October 17, 2022

News and notes

Before going on with a discussion of the marine animals of the Paleogene and Neogene Periods, here are some news items that I thought were interesting.

Research

- The Earth from Space, the Mississippi River.
- Geophysics: Crust and upper mantle electrical structure of the eastern Central Asian Orogenic Belt revealed by the MT line from Zhangwu County to East Ujimqin Banner.
- More geophysics: 3D Bayesian Inversion of Potential Fields: The Quebec Oka Carbonatite Complex Case Study.
- Oceans: Novel sulfur isotope analyses constrain sulfurized porewater fluxes as a minor component of marine dissolved organic matter; Phys.org summary here.
- Coral reefs and sedimentology: Lagoon infilling by coral reef sand aprons as a proxy for carbonate sediment productivity; Phys.org summary here.
- Sedimentology and plate tectonics: Tectonic and climatic controls on sediment transport to the Southeast Indian Ocean during the Eocene: New insights from IODP Site U1514; Phys.org summary here.
- Sedimentology and turbidity: Effect of flocculation on turbidity currents.
- Sedimentology and impact craters: Evolution of organic matter quantity and quality in a warm, hypersaline, alkaline lake: The example of the Miocene Nördlinger Ries impact crater, Germany.
- From Phys.org and The Conversation: Coastal erosion is unstoppable. So how do we live with it?
- Hydrology and plate tectonics: Structural Hillslope Connectivity Is Driven by Tectonics More Than Climate and Modulates Hydrologic Extremes and Benefits; Phys.org summary here.
- Glaciology: Tidewater-glacier response to supraglacial lake drainage; Eureka Alert summary here.
- Antarctic glaciology: Stratigraphic templates for ice core records of the past 1.5 Myr.
- Glaciology, Italy: Past and future behavior of the valley glaciers in the Italian Alps.
- More Italian glaciology: Energy and glacier mass balance of Fürkeleferner, Italy: past, present, and future.

Paleontology

- Evolution and variable oxygen levels: Extreme variability in atmospheric oxygen levels in the late Precambrian; Phys.org summary here.

- Evolution of photosynthesis in the Precambrian: Evolution of increased complexity and specificity at the dawn of form I Rubiscos; Phys.org summary here.
- Evolution of carnivores: An early nimravid from California and the rise of hypercarnivorous mammals after the middle Eocene climatic optimum; Eureka Alert summary here.
- From Eureka Alert: University of Tennessee dinosaur mummy provides new insight into soft tissue fossilization.
- Carboniferous plants: Plant taphonomy and palaeoecology of Pennsylvanian wetlands from the Erillcastell Basin of the eastern Pyrenees, Catalonia, Spain; Eureka Alert summary here.

Climate Research

- From Phys.org: Researchers studying climate futures shouldn't jump to extremes; research papers here and here.

Environmental Geology and Hydrogeology

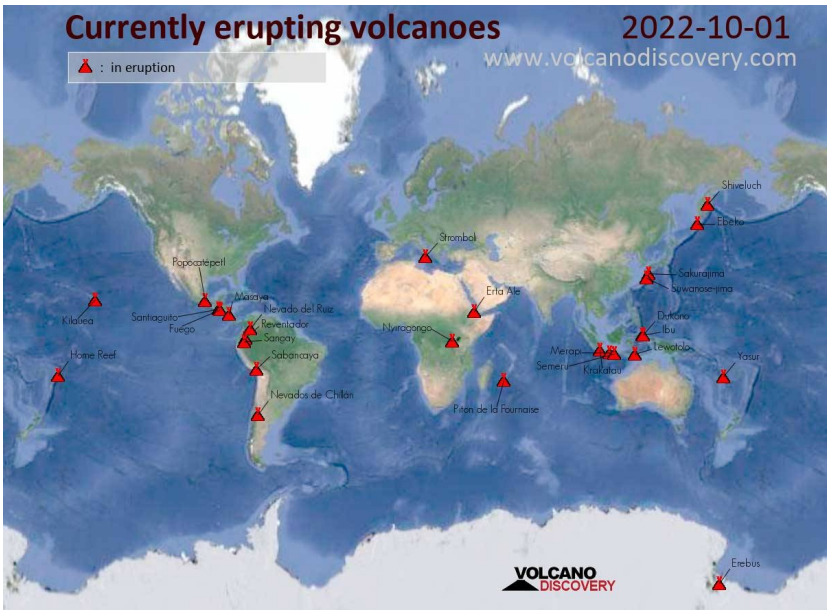
- From Phys.org and the Geological Society of America: Rising sea levels mean rising groundwater—and that spells trouble for coastal septic systems.
- Soil contamination: Mapping risks associated with soil copper contamination using availability and bio-availability proxies at the European scale.
- From the American Geophysical Union (AGU): Lake Sediments Record North Carolina's Coal Legacy.

Mining and Energy

- From Mining.com: Turkey coal mine explosion kills 41 as rescue efforts end.
- Lithium price jumps to fresh all-time high.
- New mine: Vale opens first phase of $684 million copper complex expansion in Canada.
- Research on mineralization: A rapid change in magma plumbing taps porphyry copper deposit-forming magmas.
- More research on mineralization: Mobilization of tin during continental subduction-accretion processes.
- From Phys.org and the Geological Society of America: Can critical metals for renewable energy products be found in existing mines? New research says yes.
- OPEC+ Members Line Up to Endorse Output Cut after U.S. Coercion Claim.
- Rig counts are up in Canada and the U.S.A.
- Shale oil problems: U.S. Shale Output at Risk of Peaking in 2024, Energy Aspects Says; to quote Arthur Berman: "Shale is not a revolution, it's a retirement party".

- Shale oil research: Pore types, genesis, and evolution model of lacustrine oil-prone shale: a case study of the Cretaceous Qingshankou Formation, Songliao Basin, NE China.
- From the United States Energy Information Administration (USEIA): U.S. natural gas production set a new record in 2021.
- Also from the USEIA: EIA expects most U.S. households will spend more on energy this winter

Volcanoes, Earthquakes and Geohazards



Currently Erupting Volcanoes

- Mauna Loa Summit Closed Due to Increased Seismic Activity.
- Volcano research, from Phys.org: Research mission to probe Santorini volcano mysteries.
- Satellite Detection of a Massive Phytoplankton Bloom Following the 2022 Submarine Eruption of the Hunga Tonga-Hunga Ha'apai Volcano; Eureka Alert summary here.
- Eyewitness accounts: Perspectives on the 12 January 2020 Taal Volcano eruption: An analysis of residents' narrative accounts.
- Earthquake research, New Zealand: Observational and theoretical evidence for frictional-viscous flow at shallow crustal levels; Phys.org summary here.
- Earthquake research, Italy: Applying the damage assessment for rapid response approach to the august 24 M6 event of the seismic sequence in central Italy (2016).
- Floods: A seismic approach to flood detection and characterization in upland catchments; Phys.org summary here.

October 17, 2022

Marine Animals of the Paleogene and Neogene -1

When I finished last week's blog entry I realized that I hadn't discussed the fossils of marine animals from the Paleogene Period. Since there is a fair amount of overlap between the Paleogene and Neogene Periods with regards to marine life, I'll deal with them both in the next two week's posting and also correct my mistake. We'll start with whales, then go on to sirenians, and aquatic birds. Next week, we'll take a look at fish and marine invertebrates from the Paleogene and Neogene.

Whales

Whales appear to have evolved from even-toed ungulates (Artiodactyla) with the first examples appearing during the Eocene. The original home appears to be the Tethys Sea between the Indian Subcontinent and Asia. There have been many orders and species of cetaceans, here are a few from the Paleogene and Neogene.

Pakicetus

Figure 1 – *Pakicetus* Skeleton
Credit: Kevin Guertin, Creative Commons Attribution-Share Alike 2.0 Generic license

One of the earliest cetaceans was *Pakicetus*, which was a semi-aquatic predator or omnivore that lived along the shores of the Tethys Sea during the early to middle Eocene in what is now Pakistan. They

ranged in size from one to two metres long. It appears to have been the common ancestor, or closely related to, of all subsequent whales and is thus considered to be the basal cetacean.

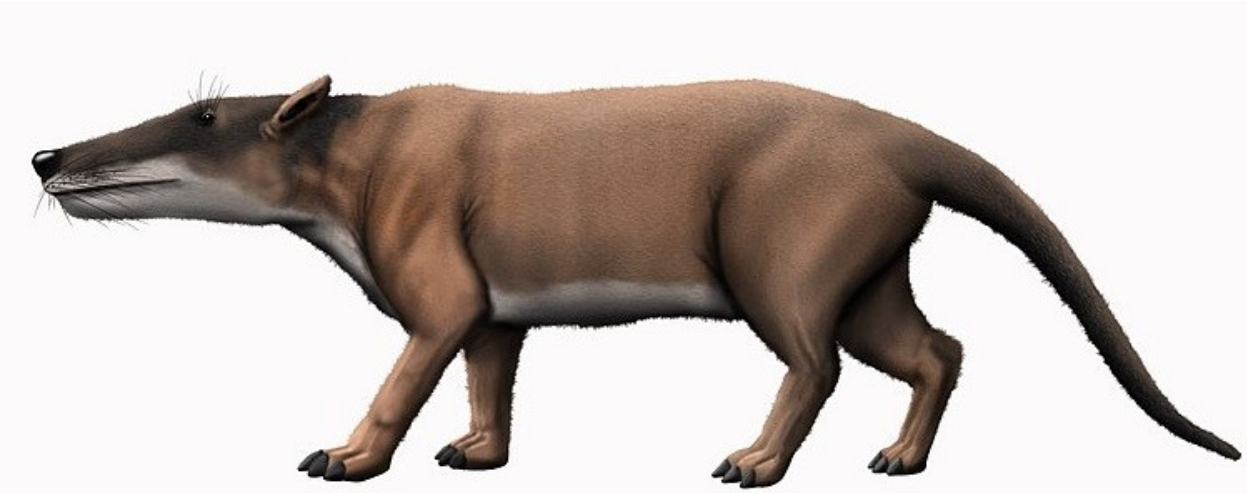


Figure 2 – *Pakicetus* Reconstruction
Credit: Zerosmany, Creative Commons Attribution-Share Alike 4.0 International license

Paleontologists Philip D. Gingerich and Donald E. Russell first described fossils of *Pakicetus* in 1981. There are four species in the genus *Pakicetus*: *P. inachus, P. attocki, P. calcis*, and *P. chittas.*

Cetotheriopsis

Figure 4 – *Cetotheriopsis* Skull at the Field Museum of Natural History, Chicago
Credit: James St. John, Creative Commons Attribution-Share Alike 2.0 Generic

One of the early baleen whales was *Cetotheriopsis that* lived during the Late Oligocene in the Tethys Sea of what is now Austria.

The first description of *Cetotheriopsis* fossils was by Hermann von Meyer in 1849 who called it *Balaenodon lintianus.* Later, Constantine Samuel Rafinesque, recognized that it did not belong in that genus and called it *Cetotheriopsis lintianus.* To make it more confusing, Pierre-Joseph van Beneden called the fossil *Aulocetus;* however *Cetotheriopsis* is the agreed name for the genus. There is only one species in the genus: *Cetotheriopsis lintianus.*

Balaenula

Figure 5 – *Balaenula* at the Lake Waccamaw Depot Museum
Credit: altondooley, Updates from the Paleontology Lab, Virginia Museum of Natural History

Another baleen whale, *Balaenula* lived from the Neogene to the Quaternary. Fossils of the genus come from the marine strata of Belgium, Italy, United Kingdom, United States, the Netherlands, France and Japan. The most complete specimen of *Balaenula* in North America was recovered from limestone deposits at Lake Waccamaw, North Carolina is on display at the Lake Waccamaw Depot Museum.

Pierre-Joseph van Beneden made the first description of *Balaenula* in 1872 from a fossil found near Antwerp, Belgium. There are two recognized species of *Balaenula: B. balaenopsis* and *B. astensis.*

Sirenians

Modern day examples of sirenians include the manatee and the dugong. The term sirenian comes from the ancient Greek name for mermaids, sirens. Sirenians today are herbivorous mammals that are adapted to living in rivers, estuaries, and nearshore marine water. The earliest sirenians appeared during the Eocene. Here a couple examples from the fossil record.

Prorastomus

Figure 6 – *Prorastomus* Reconstruction
Credit: Nobu Tamura, Creative Commons Attribution 3.0 Unported license

First discovered as a fossil skull from Jamaica, *Prorastomus* was one of the earliest known sirenians. Unlike modern sirenians, it was mostly a terrestrial animal that spent only part of its time in the water feeding, something like the modern hippopotamus. It was about 1.5 m long.

The English geologist Richard Owen first described *Prorastomus* in 1855 from a fossil found in the in the Paleogene Yellow Limestone Group of Jamaica. There is only one species in the genus, *P. sirenoides*.

Miosiren

Figure 7 - *Miosiren* Fossil from the Musee d'Histoire Naturelle, Brussels
Credit: Ghedoghedo Creative Commons Attribution 3.0 Unported license

By the Miocene Epoch, sirenians had evolved to become fully aquatic; one example is *Miosiren*. Known from fossils found in Suffolk, England and near Antwerp, Belgium. Louis Dollo first described the type

species, *Miosiren kocki*, in 1889. A second species, *Miosiren canhami* was described in 1874, but there doesn't seem to be a good reference to who made the description.

Aquatic Birds

Waimanu

Figure 8 - *Waimanu* Bones
Credit: From Figure 1 in Slack *et al* 2006

Penguins are among the most important aquatic birds of the Paleogene and Neogene and *Waimanu* is one of the earliest examples. First found in Oligocene fossils from New Zealand, *Waimanu* is probably related to the earliest members of the penguin family. I was about one metre long, similar in size to the modern Emperor Penguin.

Figure 9 – *Waimanu manneringi* Reconstruction
Credit: Nobu Tamura, Creative Commons Attribution 3.0 Unported license

The first fossils discoveries of *Waimanu* was in 1980 from fossils that came from the basal Waipara Greensand near the Waipara River, in the Canterbury region of the South Island, New Zealand. The base of the Waipara Greensand is Paleocene in age. The team of Kerryn E. Slack, Craig M. Jones, Tatsuro Ando, G. L.(Abby) Harrison, R. Ewan Fordyce, Ulfur Arnason, and David Penny first described *Waimanu* in their 2006 paper. Their are two species of *Waimanu: W. manneringi* and *W. tuatahi.*

Aptenodytes ridgeni

Figure 10 – *Aptenodytes*
Credit: Charles Joseph Hullmandel, public domain

A Pliocene species of the genus that includes such modern birds as the King Penguin and the Emperor Penguin, *Aptenodytes ridgeni* lived in New Zealand. An 11 year old boy boy, Alan Ridgen, found the first fossil of *Aptenodytes ridgeni* in 1968 on a beach in the Canterbury region of New Zealand, hence the common name for the fossil: “Ridgen's penguin”. The fossils showed a penguin 90 to 100 cm tall, intermediate between the King Penguin and the Emperor Penguin.

After its discovery by Alan Ridgen, George Gaylord Simpson described and named *Aptenodytes ridgeni* in 1972.

Wrapping it Up, for now

There are lots of marine fossils from the Neogene and Paleogene, so if these intrigue you, so follow upon on the links here to start your own search.

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.