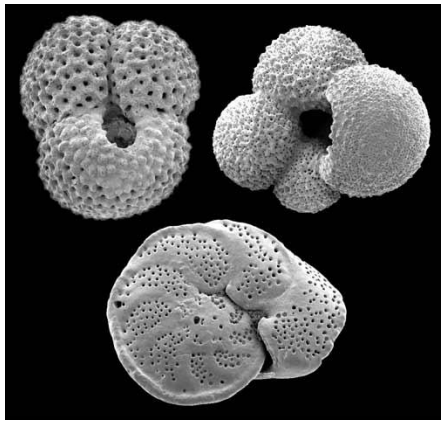
# A Brief Survey of Important Fossil Groups

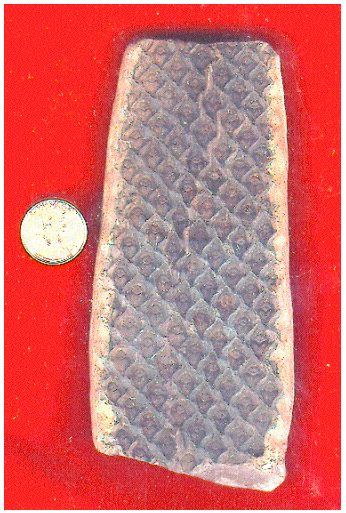
Dr. Michael J Passow

# Fossils



http://www.teara.govt.nz/files/p9047niwa.jpg

Remains of organisms that lived and died a very long time ago



http://www.uky.edu/KGS/education/trex.html

http://science.nationalgeographic.com/

http://www2.mcdaniel.edu/Biology/botf99/ancientforests/lepidendron.htm

# Types of fossils

- Some fossils are actual hard parts, like this mastodont tooth
(http://www.lakeneosho.org/More20.html)

- Other fossils have had the organic matter replaced by minerals, such as this “petrified” (permineralized) wood

https://www.ginkgogemshop.com/store/

# Many fossils only preserve the shape of the shell

Mold: hollow cavity

Cast: replica from the mold

http://petrifiedwoodmuseum.org/moldscasts.htm

# “Trace fossils”

- Dinosaur footprints

http://education.usgs.gov/lessons/schoolyard/dinosaurtracks.html

- Fossilized worm burrows

http://www.blackriverfossils.org

- Fossil trails of unknown origin


http://www.emc.maricopa.edu/faculty/farabee/biobk/biobookpaleo1.html

# How are fossils organisms classified?

We classify fossil organisms the same way we classify living organisms: the “Linnean System”

- Kingdom
- Phylum
- Class
- Order
- Family
- Genus
- Species

(King Philip Called Out For Great Spaghetti)

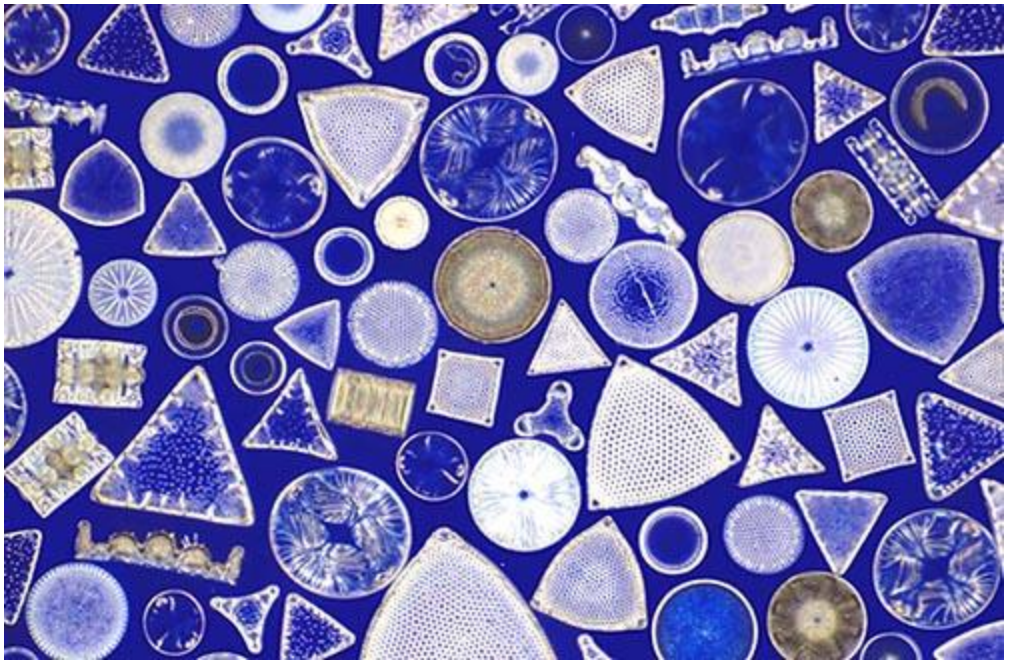
# How detailed do I have to get?

- Most of the time, people describe fossils simply by their Phylum (such as “Brachiopod” or “Bryozoa”)
- Some groups, such as Mollusks, use the Class (such as Gastropod or Cephalopod)
- Usually only specialists or advanced students use Order and Families
- The scientific name is the *Genus species*

# A Brief Survey of Important Fossil Groups

"Microfossils"

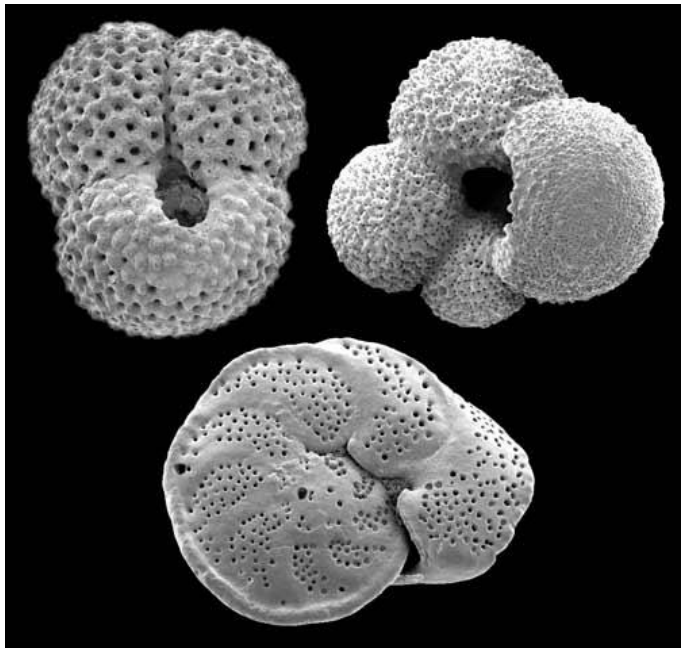
Diatoms
(one-celled plants)



http://www.microscopy-uk.org.uk/mag/indexmag.html?http://www.microscopy-uk.org.uk/mag/artmay05/swgallery1.html

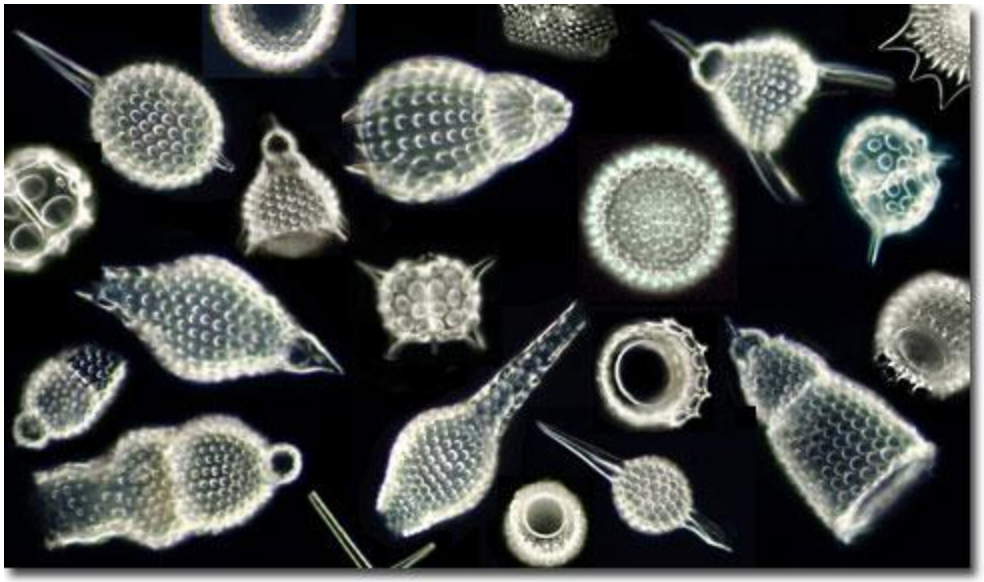
# Protozoans (one-celled animals)

- Foraminifera (chalky)



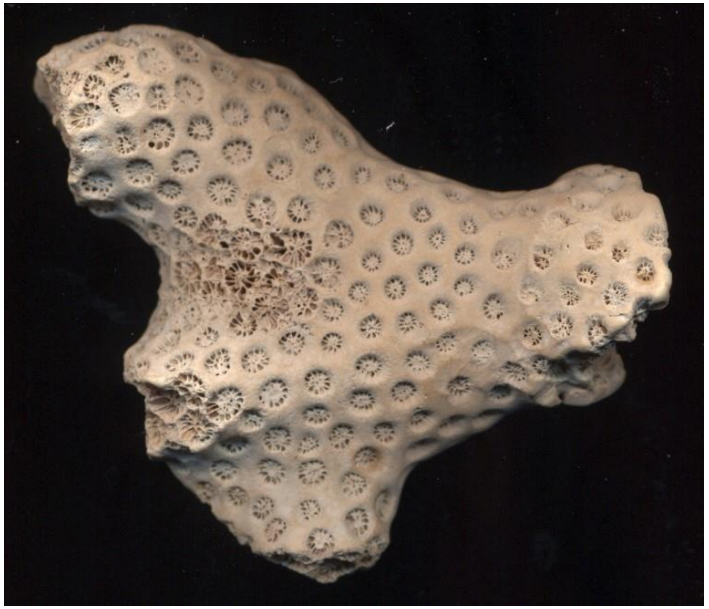
http://www.teara.govt.nz/en/fossils/7/1

- Radiolaria (glassy)



http://micro.magnet.fsu.edu/micro/gallery/radiolarians/radiolarians.html

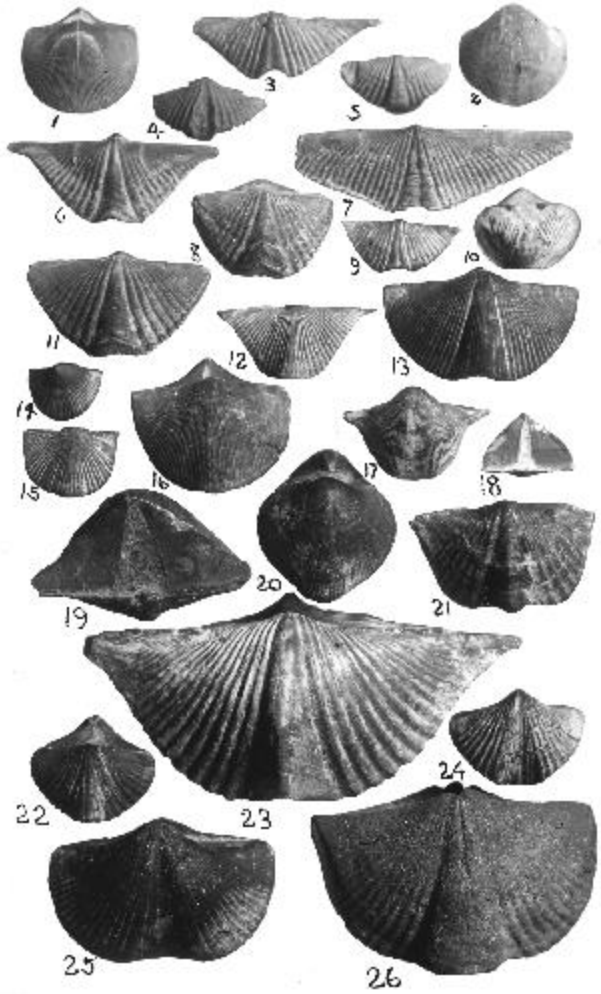
# Phylum Coelenterata (hollow-bodied animals)



Jellyfish→

horn coral

# Phylum Brachiopoda
# Common fossils, rare today

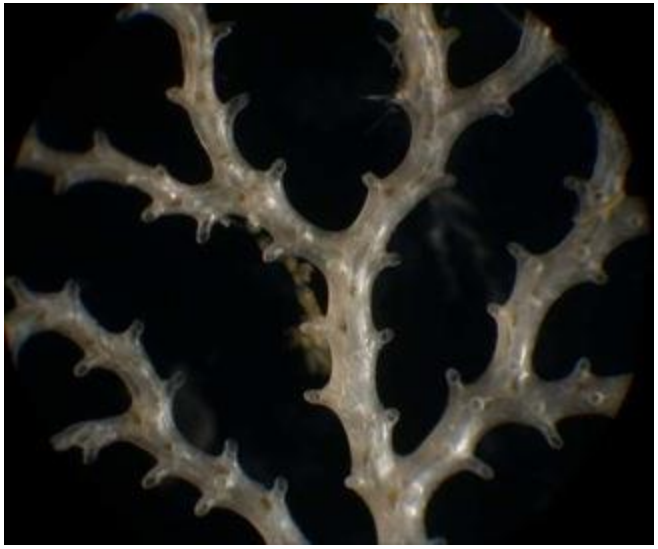



http://www.uiowa.edu/~calvin/calvfossil.htm

# Phylum Bryozoa (“moss animals”) also more common as fossils

← Fossil bryozoans

Living bryozoans →



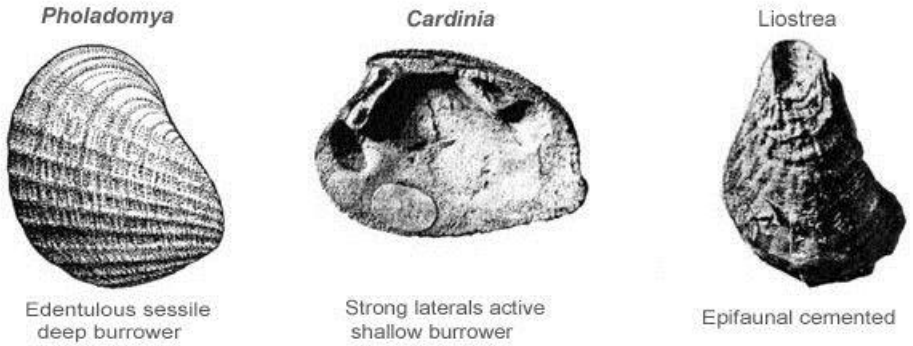
# Phylum Mollusca ("soft-bodied animals")

Usually studied at the "Class" level

- Gastropods (snails)

http://www.nhm.ac.uk/research-curation/collections/

- Pelecypods (bivalves)




http://www.conchsoc.org/node/573

# Molluscs, cont'd

- Cephalopods – octopus, squid, and relatives

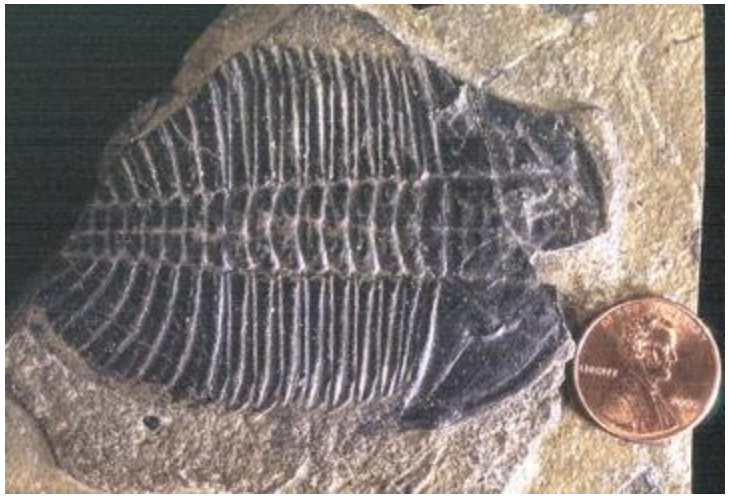
Modern living chambered nautilus →

# Phylum Arthropoda ("jointed-foot animals")

- Modern arthropods are probably the most numerous of all animal groups

photo (c) Alex Wild

# Trilobites—first hard-shelled organisms

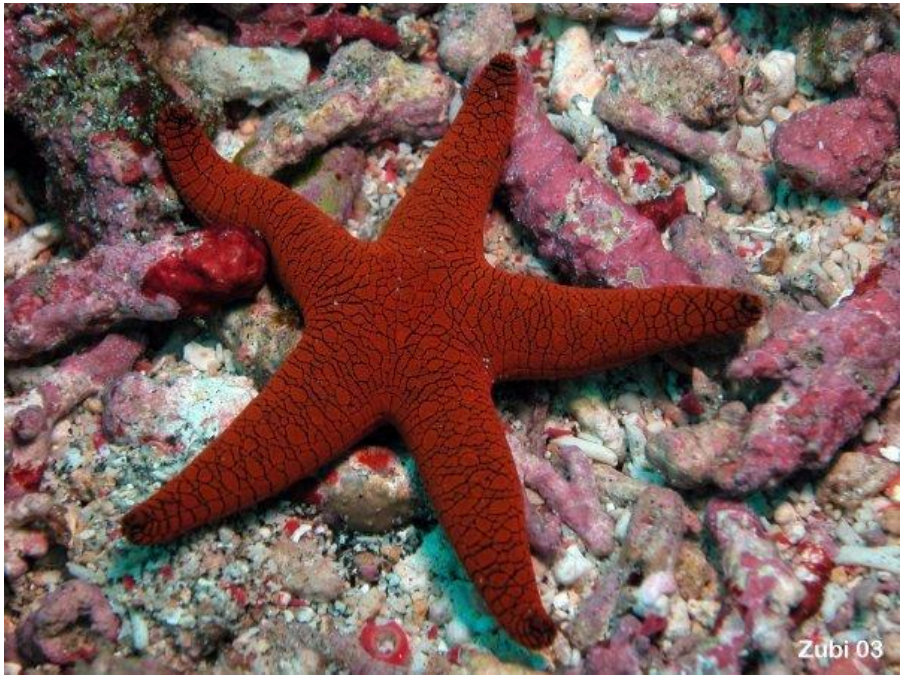


# What happened 248 million years ago?

- Trilobites appeared about 540 mya and lasted for almost 300 millin years.
- But about 248 mya, trilobites ceased to exist in one of the great MASS EXTINCTIONS found in the fossil record.
- At this time, no conclusive explanation has been presented for this change.

# Phylum Echinodermata ("spiny-skinned animals")

- Modern echinoderms include starfish and sea urchins



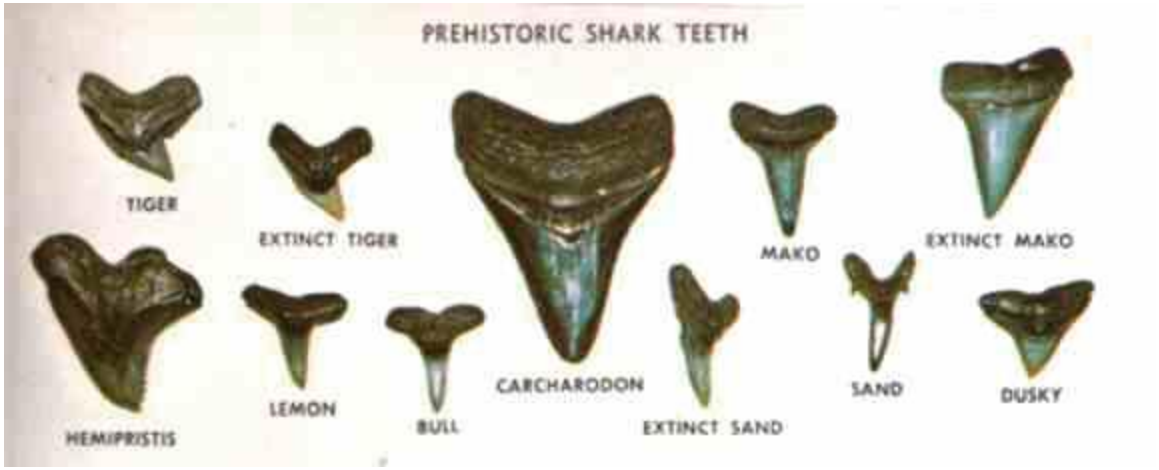

# Fossil echinoderms

# Phylum Chordata

- Our scientific phylum
- Possess a dorsal (back) spinal cord
- Subphylum Vertebrata—cord protected inside vertebrae (“backbones”)
- Five important Classes:
    - Fish
    - Amphibians
    - Reptiles
    - Birds
    - Mammals

# Class Pisces -- Fish

- Gills and fins
- “Chondrichthyes”—skeletons of cartilage
  Sharks and rays




http://www.mcintosh55.com/pics/sharksth.jpg

# Class Osteichthyes
# Bony Fish

http://www.treasure-hunting-team.com/a27-treasure-hunting-for-fossil-fish.php

http://skywalker.cochise.edu/wellerr/fossil/fish/fishL.htm

# Class Ambiphians

- Frogs, toads, newts, and their relative
- Gills first, then lungs – air-breathers
- Soft eggs deposited in water

http://www.dinosaurstore.com/REPLICAS.htm

# “Age of Amphibians”

- Without other competition, amphibians became dominant during the Carboniferous Period, about 300 mya
- Vast swamps later became the coal deposits of eastern North America

http://news.nationalgeographic.com/news/2010/03/100315-new-fossil-amphibian-fedex/

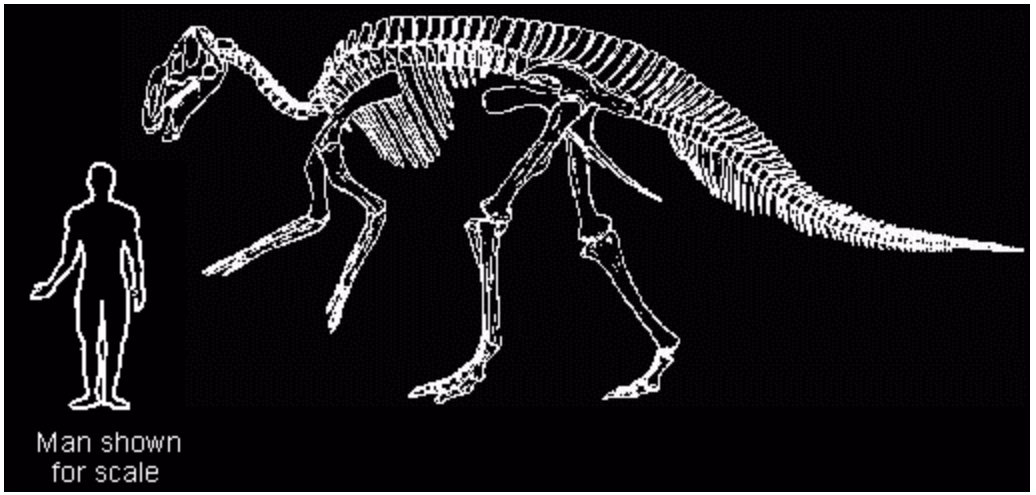
# Plant Fossils

- Because plants live on land and do not have hard parts (bones, shells), fossilization is less common than with animals
- Plants that live in damp places, such as ferns, are more common as fossils

# Class Reptilia

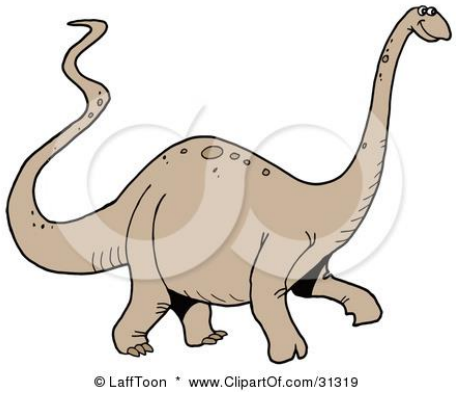
- Living turtles, snakes, lizards, alligators, crocodiles
- Fossil dinosaurs and their relatives
- Leathery or hard-shelled eggs—no longer necessary to reproduce in water
- First large-sized “conquerors of land”
- “Age of Reptiles”—Mesozoic Era
  248 – 65 mya

# Dinosaurs – skeletal or drawn – have captured imaginations for decades




http://www.state.nj.us/dep/njgs/enviroed/hadro.htm

http://www.scienceviews.com/photo/library/SIA0344.html

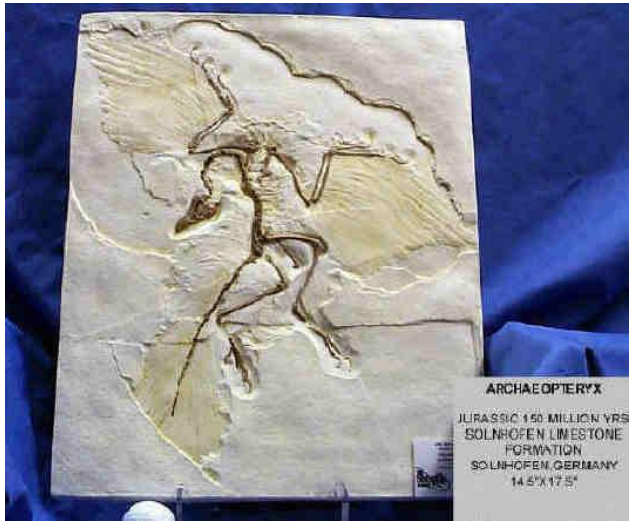



# Dinosaurs Take Control

- Between their first appearance more than 225 mya and their disappearance about 160 million years later, dinosaurs became the dominant organisms on this planet
- Dinosaurs evolved to fill many **ecological niches**—ways of living. They were herbivores, carnivores, omnivores, terrestrial, marine, small, large—everywhere.

# Birds – Living Dinosaurs?

- Recent research has established close links between one group of dinosaurs and birds




http://www.dinosaurstore.com/REPLICAS.htm

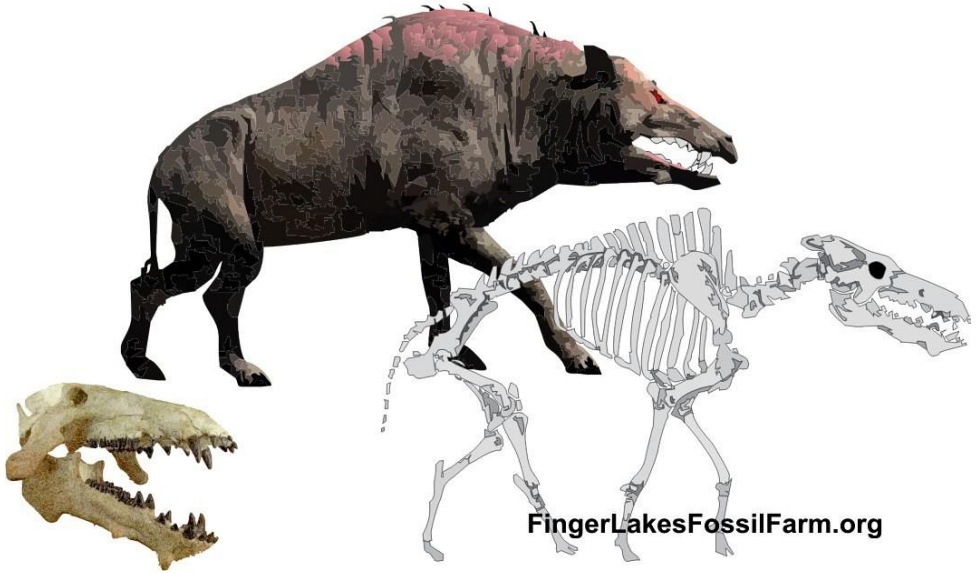
The first bird fossil was discovered in 1859 in a limestone quarry. It is called Archeopteryx (“ancien feathers”)

# “K-T Boundary Event – The Beginning of the Modern World

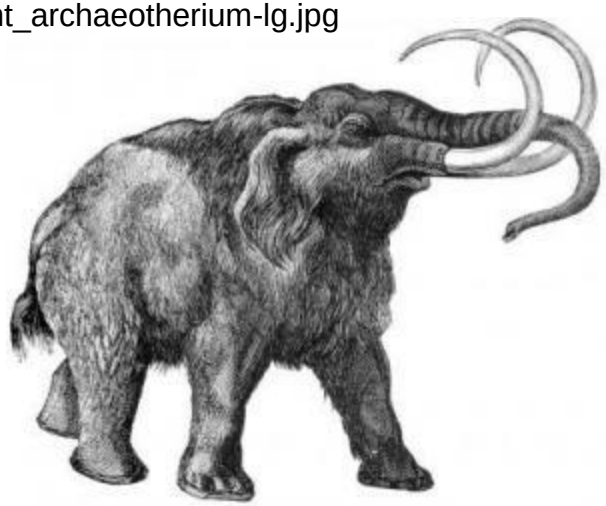
- ‘One bad day about 65 million years ago,’ an asteroid collided with Earth off the coast of what became the Yucatan Peninsula.
- The effects of this impact created another great extinction were immense.
- The ecological niches previously occupied by dinosaurs became available.
- Either birds or mammals could become dominant.

# Class Mammalia

- Why did mammals win over birds?
- Birds have external development in eggs, which make them vulnerable to predators.
- Mammals, with a few exceptions, have internal development (in the womb), which greatly increase chances for survival
- Result? Mammals rule!



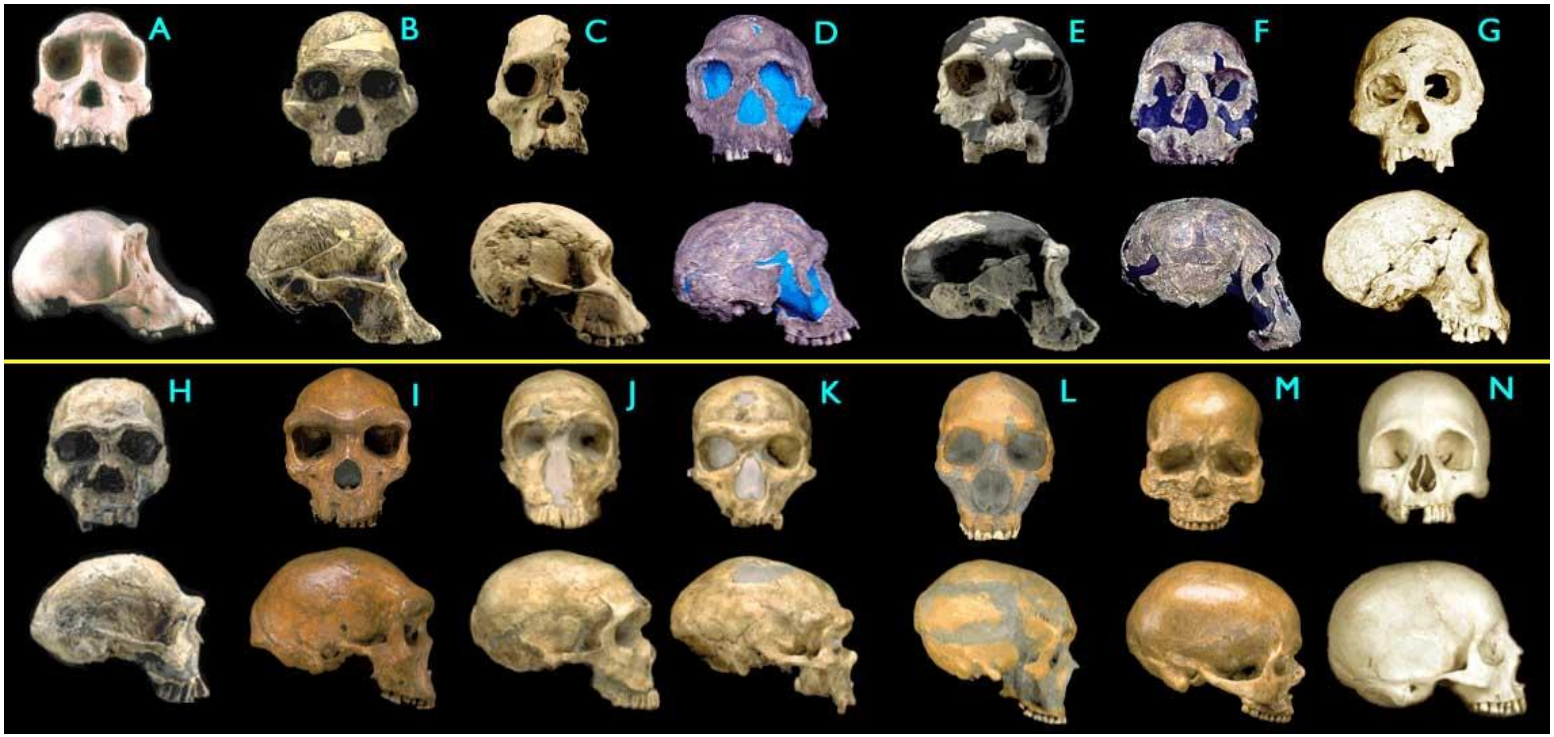

http://fingerlakesfossilfarm.org/mammal_images/enteledont_archaeotherium-lg.jpg

http://www.networlddirectory.com/

http://phys.org/news/2011-08-discovery-million-year-old-fossil-milestone-early.html

# Can humans be fossils?




Since humans live on land, very few have been preserved. But from these, we have been able to construct a tentative story of human origins.

# There’s still so much more to be learned!

- Each year brings new discoveries of previously unknown fossils.
- A visit to a museum is the best way to learn more.
- New Jersey has an impressive record of fossils:
  http://www.njfossils.net/
  http://fossilsofnj.com/
  http://www.geoworld.org/New_Jersey/Prehistory