Module 10
Fossils

FOSSILS

Fossil

- An **organic trace** buried by **natural processes**, and subsequently permanently preserved
- Organic traces include skeletal material, impressions of organisms, excremental material, tracks, trails, and borings
- The preservation is considered older than **10,000 years** (before Holocene)
- **Human artifacts** are **not** regarded as fossils

FOSSILS

Fossil may be preserved in the following forms

- Physically and chemically almost unaltered
- Physically (structurally) unaltered but chemically altered
  - Carbonization
  - Silicification
  - Calcification
  - Pyritization
  - Hematization
- Impression
  - Mold and cast
  - Internal mold and internal cast

FOSSILS

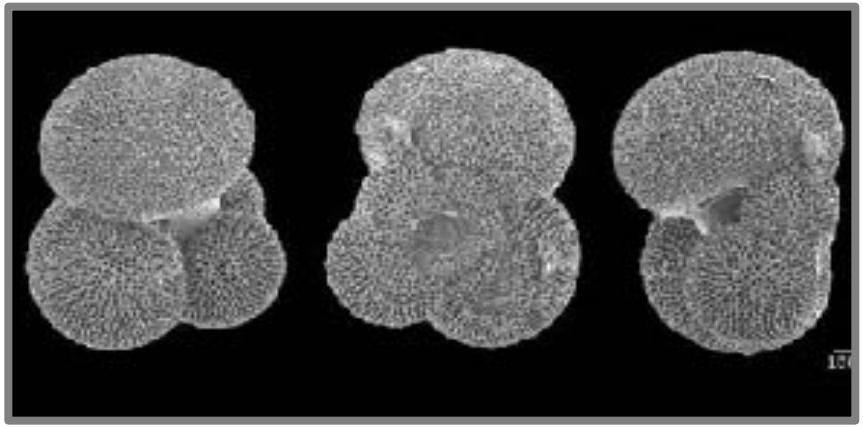
Taxonomy (organism classification)

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

There are five Kingdoms

1. Monera (bacteria, single cell)
2. Protista (single to multiple cells, *e.g.* algae)
3. Fungi (multiple cells, absorb surrounding organic material)
4. Plantae (plants, photosynthesis, 40000 species)
5. Animalia (30 phyla, 2000000 species, 5% vertebrate, 45000 sp)

FOSSILS



Taxonomy (organism classification)

- ❑ **Kingdom** — **animalia**
- ❑ **Phylum** — **protozoa**
- ❑ **Class** — **foraminifera**
- ❑ **Order** — **sarcodina**
- ❑ **Family** — **globigerinidae**
- ❑ **Genus** — **globigerina**
- ❑ **Species** — ***Globigerina praebulloides***

P16-N16

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Stegodon

Molar of stegodon

Gigantosaurus

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Mammoth

Archeopteryx (first bird)

Reptile

Fish

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Foot imprint of Dyonosaurus

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Fly preserved in amber

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Leaves fossil

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Molluscs

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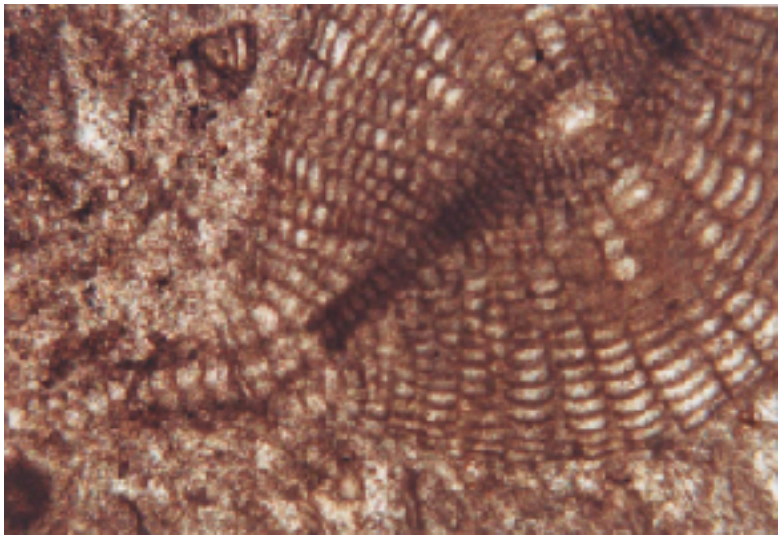
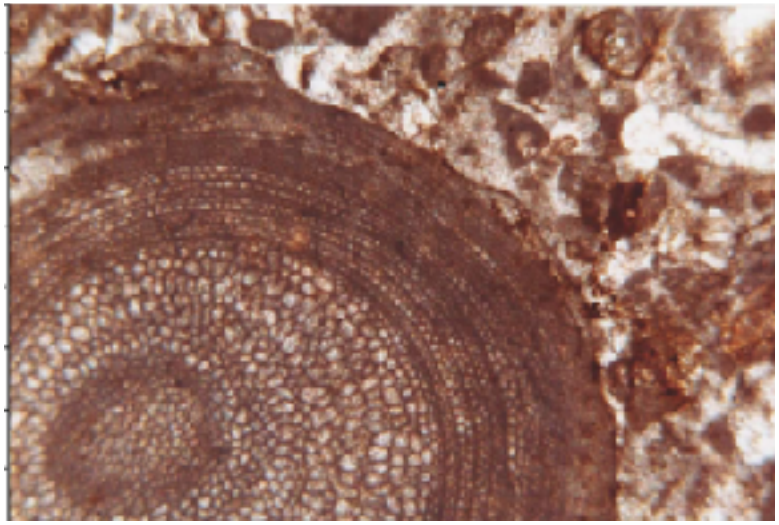
Larger foraminifera in bioclastic limestone





Thin section view under microscope

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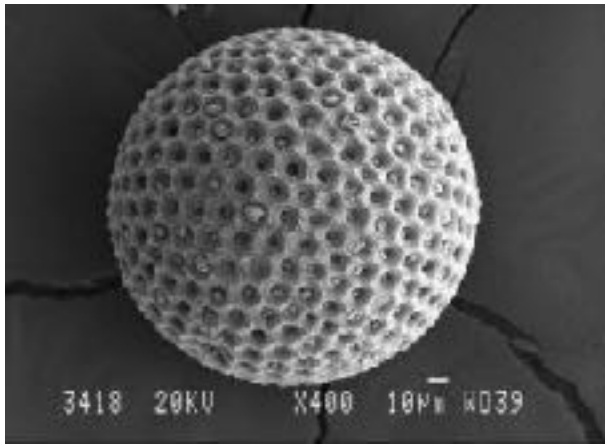
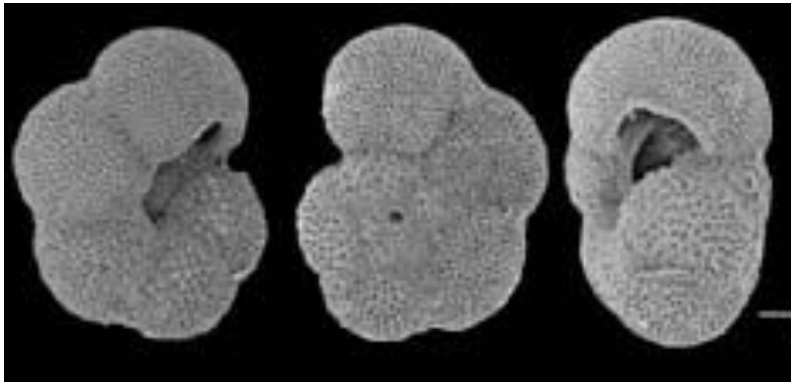
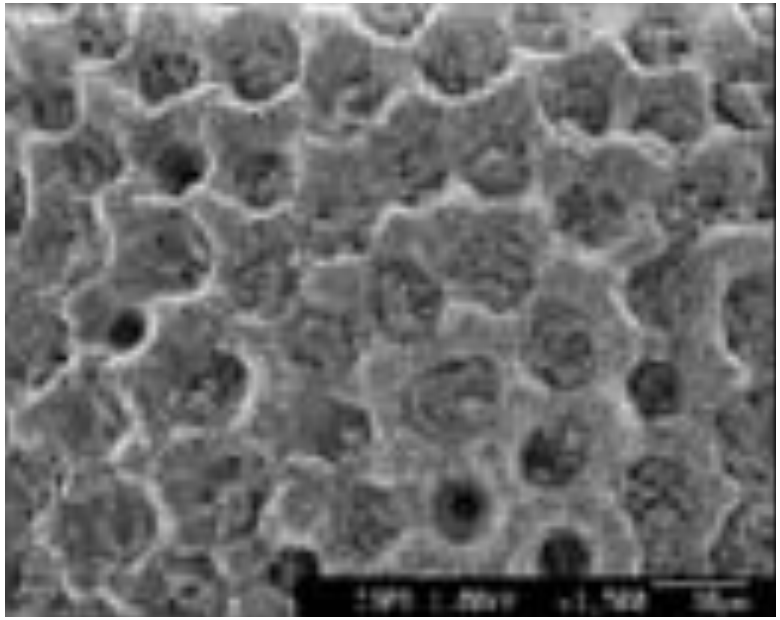
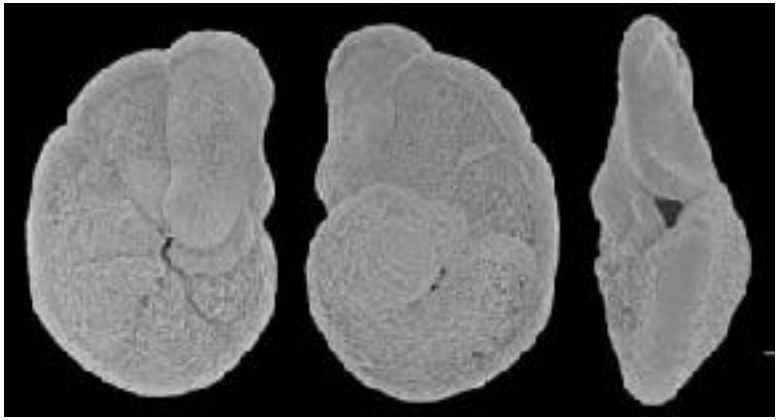




Globorotalia siakensis



Orbulina universa



Globorotalia tumida

FOSSILS

Why do we study fossils?

- To understand paleobiology
- To understand paleoclimate
- To understand paleoenvironment/ paleoecology
- To determine the relative age of rocks (strata)
- To reconstruct the Earth's history

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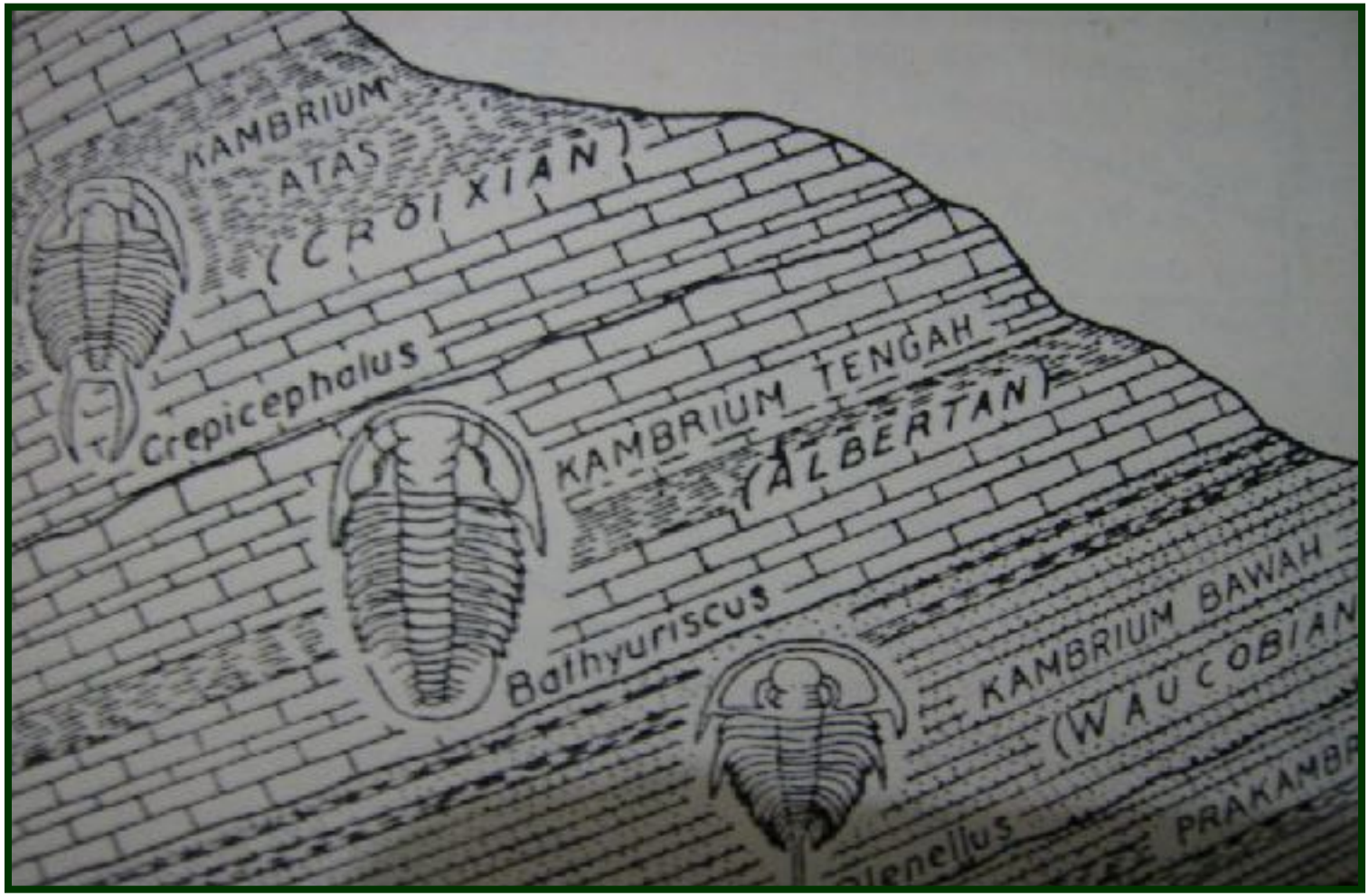
Determining the relative age of strata



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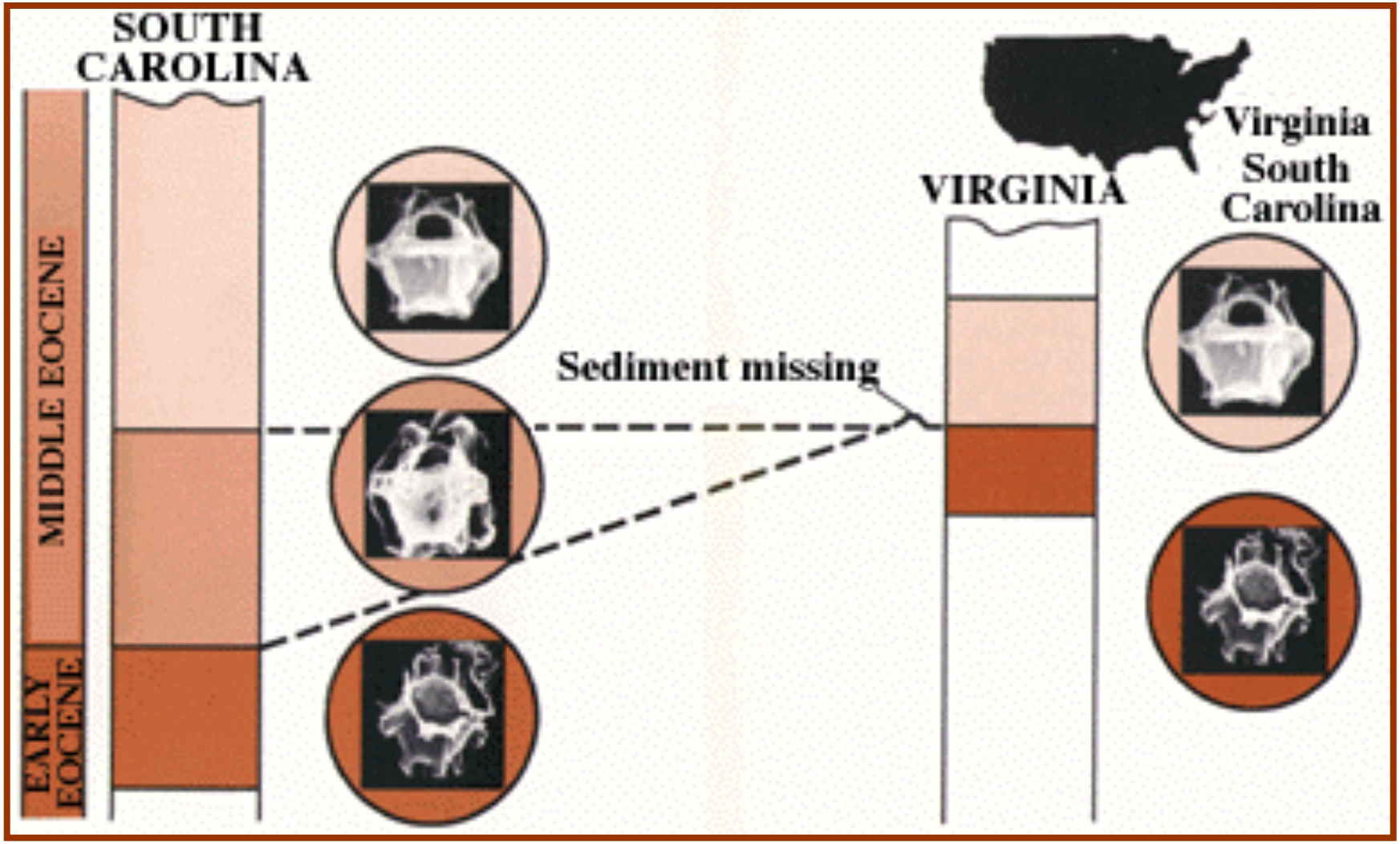
Correlation



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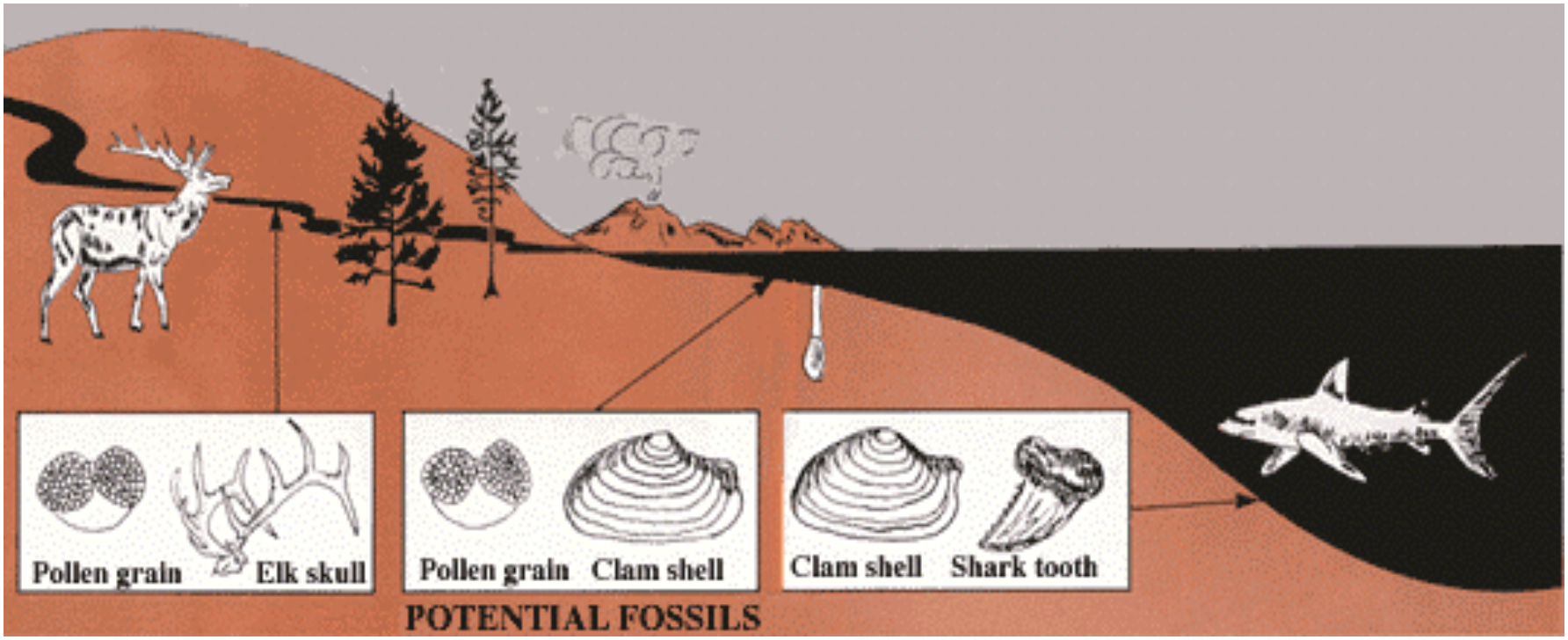
Determining paleoenvironment



THEORY OF ORGANIC EVOLUTION

- **Darwin's**
  - ***On the Origin of Species by Means of Natural Selection,* published in 1859,**
  - **revolutionized biology**
- **Provides a framework**
  - **for understanding the history of life**

THEORY OF ORGANIC EVOLUTION

Central Thesis of Evolution

- **All present-day organisms are related and descended from organisms that lived during the past**
- **Natural selection is the mechanism that accounts for evolution**
- **Natural selection results in the survival to reproductive age of those organisms which best adapted to their environment**

THEORY OF ORGANIC EVOLUTION

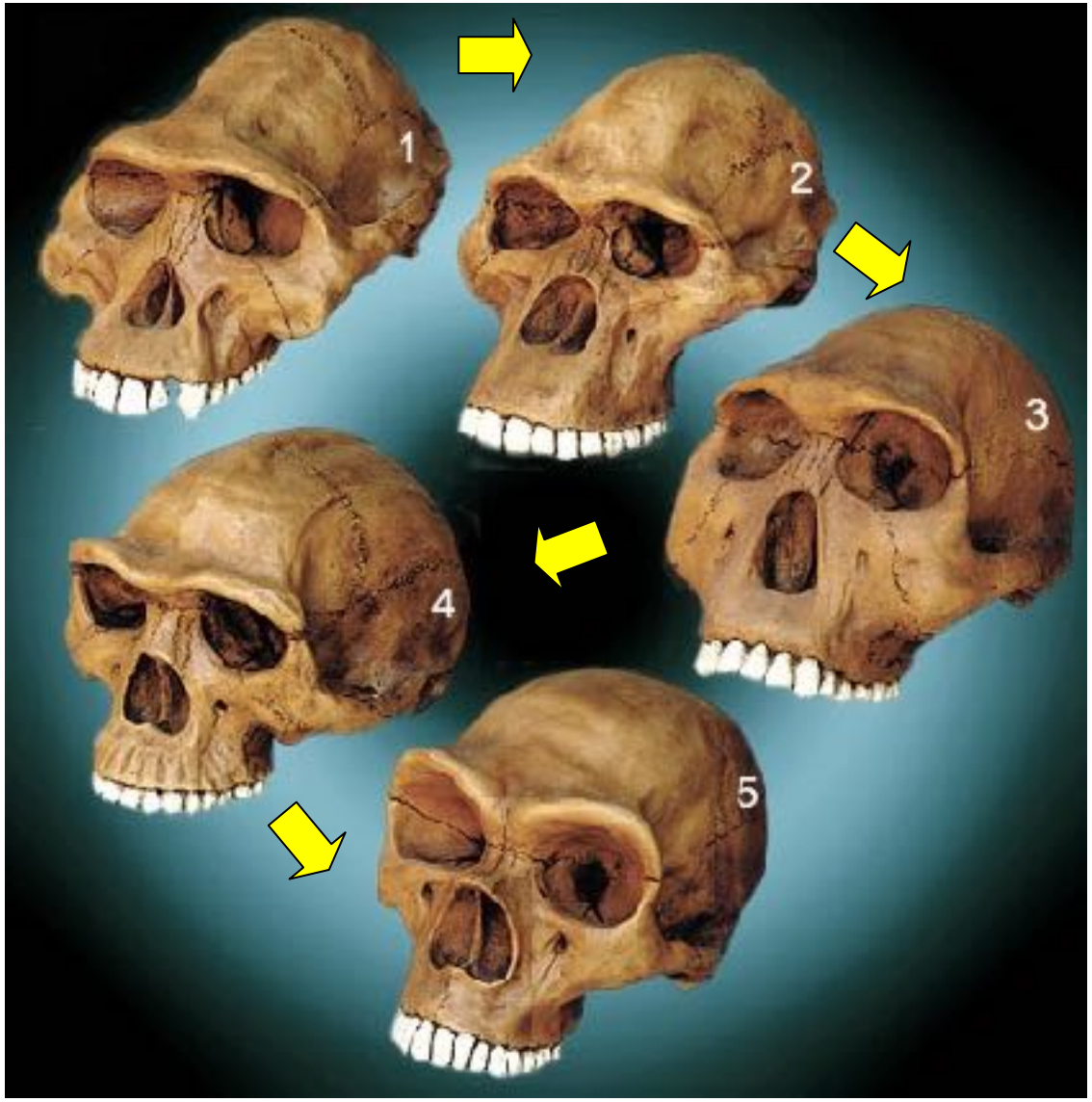
History of life

- The fossil record provides perhaps
  - the most compelling evidence
  - in favor of evolution
- **Fossils** are the remains or traces
  - of once-living organisms
- Fossils demonstrate that Earth
  - has a history of life

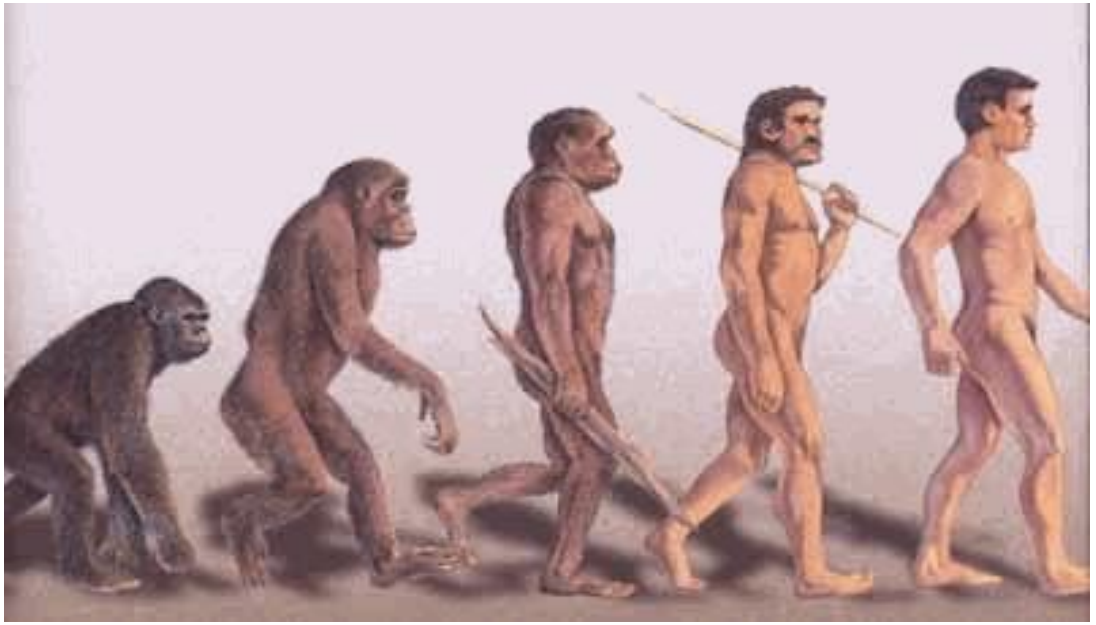
How Does the Study of Historical Geology Benefit Us?

- Survival of the human species
  - depends on understanding how Earth's various subsystems work and interact
- Study what has happened in the past,
  - on a global scale,
  - to try and determine how our actions
  - might affect the balance of subsystems in the future

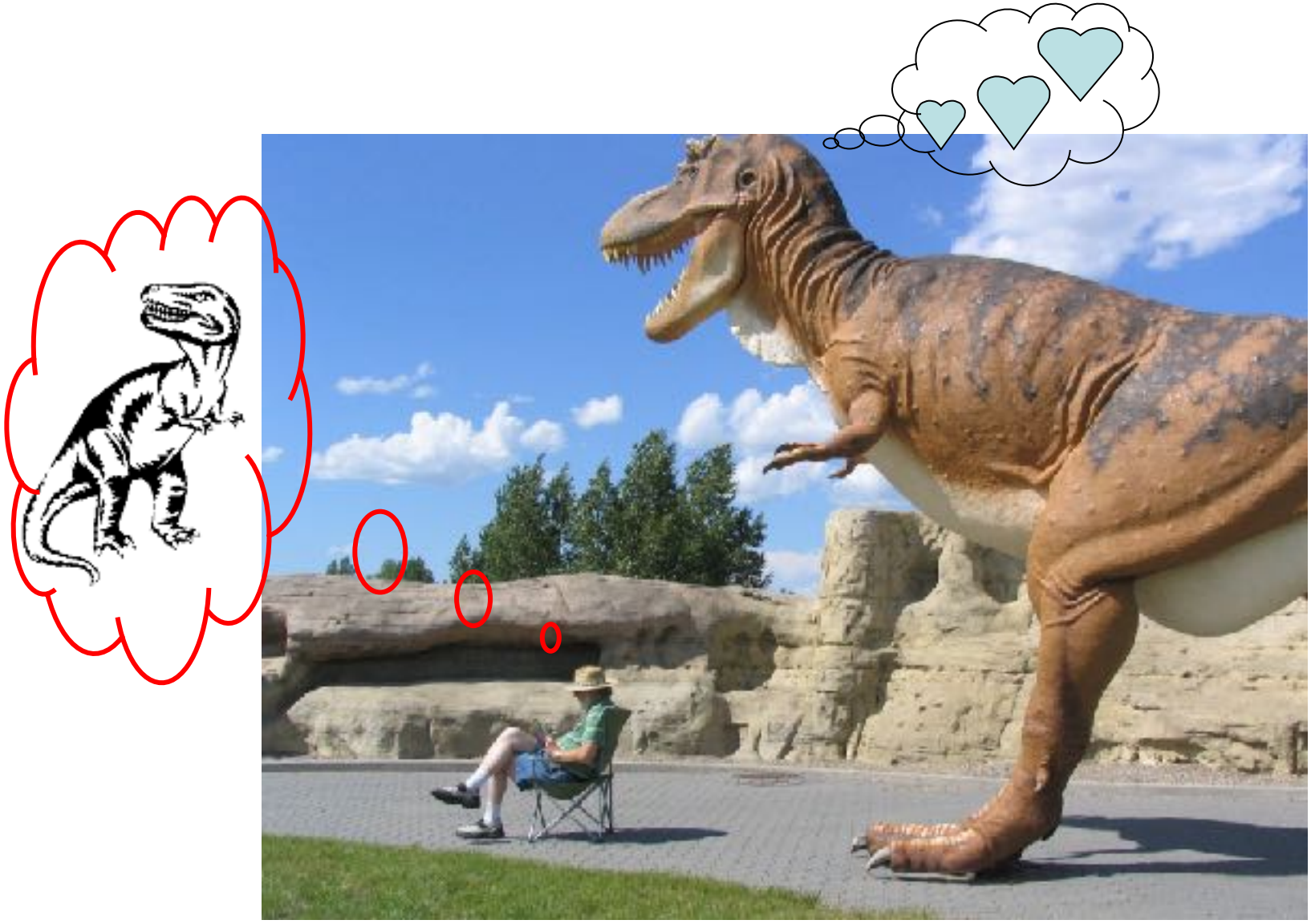
From Primata to Human



From Primata to Human



Do you believe it?



Tyranosaurus Rex