March 20, 2023

News and notes

Before going onto looking at Pleistocene fossils from Africa and South America, let's look at some news items that I thought were interesting.

Research

- Sedimentology: Influence of Climatic Trends and Cycles on Varve Deposition in Crawford Lake, Ontario, Canada.
- More sedimentology: Late Pleistocene and Holocene transgression inferred from the sediments of the Gulf of San Jorge, central Patagonia, Argentina.
- Coastal geology: Dammed deltas: Sinking Asian deltas in a warming world; behind a paywall, Phys.org summary here.
- Petrology: Valgarður: a database of the petrophysical, mineralogical, and chemical properties of Icelandic rocks.
- Origin of diamonds: Deep, ultra-hot-melting residues as cradles of mantle diamond; more in The Conversation, here.

Plate Tectonics and Geophysics

- Italy: Combined volcano-tectonic processes for the drowning of the Roman western coastal settlements at Campi Flegrei (southern Italy).
- Arabia: The influence of Cenozoic Eurasia-Arabia convergence on the Southeast Arabian Foreland Basin: new geochronological and geochemical constraints from syn-kinematic carbonate mineralization.
- Deep geophysics and tectonics: Longitudinal structure of Earth's magnetic field controlled by lower mantle heat flow; Phys.org summary here.
- Geophysics: A water transport system across the mantle transition zone beneath western North America as imaged by electrical conductivity data.

Paleontology

- Trilobites: The median eyes of trilobites; Eureka Alert summary here.
- Middle Devonian (Givetian) coral-stromatoporoid patch reefs from the Lazhuglung Formation, Xizang (Tibet) and their palaeoecological and palaeogeographical implications; Phys.org summary here.
- Divergent vertebral formulae shape the evolution of axial complexity in mammals; Phys.org summary here.
- Molecular fingerprints resolve affinities of Rhynie chert organic fossils; Phys.org summary here.

- Cnidarians: New *Qinscyphus* material from the Fortunian of South China.
- Paleohistology of *Caraguatypotherium munozi* (Mammalia, Notoungulata, Mesotheriidae) from the early late Miocene of northern Chile: A preliminary ontogenetic approach.

Glaciers and Climate Change

- Glacier Surface Heatwaves Over the Tibetan Plateau.
- Climate history: A new view on abrupt climate changes and the bipolar seesaw based on paleotemperatures from Iberian Margin sediments.

Environmental Geology and Hydrogeology

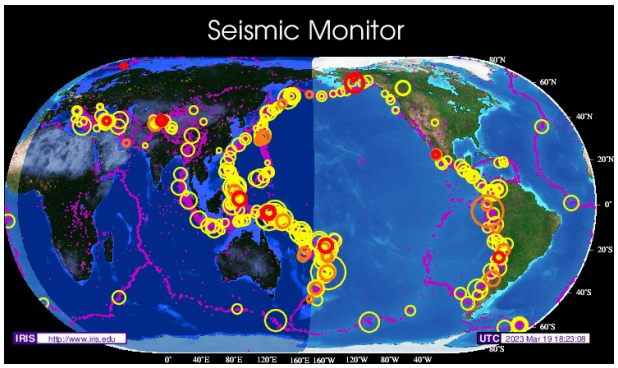
- Trade offs: Watermains leakage and outdoor water use are responsible for significant phosphorus fluxes to the environment across the United States; Phys.org summary here.
- Groundwater deeper than 500 m contributes less than 0.1% of global river discharge; Phys.org summary here.
- Flush with rain, California plans to replenish drought-depleted groundwater with floodwaters.
- Rocks Made of Melted Plastic Waste Found on Remote Island.
- From the United States Environmental Protection Agency, Per- and PolyfluoroAlkyl Substances (PFAS): EPA Proposes First Drinking Water Standards for PFAS.

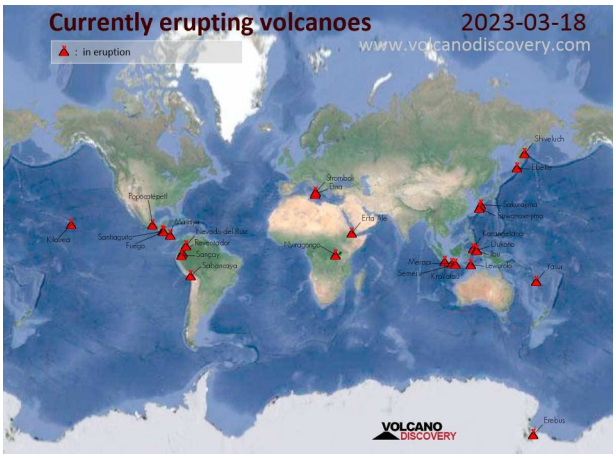
Mining and Energy

- Crooked dealing: LME Finds Some Nickel Underlying Its Contracts Is Missing.
- Gold juniors Trillium and Pacton to combine forces in Ontario's Red Lake mining district.
- Geology of an ore deposit, sorry, behind a paywall: Apatite Volatile Contents of Porphyry Cu Deposits Controlled by Depth-Related Fluid Exsolution Processes.
- More ore deposit geology, also behind a paywall: Ultramafic-Hosted Ni-Cu-Co-(As) Mineralization from an Ancient Oceanic Transform Fault Zone in the Troodos Ophiolite, Cyprus: An Analogue for Ultramafic Sea Floor Massive Sulfide Mineralization?
- Lithium mining geology: Lithium and brine geochemistry in the Qianjiang Formation of the Jianghan Basin, central China.
- From the United States Energy Information Administration (USEIA): Annual Energy Outlook 2023.
- Oil & gas deposit geology: Physical property response of peri-well sediments during cementing of gas hydrate-bearing sediments in conventional oil-gas wells in the South China Sea.
- Exploration: Eni Makes Oil Discovery Offshore Mexico.
- Oil Posts Worst Weekly Loss Since April 2020 Amid Bank Chaos.

- OP-ED: Why Myself and 10,000 Other Canadians Are Standing Behind our Energy as the Responsible Global Alternative – Ryan Fournier – Join Us and Sign the Petition.
- Battle Over Nuclear's Role In Renewable Energy Goals Continues.
- What could go wrong: 2.5 Tons Of Uranium Missing From Libya Amid Rival Government Crisis.

Volcanoes, Earthquakes and Geohazards





Seismic Alert **Active Volcano Map**

- YouTube: This Week in Volcano News; Kilauea Erupts in Hawaii, A Volcano in India Erupts.
- Prediction of volcanic ash concentrations in ash clouds from explosive eruptions based on an atmospheric transport model and the Japanese meteorological satellite Himawari-8: a case study for the Kirishima-Shinmoedake eruption on April 4th 2018.
- At least 15 dead after strong earthquake hits Ecuador and northern Peru; USGS report here.
- Earthquake prediction: An Early Forecast of Long-Period Ground Motions of Large Earthquakes Based on Deep Learning.
- Earthquake research: Fault Roughness at Seismogenic Depths and Links to Earthquake Behavior.
- Landslide research: High-Frequency 3D LiDAR Measurements of a Debris Flow: A Novel Method to Investigate the Dynamics of Full-Scale Events in the Field; Phys.org summary here.
- Geohazards: U.S. East Coast landslide impacts from Puerto Rico to Vermont and in between; was discussed March 17 at the Geological Society of America Joint 72nd Annual Southeastern/ 58th Annual Northeastern Section Meeting.
- Geohazards, floods: Risk-Reduction, Coping, and Adaptation to Flood Hazards in Manitoba, Canada: Evidence from Communities in the Red River Valley.

Geologists in the News

- NGWA Mourns Loss of Fletcher Driscoll, Ph.D., PG; I have his book *Groundwater and Wells* in my library.

Upcoming Events

The Fen carbonatite complex, Norway: a world-class REE deposit?

Sven Dahlgren

Geological Advisor, Vestfold and Telemark County Council and Njord Center - Physics of Geological Processes, Department of Geosciences, University of Oslo, Norway

The Fen complex in southern Norway is of key importance to understanding rare-earth deposits in carbonatite complexes. It is the type locality for carbonate igneous rocks (calcite and dolomite carbonatites), alkali-rich contact metasomatic rocks (fenites) and several other unusual rock types known for their enrichment in lanthanides, niobium and other rare elements. In the 1950s, carbonatites at Fen were used as one of the earliest commercial sources of niobium. The present talk will summarize key aspects of the general geology of the Fen complex, and its role in the development of carbonatite science. Some rocks within the complex contain elevated levels of rare-earth elements (REE) and are presently explored as a potential critical metal deposit. Preliminary results suggest a resource of at least 50 million tons of total REE oxide.

When? **1 pm, March 23, 2023**

Where? **Rm 223 Wallace, 125 Dysart Rd, UM Fort Garry campus**

Note: access to the Wallace guest parking is temporarily via Dysart Rd, then Sidney Smith St (first right), then Ralph Campbell Rd (first left, past the parkade), then Sifton Rd going SW and past Wallace Bldg, and back on Dysart Rd (keep left) into the K lot

March 20, 2023

Life in the Pleistocene: Africa and South America

We're going to windup our look at fossils from the Pleistocene Epoch with a look at a few examples from the Afrotropical (Africa) and Neotropical Eco-zones. These two eco-zones share a similar array of local climates and ecosystems, so we may see some examples of parallel evolution.

The Afrotropical Eco-zone in the Pleistocene

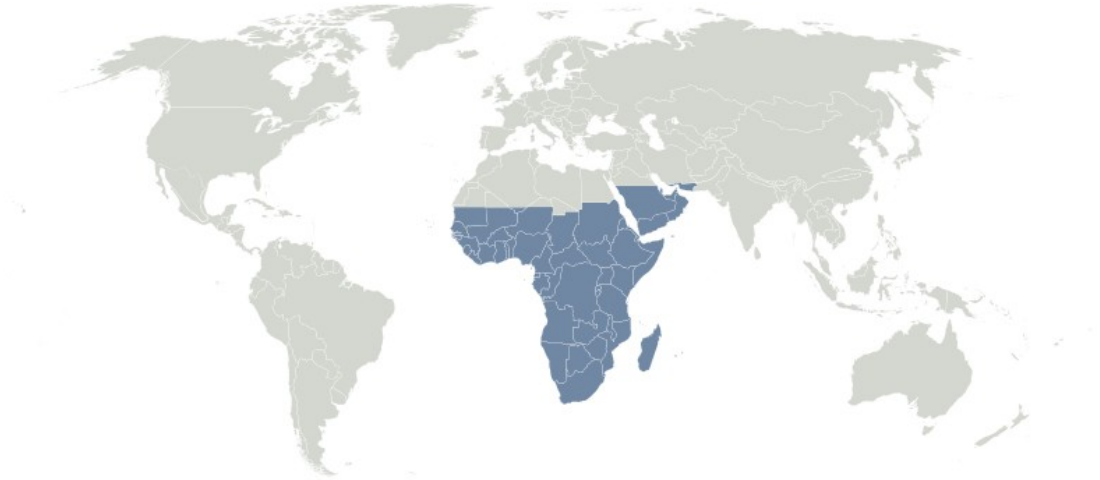


Figure 1 – The Afrotropic Eco-zones
Credit: carol, Creative Commons Attribution-Share Alike 3.0 Unported license

The Afrotropic Eco-zone includes Sub-Saharan Africa Desert, the southern part of the Arabian Peninsula, Madagascar, a small part of southern Iran and southwestern Pakistan, together with the islands of the western Indian Ocean. During the Pleistocene, it was the home to a huge variety of animals, we'll take a look a few of them.

Homo erectus

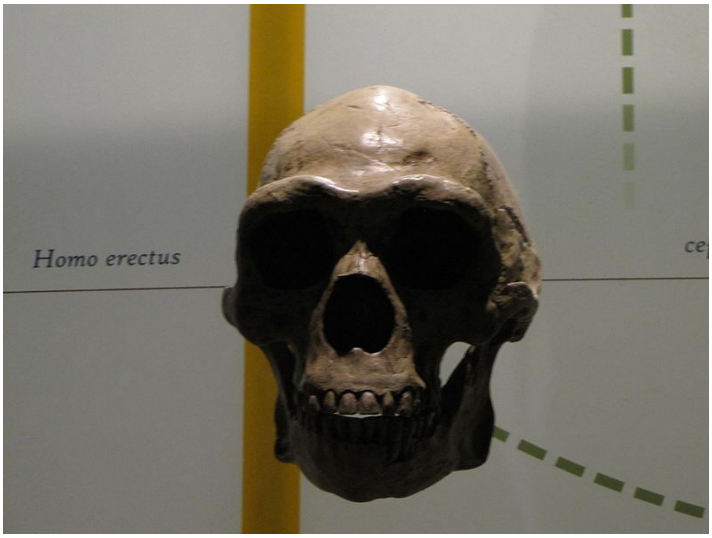


Figure 2 – Homo Erectus Skull in the American Museum of Natural History, New York
Credit: Cathrotterdam, Creative Commons Attribution-Share Alike 4.0 International license

For most of the Pleistocene, one of the most common hominin was *Homo erectus*. A very successful creature, *Homo erectus* first appeared in Africa around 2 million years ago, probably evolving from an earlier hominin, *Homo habilus*. *Homo erectus* not only expanded throughout Africa but was the first hominin to expand its range into Eurasia and Southeast Asia. The youngest fossils of *Homo erectus* came from Java in Indonesia, from about 117,000–108,000 years ago.

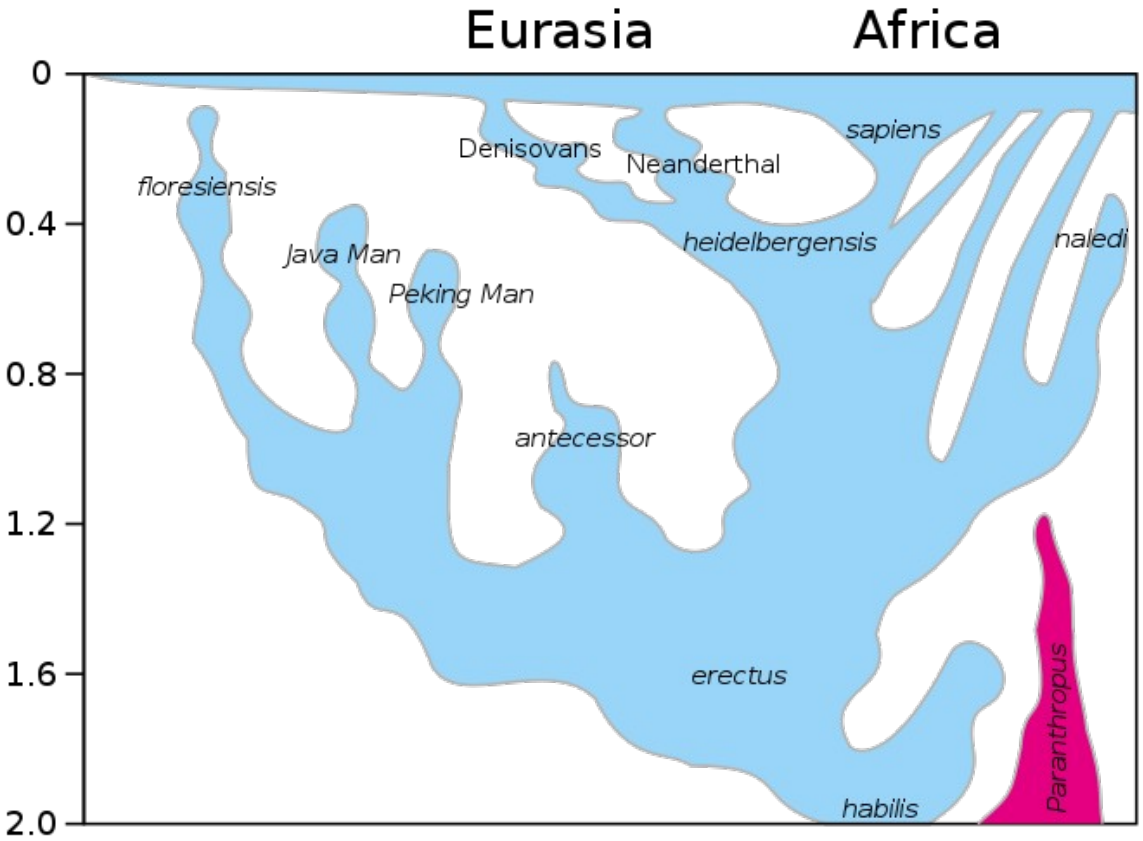


Figure 3 – Hominin Evolution according to Stringer, 2012
Credit: Conquistador and Dbachmann, Creative Commons Attribution-Share Alike 4.0 International license

Homo erectus didn't die without issue. Among the descendants of *Homo erectus* were the Indonesian hobbit, *H. floresiensis*, *Homo antecessor*, *Homo heidelbergensis*, *Homo neanderthalensis*, *Homo denisova* and ourselves, *Homo sapiens*. The descent is not a straight line, but is marked by lots of migrations and intermingling of previously separate populations as suggested by Figure 3, above.

From the neck down, *Homo erectus* appears to be indistinguishable from modern humans. In height and weight the fossils show a lot of variation, ranging from 146–185 cm in height and 40–68 kg in weight. This variation seems to have been the result of natural selection acting on separate populations, a phenomena called phenotypic plasticity. The main difference between *Homo erectus* and ourselves is in the shape of the skull and the size of the brain. *Homo erectus* brains varied in size from 546–1,251 cc compared to between 1,000 and 1,600 cc for modern humans.

Throughout its range, *Homo erectus* seems to have been an apex predator eating a wide variety of animals. Also, they used fire and made stone tools, creating the Acheulean stone tool industry.

Figure 4 – Model of Homo erectus man in the Naturhistorisches Museum, Wien
Credit: Jakub Hałun, Creative Commons Attribution-Share Alike 4.0 International license

Dutch scientist Eugène Dubois discovered the first fossils of *Homo erectus* in 1891, calling it *Pithecanthropus erectus* in 1895, also called Java Man. Later discoveries in Java (Solo Man) and China (Peking Man) led Ernst Mayr to combine the species into one: *Homo erectus*. Later discoveries in Africa and Europe have also been added into the classification *Homo erectus*.

A long lived species like *Homo erectus* evolved into a variety of subspecies, these include:

- *Homo erectus erectus* (Java Man, 1.6–0.5 Ma);
- *Homo erectus ergaster* (1.9–1.4 Ma);
- *Homo erectus georgicus* (1.8–1.6 Ma);
- *Homo erectus lantianensis* (Lantian Man, 1.6 Ma);
- *Homo erectus nankinensis* (Nanjing Man, 0.6 Ma);
- *Homo erectus pekinensis* (Peking Man, 0.7 Ma);
- *Homo erectus soloensis* (Solo Man, 0.546–0.143 Ma);
- *Homo erectus tautavelensis* (Tautavel Man, 0.45 Ma); and
- *Homo erectus yuanmouensis* (Yuanmou Man).

The Swedish naturalist coined the name for the genus *Homo* in 1758. There is one extant species of *Homo*, *H. sapiens* (us) and about 12 extinct species.

Lycaon sekowei

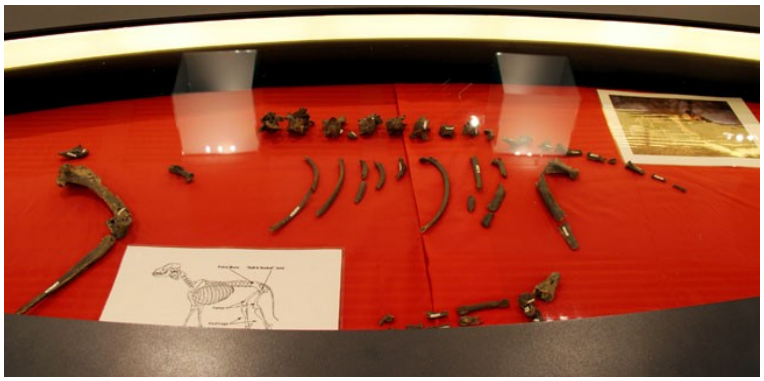


Figure 5 – Bones of *Lycaon sekowei*
Credit: Cradle of Humankind, Creative Commons Attribution 2.0 Generic license

Human ancestors living during the Pleistocene were not only predators, but also prey. Among the predators that probably fed on hominins were African Wild Dogs, the ancestor of which was *Lycaon sekowei*. Fossils of *Lycaon sekowei* have been found in Pliocene to Pleistocene deposits in South Africa as well as Quaternary deposits in Congo-Kinshasa, Kenya, Morocco, and Tanzania.

Lycaon sekowei was a hypercarnivore, that is, its diet was almost exclusively meat. Like modern African Wild Dogs, *Lycaon sekowei* probably hunted in packs. However, it's paws appear not to be adapted for running, so it probably didn't run down its prey, like its modern descendants. Rather, it probably used more direct ambush techniques. If you were a *Homo erectus* out by yourself, looking for something to eat, you might suddenly find yourself surrounded by a pack of these hypercarnivores and torn to pieces to feed their ravenous appetites.

Figure 6 – African Wild dogs Feeding
Credit: Brian Gratwicke, Creative Commons Attribution 2.0 Generic license

In their 2015 paper, Adam Hartstone-Rose, Lars Werdelin, Darryl J. De Ruiter, Lee R. Berger and Steven E. Churchill were the first to describe *Lycaon sekowei* in the scientific literature.

British naturalist Joshua Brookes first defined the genus, *Lycaon*, in 1827. The genus name, *Lycaon*, was derived from a nasty character in Greek mythology who Zeus turned into a wolf in retribution for *Lycaon* cooking up one of his sons as a feast for Zeus.

Syncerus antiquus

Figure 7 – *Syncerus antiquus* skull in the Nairobi National Museum
Credit: Bjørn Christian Tørrissen, Creative Commons Attribution-Share Alike 3.0 Unported license

Also called *Pelorovis antiquus*, *Syncerus antiquus* was an African buffalo. Fossils of *Syncerus antiquus* have been found in Pliocene deposits in South Africa and Quaternary deposits in Congo-Kinshasa, Kenya, Morocco, South Africa, and Tanzania.

Like modern buffaloes, and other bovines, *Syncerus antiquus* was a herbivore that lived in herds. It was one of the largest bovines that have lived. Up to 3 m in length from muzzle to the end of the tail, the distance between the tips of its horns was as much as 2.4 m and it probably weighed about 1,200 kg although the largest males could have weighed up to 2,000 kg.

Figure 8 – Rock Art from Tin Taghirt on the Tassili n'Ajjer in southern Algeria
Credit: Linus Wolf, Creative Commons Attribution-Share Alike 3.0 Unported, 2.5 Generic, 2.0 Generic, and 1.0 Generic license

Humans first depicted bovines that looked like *Syncerus antiquus* in rock art from the Late Pleistocene. In 1851, French zoologist Georges Louis Duvernoy was the first to describe *Syncerus antiquus* in the scientific literature. British naturalist Brian Houghton Hodgson first described the genus *Syncerus* in 1847. There is one living species in the genus, *S. caffer* and two extinct species *S. acoelotus*, and *S. antiquus.*

The Neotropic Eco-zone in the Pleistocene

Figure 9 – The Neotropic Eco-zone
Credit: carol, Creative Commons Attribution-Share Alike 3.0 Unported license

The Neotropic Eco-zone covers all of South America together with Central America, the Caribbean islands, parts of Mexico as well as southern Florida in the United States. Let's look at some of the Pleistocene fossils from that eco-zone.

Doedicurus clavicaudatus

Figure 10 – Skull of *Doedicurus clavicaudatus*
Credit: Richard Lydekker, public domain

Distantly related to modern armadillos, *Doedicurus clavicaudatus* was a glyptodont that lived during the Pleistocene of Argentina, Brazil, and Uruguay. It persisted in South America until about 8,000–7,000 years ago. A large herbivore, *Doedicurus clavicaudatus* weighed about 1,400 kg and sported at spiked 40 kg club on its tail. This did not deter humans, who apparently hunted the animal, possibly to extinction.

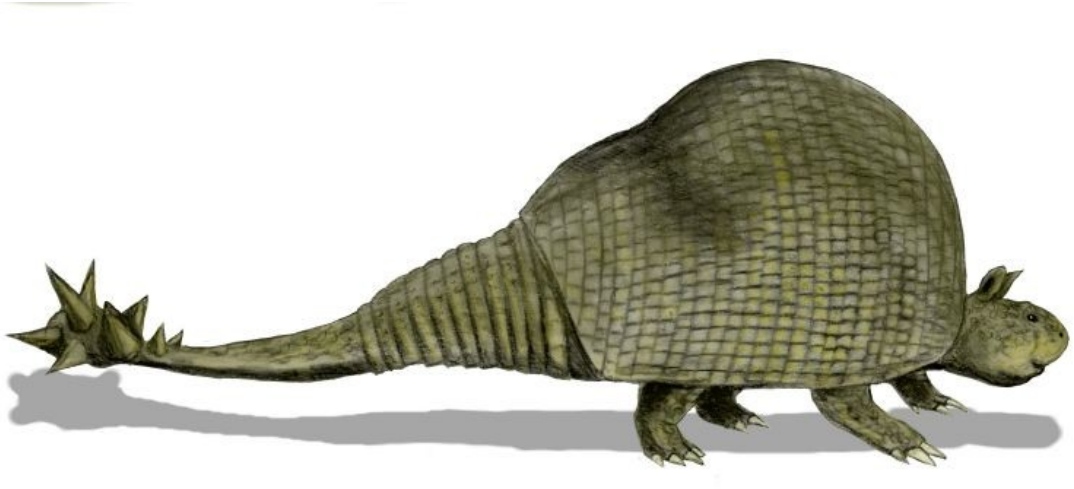


Figure 11 – Reconstruction of *Doedicurus clavicaudatus*
Credit: Nobu Tamura, Creative Commons Attribution-Share Alike 3.0 Unported license

English naturalist Richard Owen, first described *Doedicurus clavicaudatus* in 1847, originally calling it *Glyptodon clavicaudatus*. In 1874, German-Argentine zoologist Hermann Burmeister placed it in the genus *Doedicurus*, of which *D. clavicaudatus* is the only species.

Mixotoxodon

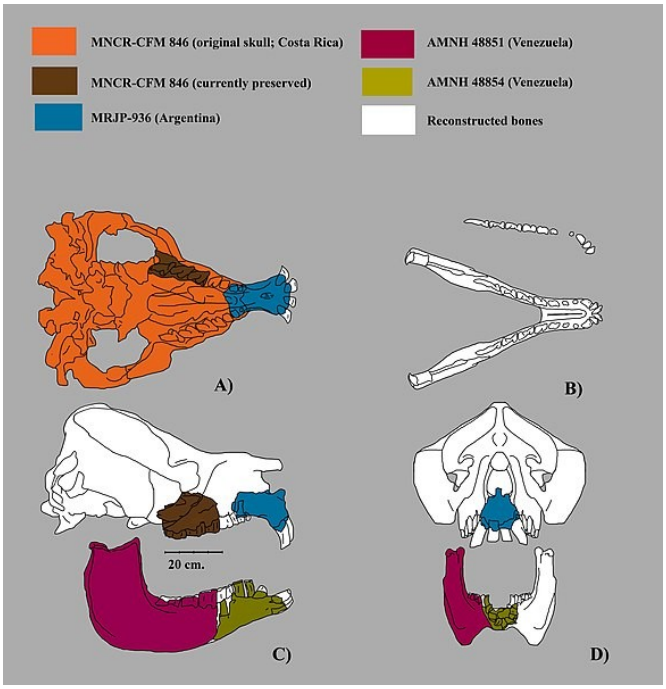


Figure 12 – *Mixotoxodon* skull reconstruction
Credit: Rextron, Creative Commons Attribution-Share Alike 3.0 Unported license

A genus of notoungulate, a group of mammals unique to South America, *Mixotoxodon* lived during the Pleistocene, from about 1,800,000 to 12,000 years ago. Fossils of *Mixotoxodon* have been found in Argentina, Bolivia, Colombia, Costa Rica, El Salvador, Honduras, Mexico, Nicaragua, Panama, the United States (Texas), and Venezuela. A herbivore, *Mixotoxodon* was one of the largest notoungulates, weighing of up to 3.8 tonnes, about the size of a modern rhinoceros.

Figure 13 – *Mixotoxodon*
Credit: Sergiodlarosa, Creative Commons Attribution-Share Alike 3.0 Unported license

American paleontologists Richard van Frank and George Gaylord Simpson first described *Mixotoxodon* in 1957 from fossils that they found in Venezuela. There is only one species in the genus: *M. larensis*.

Dusicyon avus

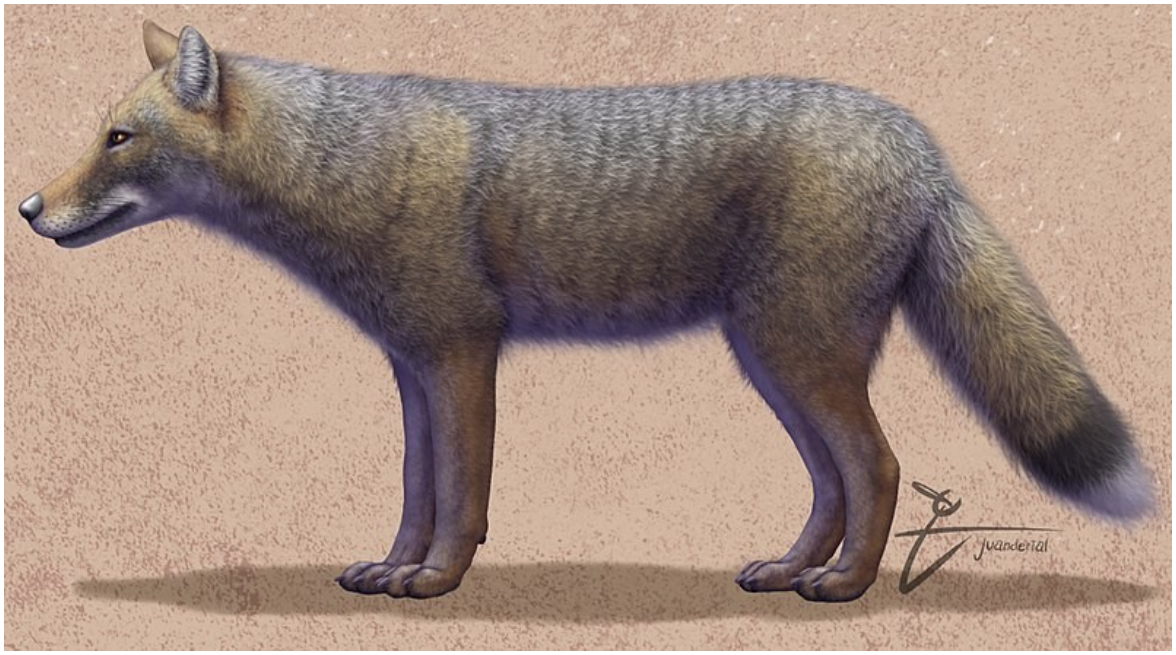


Figure 14 – *Dusicyon avus*
Credit: Juandental, Creative Commons Attribution-Share Alike 4.0 International license

About the size of a modern German Shepard dog, *Dusicyon avus* was a medium sized canid that lived from the Pleistocene until approximately 1000 years ago. A closely related species, *Dusicyon australis*,

lived on the Falkland Islands until about 400 years ago. Fossils of *Dusicyon avus* have been found in Argentina, Brazil, Chile, and Uruguay.

Figure 15 – *Dusicyon australis*, the Falkland Islands Fox
Credit: John Gerrard Keulemans, public domain

Hermann Burmeister first described *Dusicyon avus* in the scientific literature in 1866 in the Annals of the Buenos Aires Museum. His work was later reprinted in 1871 in the English publication, Nature. The genus *Dusicyon* was first described by the English naturalist Charles Hamilton Smith in 1839, who called it a variety of *Canis*. In 1914, Oldfield Thomas established the genus. There are three species in the genus: *D. avus*, *D. australis* and *D. cultridens*.

That wraps things up for the Pleistocene. Next week we'll get to work on the current epoch, the Holocene.

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.