 2 - Bones of *Eritherium azzouzorum*
Credit: Fig 1 in Gheerbrant, 2009

Researcher Emmanuel Gheerbrant found the first fossils of *Eritherium* in phosphate deposits within the Ouled Abdoun basin of Morocco and described his findings in a 2009 paper. There is only one species in the genus: *Eritherium azzouzorum*.

Figure 3 - *Eritherium* Reconstruction
Credit: Dennisguillen97, CC-BY-SA

Chiropterans - *Necromantis*

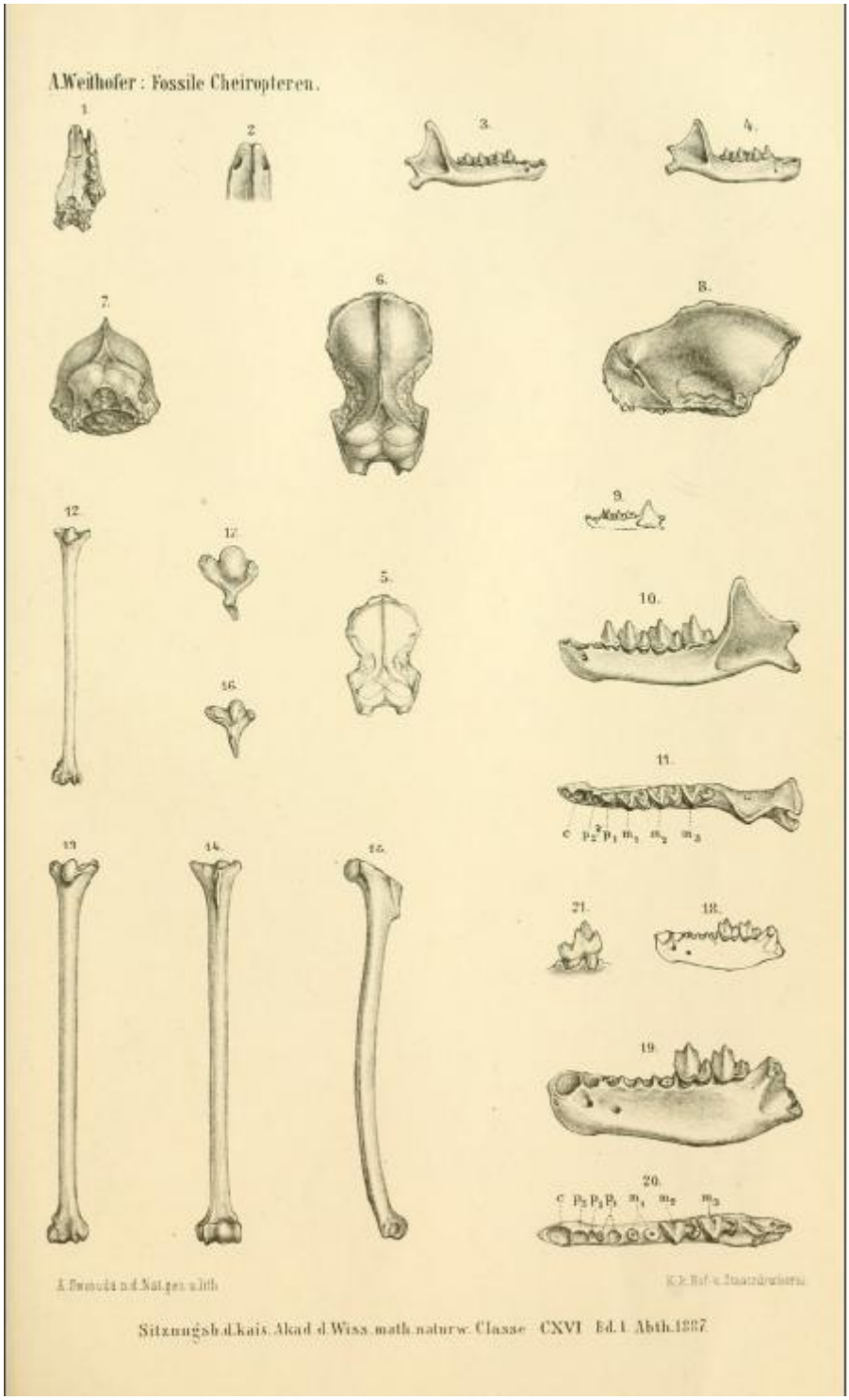


Figure 4 - Bones of *Necromantis adichaster*
Credit: A. Weithofer 1887, public domain

It is amazing to consider that the bones of such a small creature like a bat could be preserved in the fossil record, but then we find out about *Necromantis*. A chiropteran from the Eocene

Epoch. *Necromantis* was robustly built, about 47 grams in weight, and appeared to be a carnivore. Researchers speculate that it was an ambush hunter, waiting on a perch and then swooping down to dispatch it victim. The shape of its skull suggests that it had developed the ability to use echolocation, suggesting in turn that it was a nocturnal hunter.

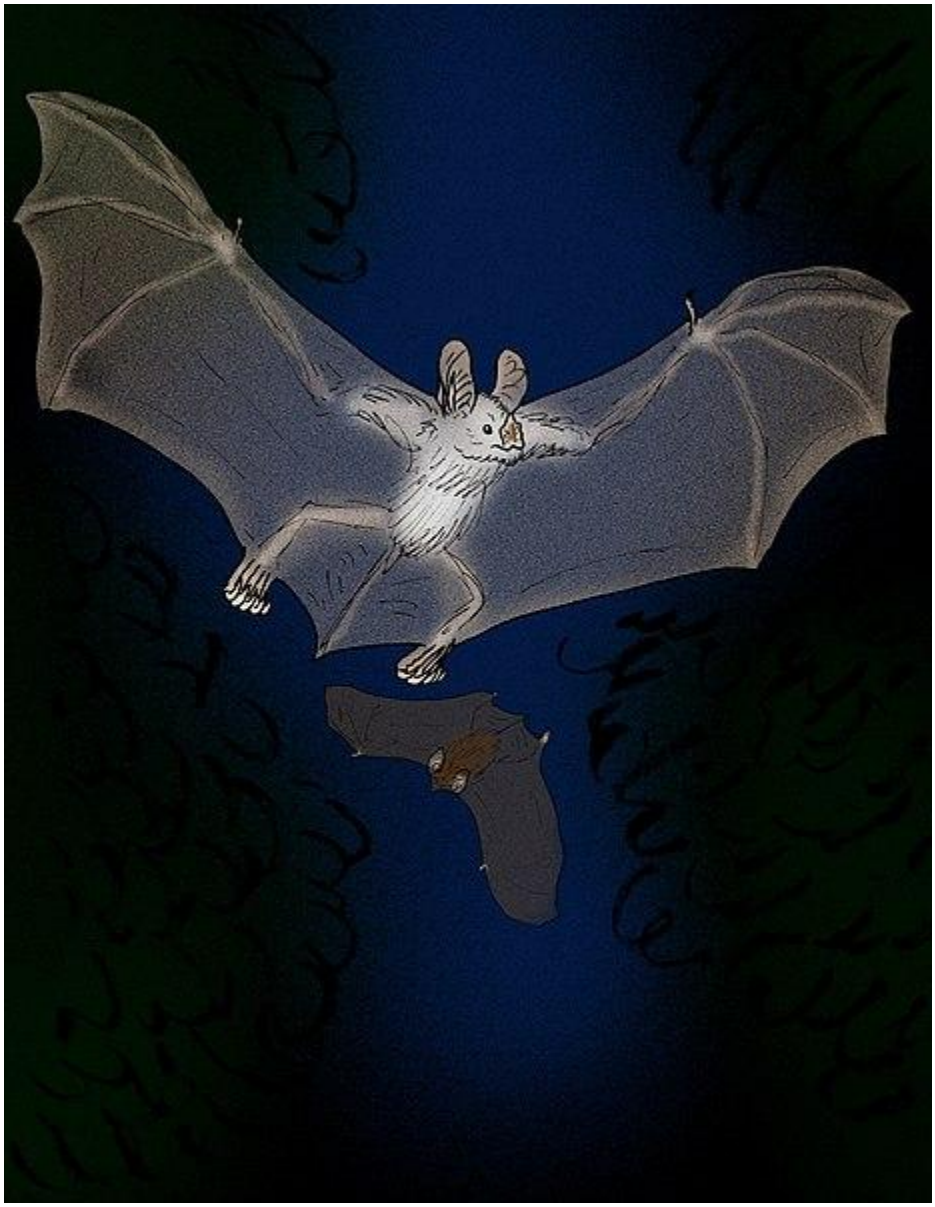


Figure 5 - *Necromantis adichaster* Restoration
Credit: Apokryltaros, Creative Commons Attribution-Share Alike 4.0 International license

Anton Carl Weithofer first described *Necromantis* in 1887 from fossils found in the Quercy Phosphorites Formation, a lagerstätte in Occitanie, southern France. Researchers have also found fossils of *Necromantis* in the Djebel Chambi of Tunisia. The phosphorites of Quercy and Djebel Chambi appear to have been deposited in an equatorial rain forest environment. There

are four species in the genus: *Necromantis adichaster, Necromantis marandati, Necromantis gezei* and *Necromantis fragmentatum.*

Rodents - *Ailuravus*

Figure 6 - *Ailuravus macrurus* fossil in the Musee d'Histoire Naturelle, Brussels
Credit: Ghedoghedo, Creative Commons Attribution-Share Alike 3.0 Unported license

Ailuravus was a large rodent of that lived during the Eocene Epoch, a giant squirrel like creature. Researchers first found fossils of *Ailuravus* in the Messel pit Lagerstätte, a bituminous shale deposit near Frankfurt am Main, Germany.

Swiss geologist, Ludwig Ruetimeyer was the first to describe *Ailuravus* in 1891. There are six species in the genus: *Ailuravus macrurus, Ailuravus michauxi, Ailuravus mitchelli, Ailuravus picteti, Ailuravus stehlinschaubi,* and *Ailuravus subita.*

Figure 7 - Reconstruction of *Ailuravus* and *Strigogyps sapea* (the bird)
Credit: Apokryltaros, Creative Commons Attribution-Share Alike 3.0 Unported license

Cimolestans - *Kopidodon*

The first mammalian fossil found in the Messel pit Lagerstätte was *Kopidodon*, a squirrel like creature, it is classified as a member of the Cimolesta Order. The cimolestans were eutherian mammals, but were not either placental or marsupials, something like modern pangolins which also fit in neither placental or marsupial categories of mammals.

Based upon its teeth, *Kopidodon* was apparently an omnivore. It had molars for crushing food, but also prominent canine teeth, possibly for defence. It was about 115 cm long.

Figure 8 - *Kopidodon macrognathus* Naturmuseum Senckenberg Credit: Daderot, Creative Commons CC0 1.0 Universal Public Domain Dedication

Kopidodon was named in 1902 by a researcher called Wittich, but there seems to be no information on him/her. There is only one species n the genus: *Kopidodon macrognathus*.

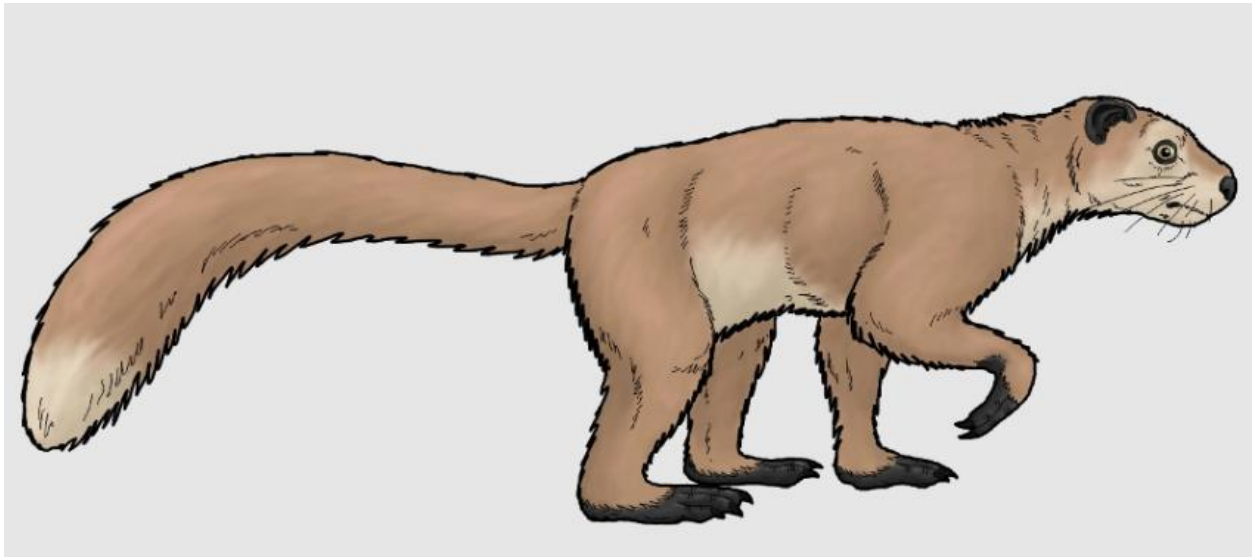


Figure 9 - *Kopidodon macrognathus* Reconstruction by wsnyder-d7s8dtj.png Credit: Dennisguillen97, CC-BY-SA

Primates - *Eosimias*

Eosimias was an early primate from the Eocene Epoch. *Eosimias* was an early example of the Simiiformes, or higher primates such as monkeys and apes. It was a tiny creature and could fit

in the palm of your hand. As early simian primate, *Eosimias* is also an example of our own ancestors.

Figure 10 - Fossil Jawbone of *Eosimias*
Credit: Ghedoghedo, Creative Commons Attribution-Share Alike 3.0 Unported license

K. Christopher Beard, Tao Qi, Mary R. Dawson, Banyue Wang and Chuankuei Li first described *Eosimias* in 1994. There are four species in the genus: *Eosimias centennicus, Eosimias dawsonae, Eosimias sinensis,* and *Eosimias paukkaungensis.*

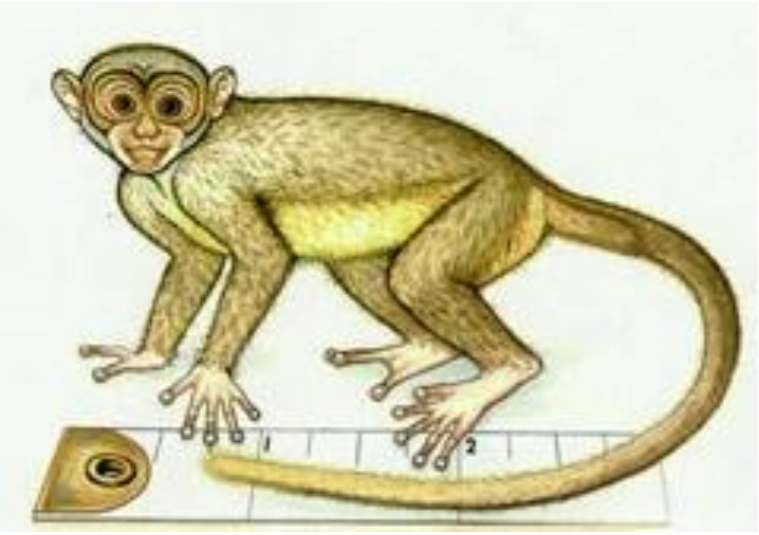
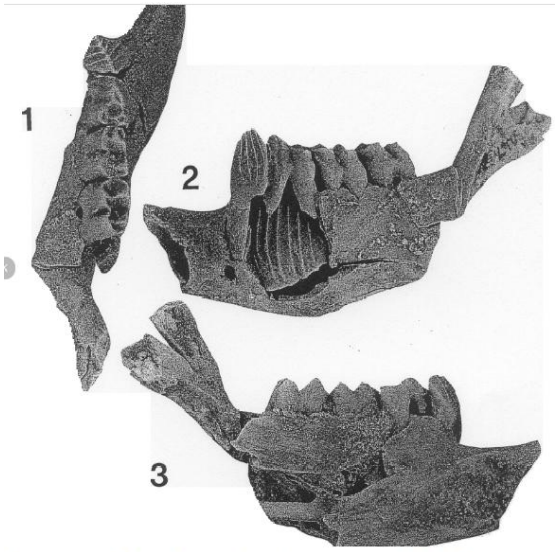


Figure 11 - *Eosimias* Reconstruction
Credit: Noeliria, CC-BY-SA

Marsupial - *Ekaltadeta*



Ekaltadeta ima (Archer and Flannery, (1985), x 2. 1, occlusal view of QM F24199, left dentary (juvenile), P2, unerupted P3, dP3, M1-2. 2, buccal view of QM F24199. 3, lingual view of QM F24199.

Figure 12 - *Ekaltadeta* Bones
Credit: Figure 2 in Wroe, 1996

Sometimes known as the "killer kangaroo", *Ekaltadeta* is a genus of marsupials that lived in Queensland Australia during the Late Oligocene until the Miocene Epoch. The teeth of *Ekaltadeta* suggest an omnivorous, possibly carnivorous diet for the animal.

Researchers Mike Archer and Tim Flannery first described *Ekaltadeta* in 1985 from fossils found in the Riversleigh formations in Northern Queensland. There are three species in the genus: *Ekaltadeta ima, Ekaltadeta jamiemulvaneyi,* and *Ekaltadeta wellingtonensis.*

Figure 13 - Reconstruction of *Ekaltadeta*
Credit: Nobu Tamura, Creative Commons Attribution-Share Alike 4.0 International license

An invented species of *Ekaltadeta, E. roufus,* has been "brought back to life" to provide biodiversity in role playing games. The invented species is about the size of a house cat and its eating habits are described as follows: "The killer rat-kangaroo is almost exclusively carnivorous, hence its name, and primarily feeds on any animal smaller than itself, using its sharp teeth for sheering through chunks of flesh, although it is known to occasionally feed on fruits and seeds to supplement its diet. "

Brontotheres - *Aktautitan*

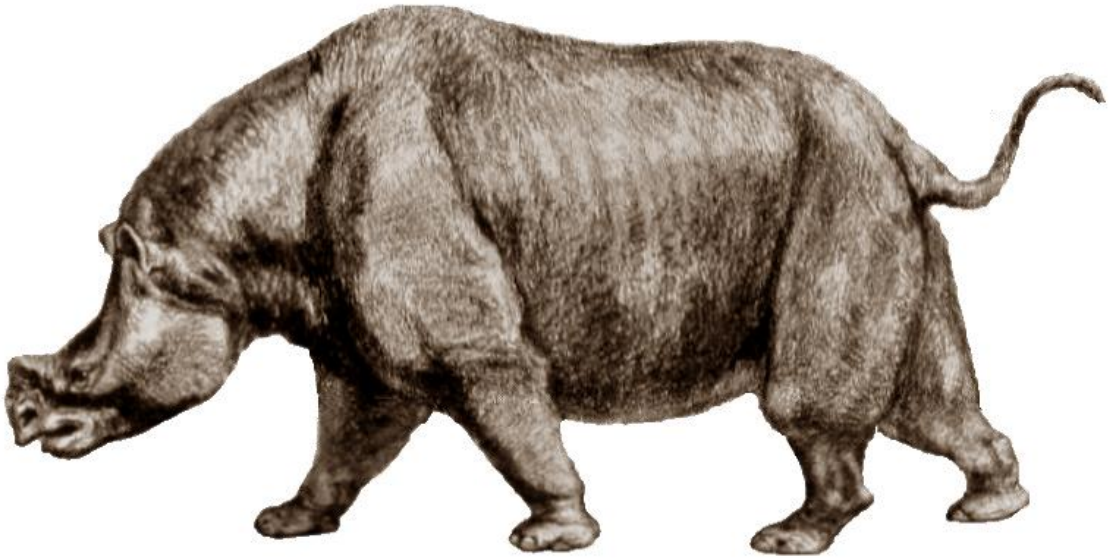


Figure 14 - *Aktautitan hippopotamopus*
Credit: R. B. Horsfall and A. C. Tatarinov, public domain

The Paleogene deposits of Eastern Kazakhstan, shown in Figure 1, have yielded many fossils, including *Aktautitan hippopotamopus*, a brontothere. *Aktautitan* was an odd toed ungulate that lived in the middle Eocene. It was an herbivore, about 4 m long, 150 cm high and weighing 1200 to 2000 kg. It resembled modern hippopotamus and may have lived a semi-aquatic lifestyle. Researchers Matthew C Mihlbachle, Spencer G. Lucas, Robert J. Emry, and Bolat U. Bayshashov first described *Aktautitan hippopotamopus* in 2009.

Aktautitan is another genus that has an invented species, *A. asiaticus*, for role playing games. Described as a rhino mimic, it was also introduced in order to enhance biodiversity role playing games.

Wrapping it Up

I could spend the rest of my life blogging on mammals from the Paleogene. I may do that, but for now, here are some links to Paleogene mammals if you want to follow up:

- Paleocene mammals
- Eocene mammals
- Oligocene mammals
- Paleogene animals

Next week we'll look at fossils for other terrestrial life during the Paleogene.

Standard Caveat

The purpose of my weblog postings is to spark people's curiosity in geology. Don't entirely believe me until you've done your own research and checked the evidence. If I have sparked your curiosity in the subject of this posting, follow up with some of the links provided here. If you want to, go out into the field and examine some rocks on your own with the help of a good field guide. Follow the evidence and make up your own mind.

In science, the only authority is the evidence.