

08

UNDERSTANDING
DARWIN, EVOLUTION, AND
WHAT TO SAY IN SCHOOL

DR. JOHN H. WHITMORE

EMANUEL BAPTIST CHURCH, NOVEMBER 13, 2022

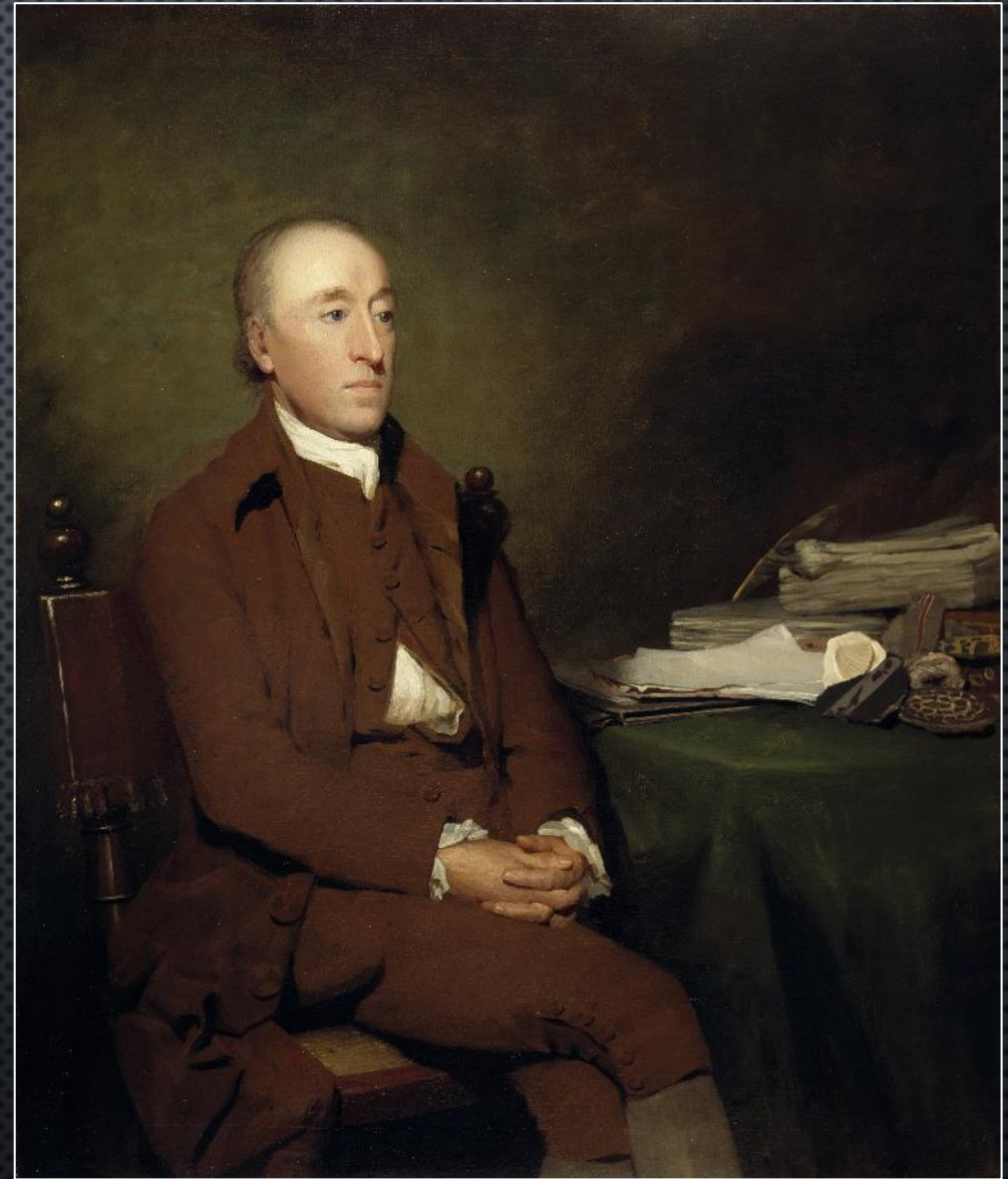
WHAT IS “EVOLUTION”

- CHANGE
- DIVERSIFICATION

I. THE HISTORY LEADING UP TO
THE ORIGIN OF SPECIES (1859)

JAMES HUTTON (1726-1797)

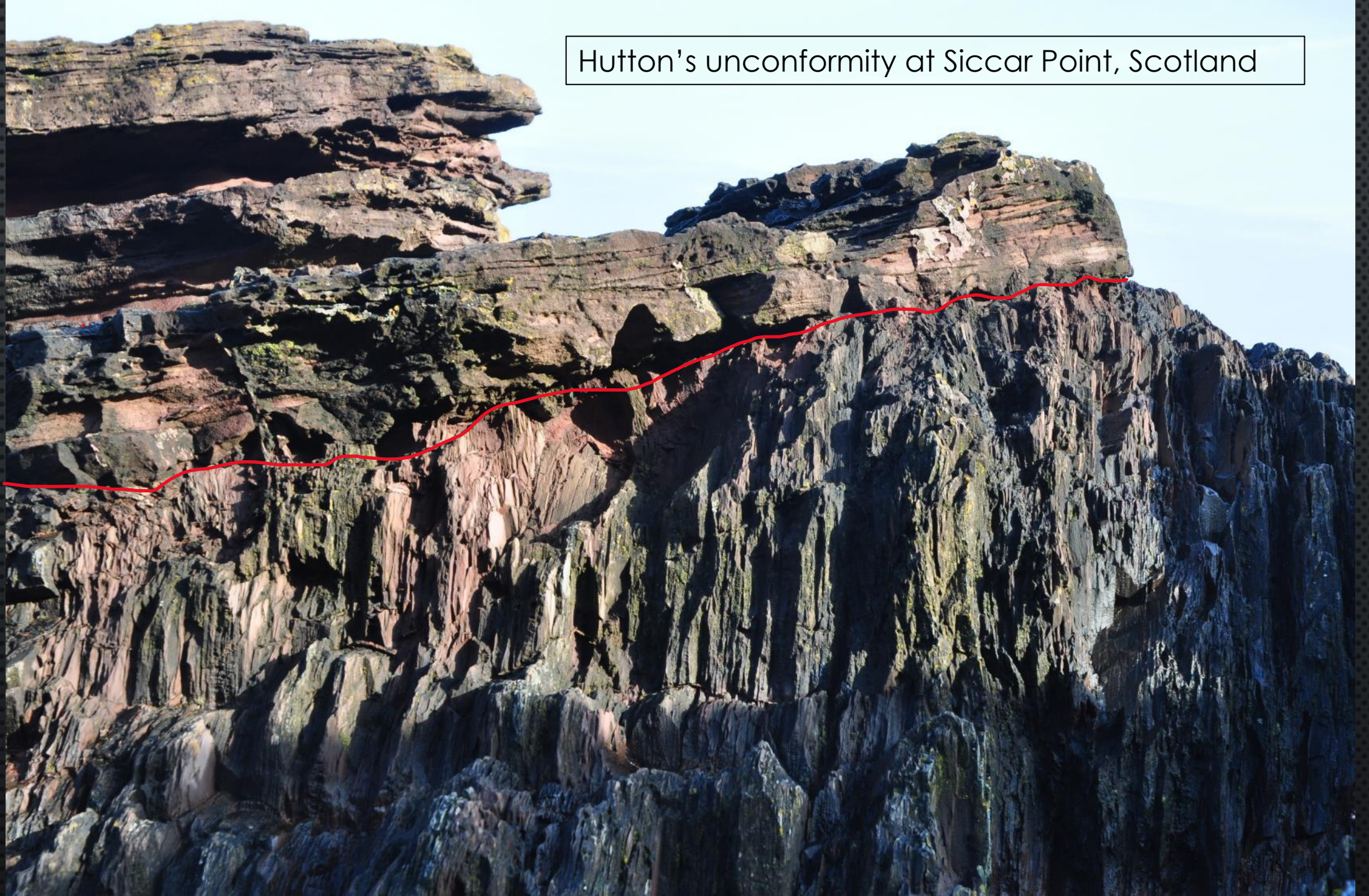
- SCOTTISH GEOLOGIST, CHEMIST, NATURALIST, DOCTOR
- U OF EDINBURGH, U OF PARIS, LEIDEN U
- THE “OYSTER CLUB”
 - ADAM SMITH, JOSEPH BLACK, JAMES WATT, DAVID HUME
- *THEORY OF THE EARTH*
 - 1785, LECTURE TO ROYAL SOCIETY OF EDINBURGH
 - 1788, PAPER IN THE TRANSACTIONS OF THE ROYAL SOCIETY OF EDINBURGH
 - 1797, BOOK
- UNIFORMITARIANISM: “THE PRESENT IS THE KEY TO THE PAST”



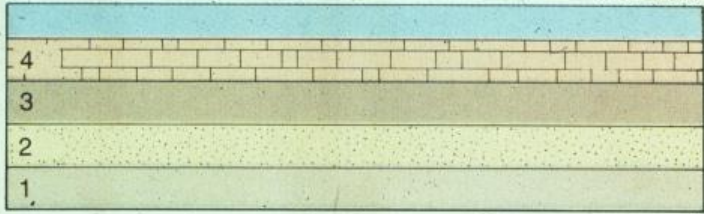
Siccar Point, Scotland



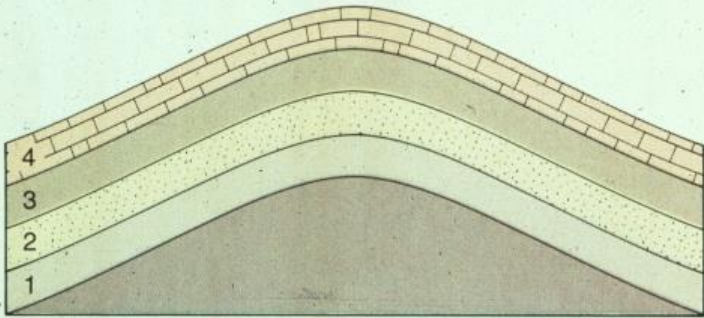
Hutton's unconformity at Siccar Point, Scotland



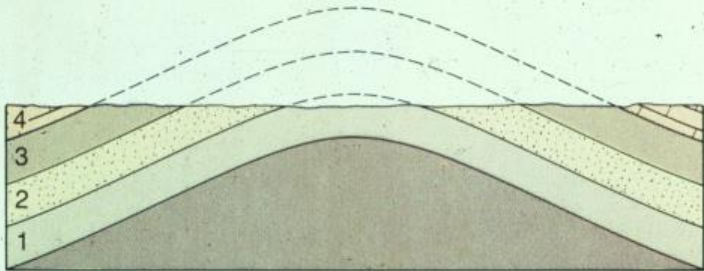
Sea level



A. Deposition

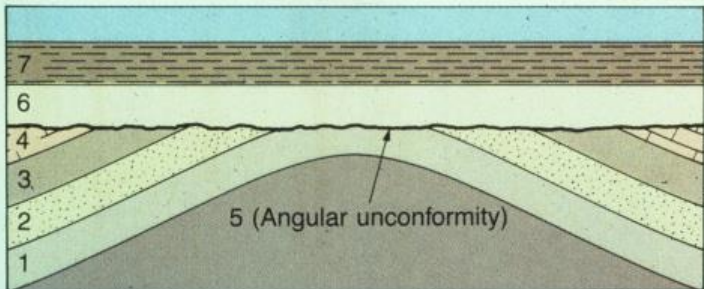


B. Folding and uplifting



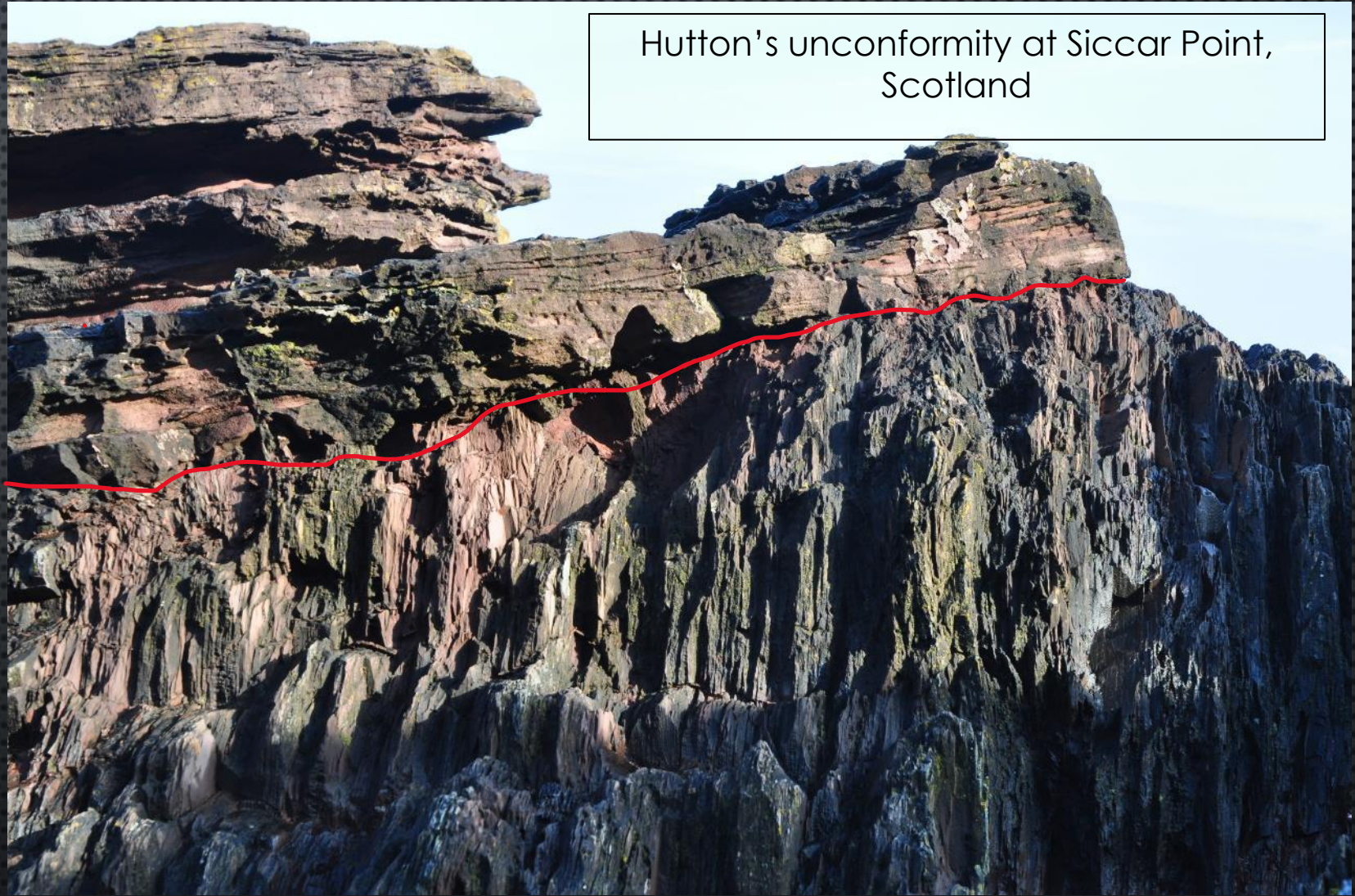
C. Erosion

Sea level



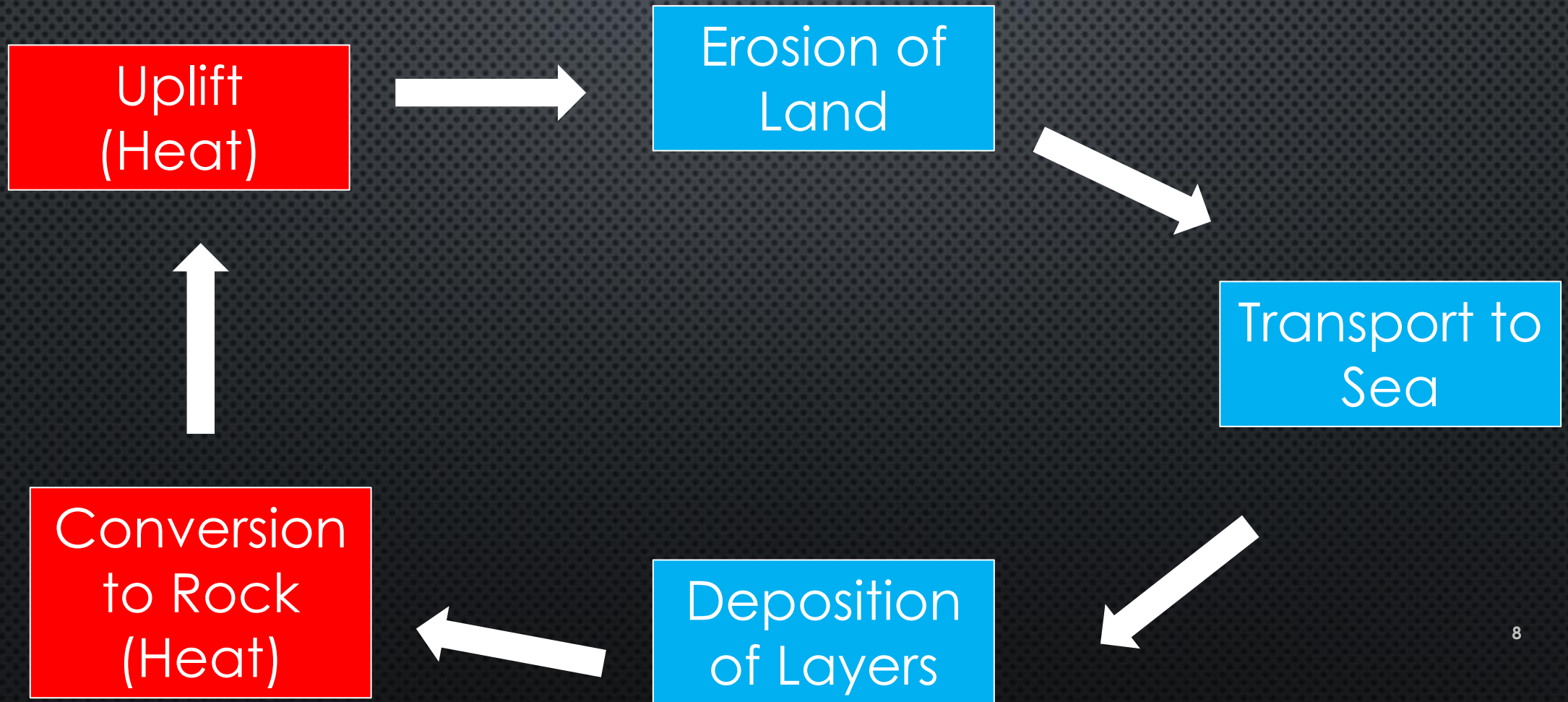
D. Subsidence and renewed deposition

Hutton's unconformity at Siccar Point, Scotland



HUTTON'S ROCK CYCLE

“The result, therefore, of our present enquiry is that we find no vestige of a beginning, no prospect of an end.”



CHARLES LYELL (1797-1875)

- SCOTTISH LAWYER AND GEOLOGIST
- OXFORD EDUCATED
- *PRINCIPLES OF GEOLOGY* (1830-33), CLEARER DESCRIPTION OF UNIFORMITARIANISM



LYELL'S GOAL: "FREE THE SCIENCE FROM MOSES"

- TO MURCHISON: "I TRUST I SHALL MAKE MY SKETCH OF THE PROGRESS OF GEOLOGY POPULAR. OLD [REV. JOHN] FLEMING IS FRIGHTENED AND THINKS THE AGE WILL NOT STAND MY ANTI-MOSAICAL CONCLUSIONS AND AT LEAST THAT THE SUBJECT WILL FOR A TIME BECOME UNPOPULAR AND AWKWARD FOR THE CLERGY, BUT I AM NOT AFRAID. I SHALL OUT WITH THE WHOLE BUT IN AS CONCILIATORY A MANNER AS POSSIBLE."
- TO SCROPE: "I AM SURE YOU MAY GET INTO Q.R. [QUARTERLY REVIEW] WHAT WILL FREE THE SCIENCE FROM MOSES, FOR IF TREATED SERIOUSLY, THE [CHURCH] PARTY ARE QUITE PREPARED FOR IT. A BISHOP, BUCKLAND ASCERTAINED (WE SUPPOSE [BISHOP] SUMNER), GAVE URE A DRESSING IN THE BRITISH CRITIC AND THEOLOGICAL REVIEW. THEY SEE AT LAST THE MISCHIEF AND SCANDAL BROUGHT ON THEM BY MOSAIC SYSTEMS PROBABLY THERE WAS A BEGINNING—IT IS A METAPHYSICAL QUESTION, WORTHY OF A THEOLOGIAN—PROBABLY THERE WILL BE AN END."

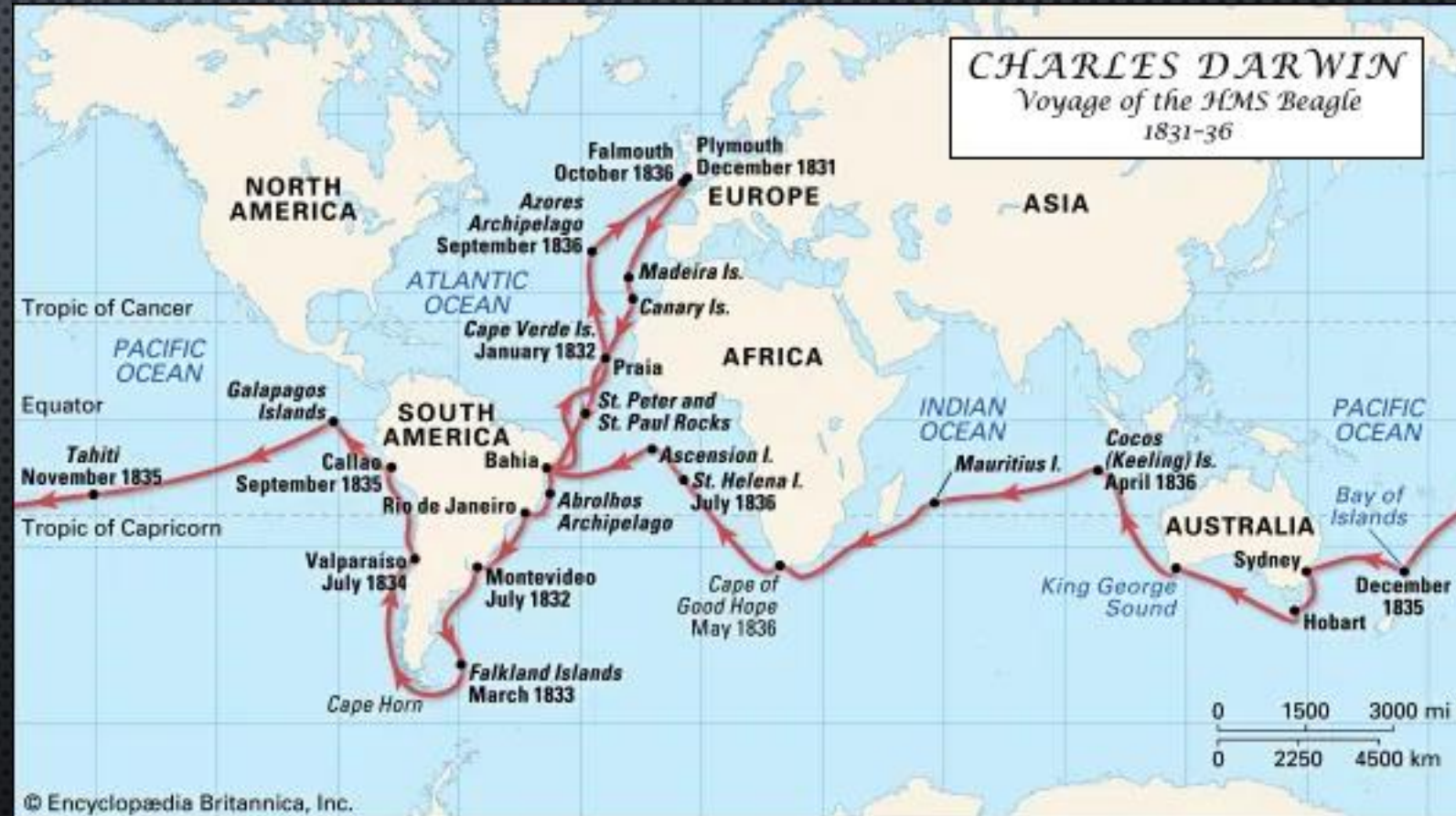
CHARLES DARWIN (1809-1882)

- NATURALIST, BIOLOGIST, GEOLOGIST
- SOCIALLY ELITE
- EDUCATION
 - U OF EDINBURGH (MEDICINE, GEOLOGY, CHEMISTRY, BIOLOGY)
 - CAMBRIDGE (ANGLICAN THEOLOGY, BOTANY)



DARWIN'S *HMS BEAGLE* VOYAGE (1831-1836)

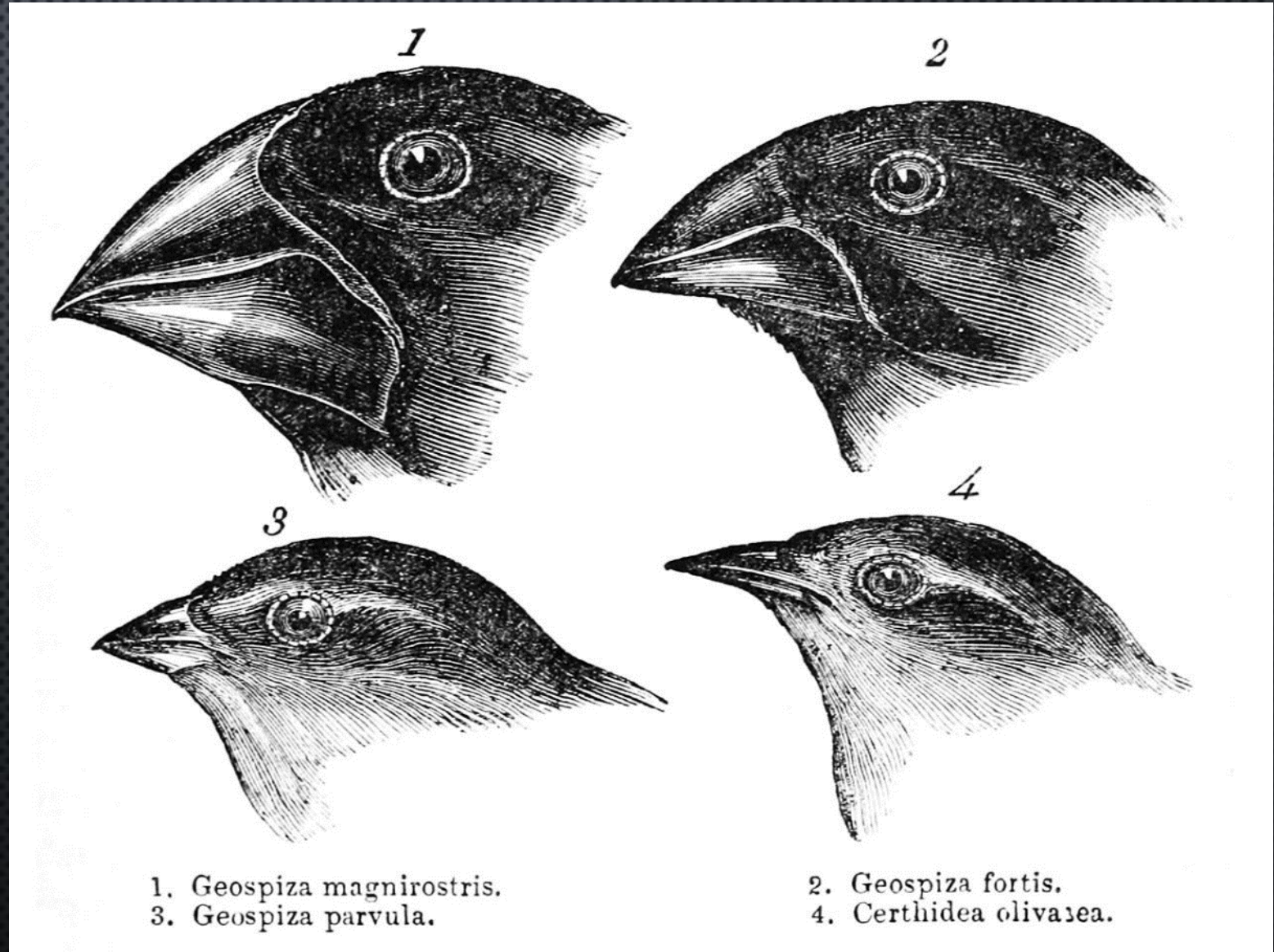
- 22 YEARS OLD
- TAKEN TO BE A "COMPANION" FOR CAPTAIN FITZ-ROY
- TOOK *PRINCIPLES OF GEOLOGY* WITH HIM



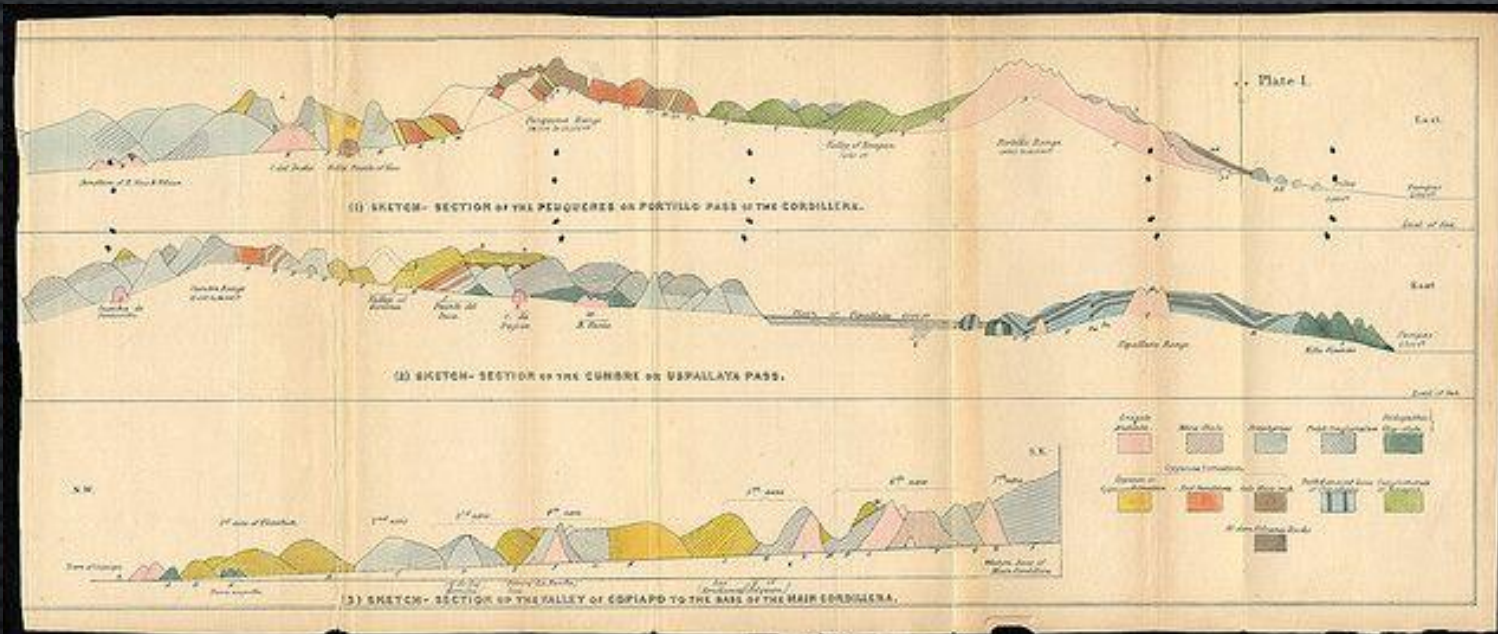
DARWIN'S NEW IDEA: NATURAL SELECTION

Darwin's finches or the Galapagos finches.

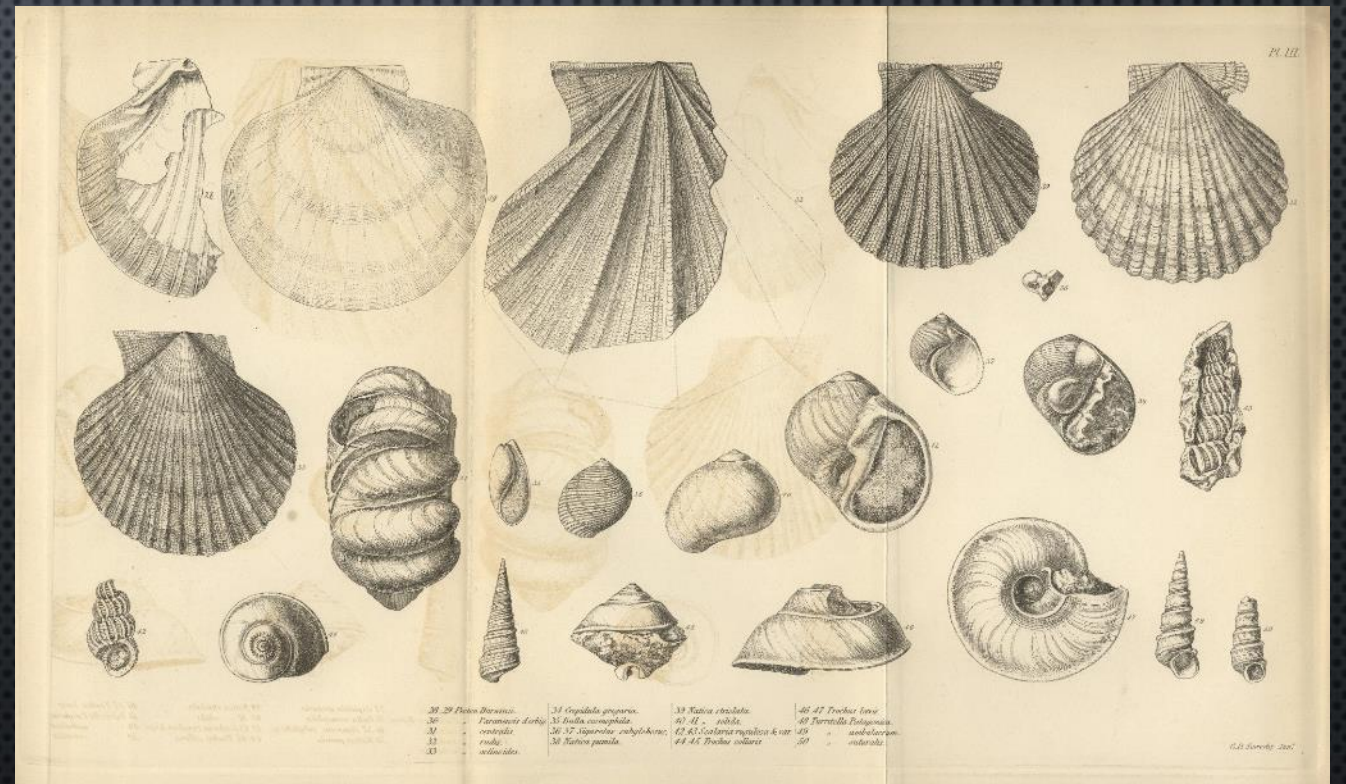
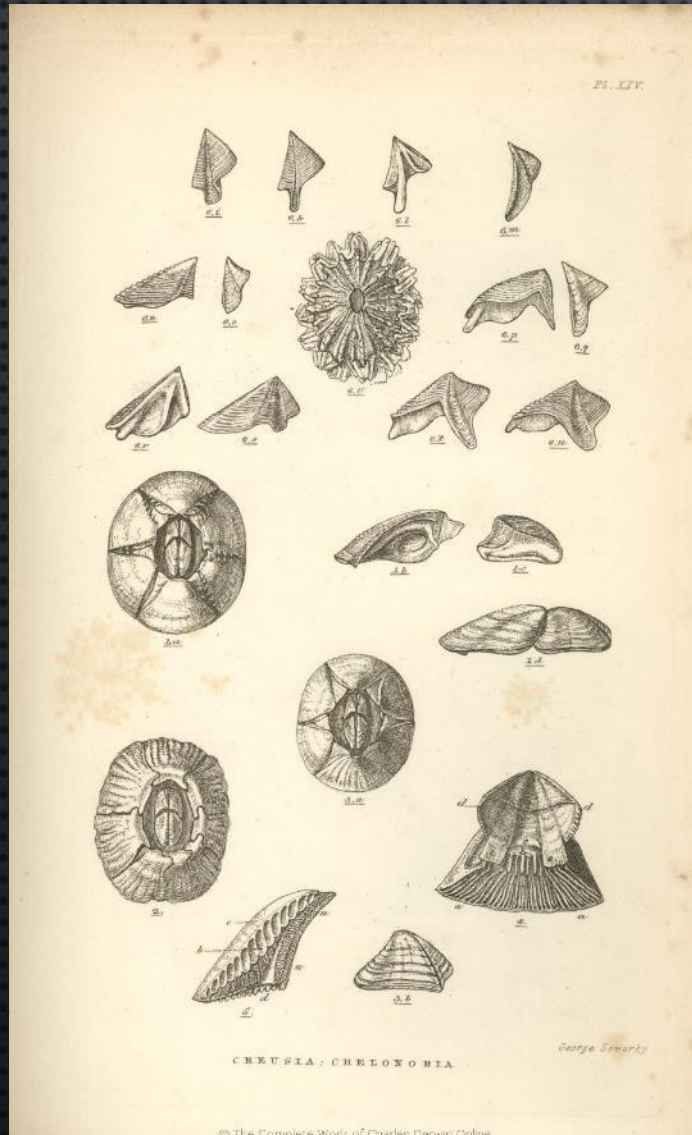
1845. *Journal of researches into the natural history and geology of the countries visited during the voyage of H.M.S. Beagle round the world, under the Command of Capt. Fitz Roy*, 2d ed.



DARWIN'S GEOLOGICAL MAP OF SOUTH AMERICA (1851 & 1846)



DARWIN'S PALEONTOLOGY OF SOUTH AMERICA (1846)



DARWIN'S BOOKS

- 1839: JOURNAL AND REMARKS (THE VOYAGE OF THE BEAGLE)
- 1842: THE STRUCTURE AND DISTRIBUTION OF CORAL REEFS
- 1844: GEOLOGICAL OBSERVATIONS ON THE VOLCANIC ISLANDS VISITED DURING THE VOYAGE OF H.M.S. BEAGLE
- 1846: GEOLOGICAL OBSERVATIONS ON SOUTH AMERICA
- 1851: A MONOGRAPH OF THE SUB-CLASS CIRRIPIEDIA
- 1859: ON THE ORIGIN OF SPECIES BY MEANS OF NATURAL SELECTION, OR THE PRESERVATION OF FAVOURED RACES IN THE STRUGGLE FOR LIFE
- 1871: THE DESCENT OF MAN, AND SELECTION IN RELATION TO SEX
- 1872: THE EXPRESSION OF THE EMOTIONS IN MAN AND ANIMALS
- 1875: INSECTIVOROUS PLANTS
- 1881: THE FORMATION OF VEGETABLE MOULD THROUGH THE ACTION OF WORMS

ON
THE ORIGIN OF SPECIES

BY MEANS OF NATURAL SELECTION,

OR THE
PRESERVATION OF FAVOURED RACES IN THE STRUGGLE
FOR LIFE.

By CHARLES DARWIN, M.A.,

FELLOW OF THE ROYAL, GEOLOGICAL, LINNEAN, ETC., SOCIETIES;
AUTHOR OF 'JOURNAL OF RESEARCHES DURING H. M. S. BEAGLE'S VOYAGE
ROUND THE WORLD.'

LONDON:
JOHN MURRAY, ALBEMARLE STREET.
1859.

The right of Translation is reserved.

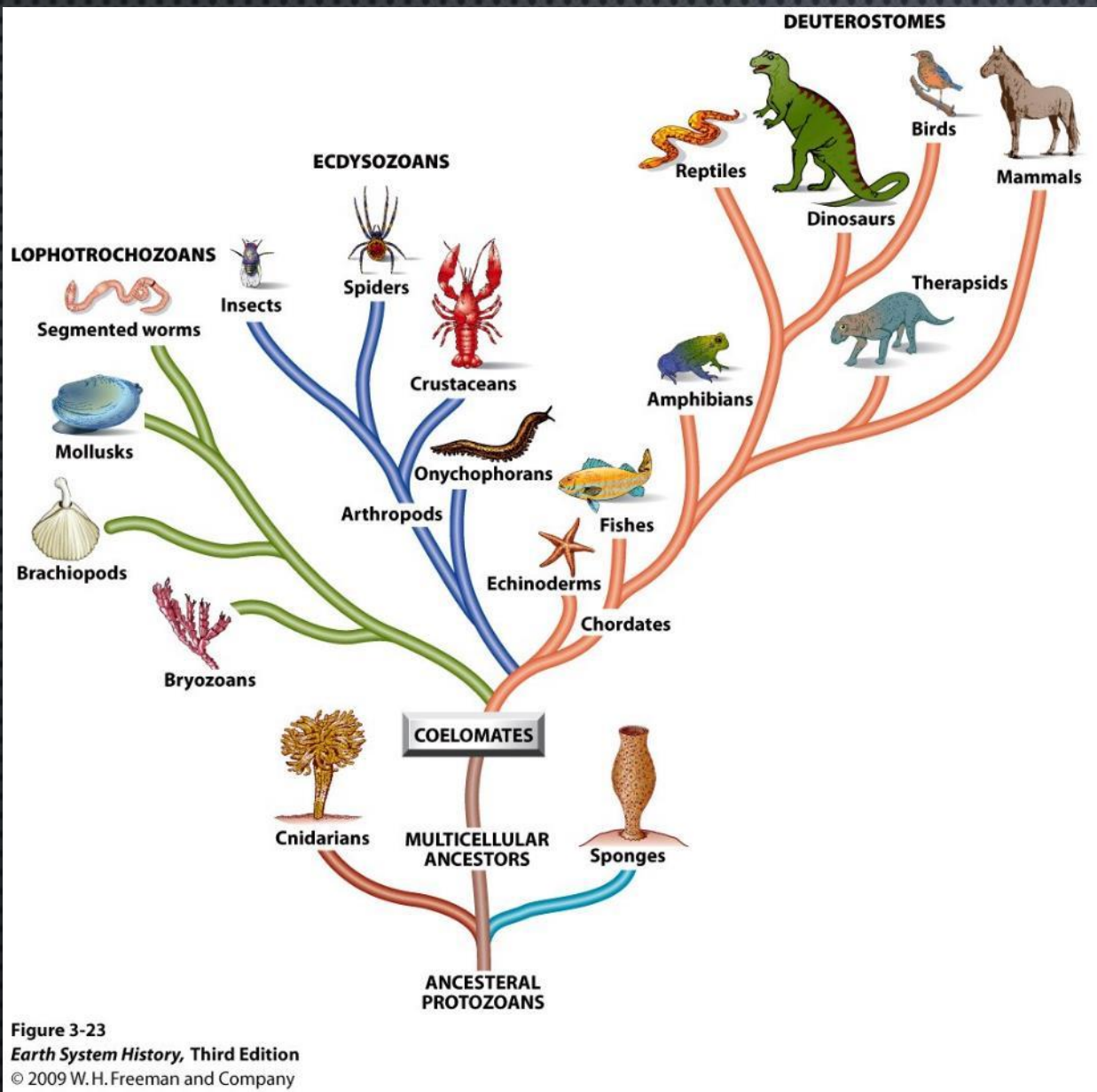
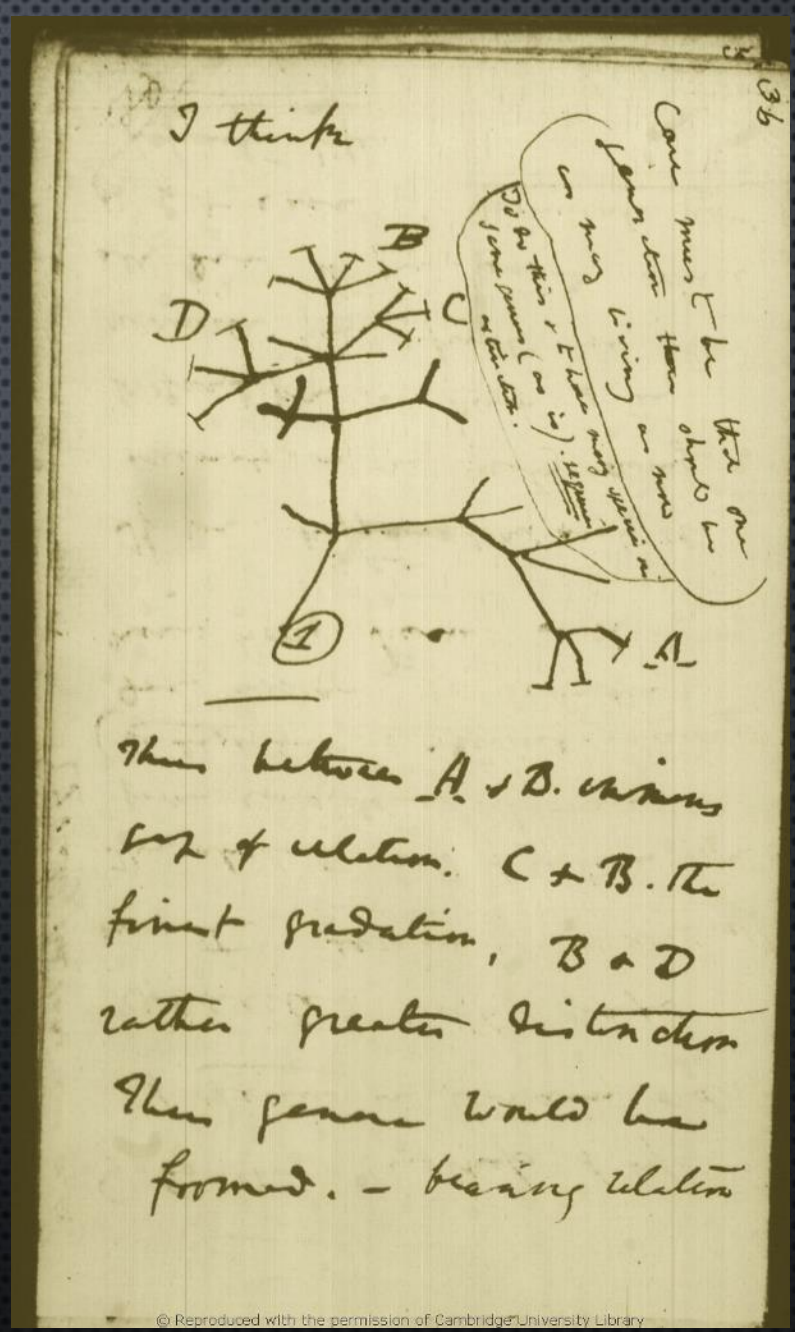


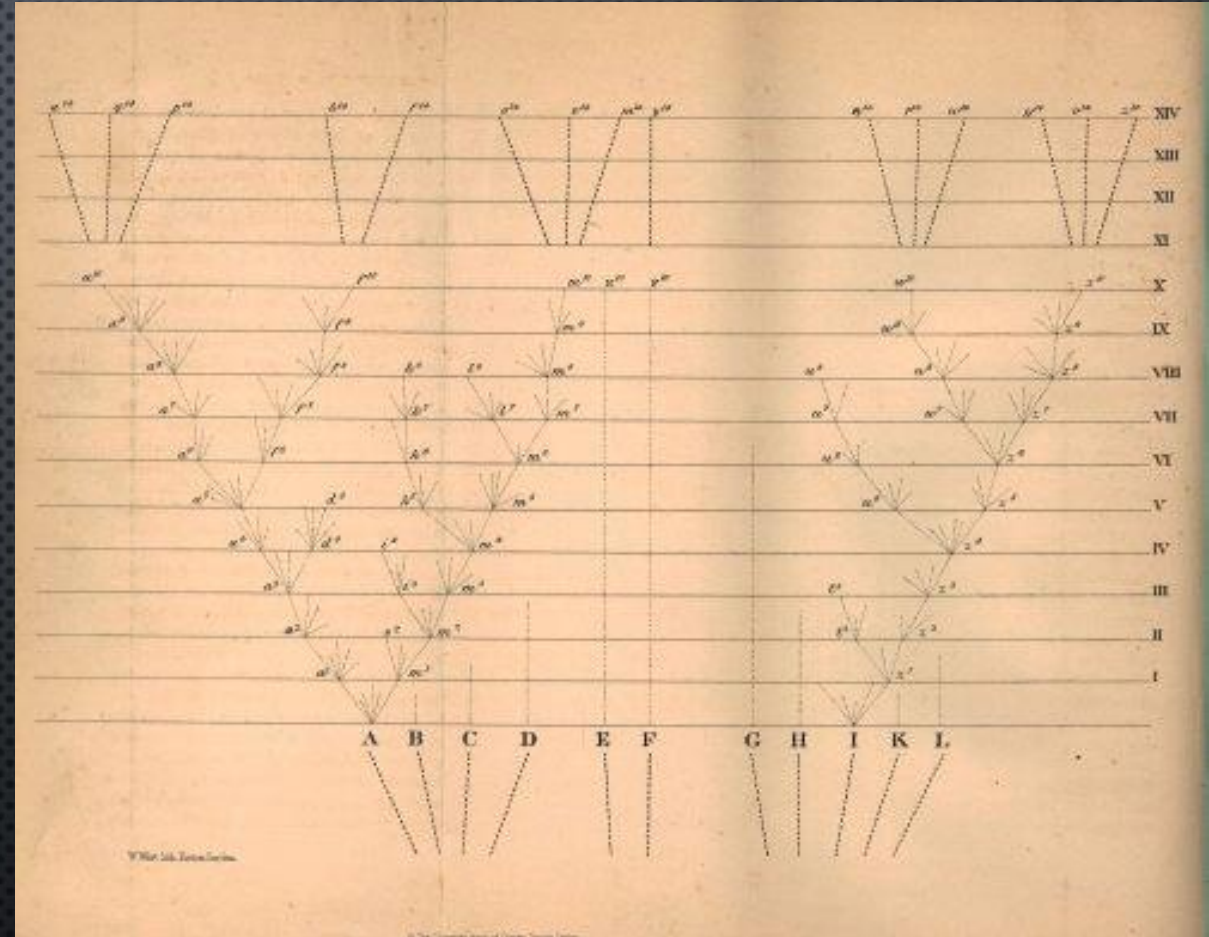
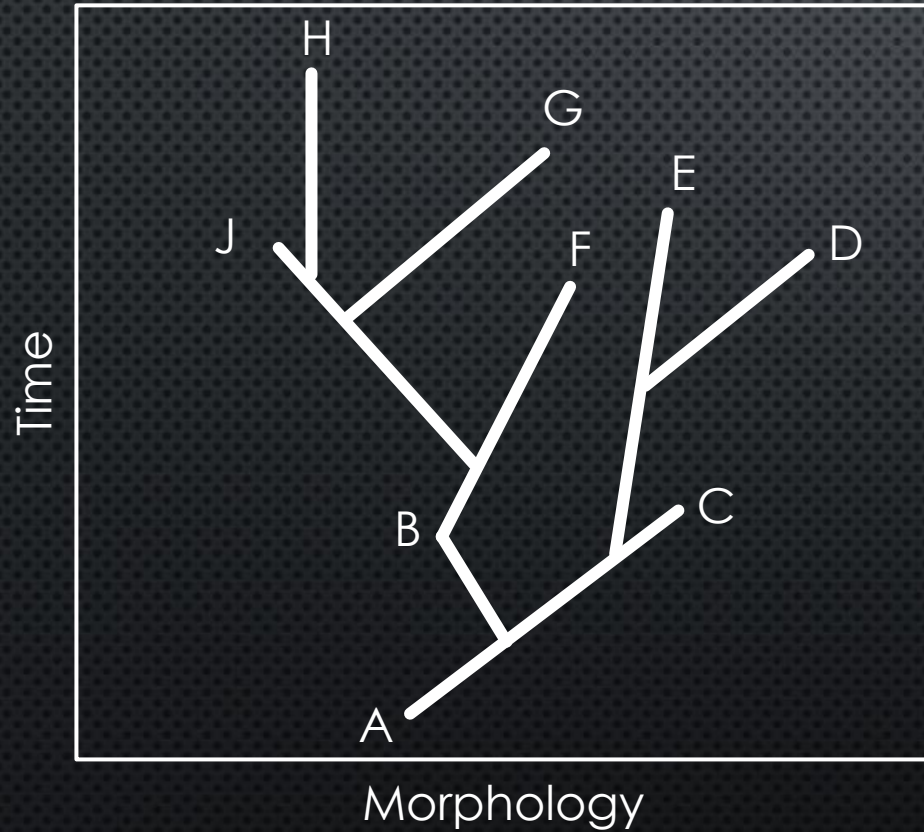
Figure 3-23
 Earth System History, Third Edition
 © 2009 W.H. Freeman and Company



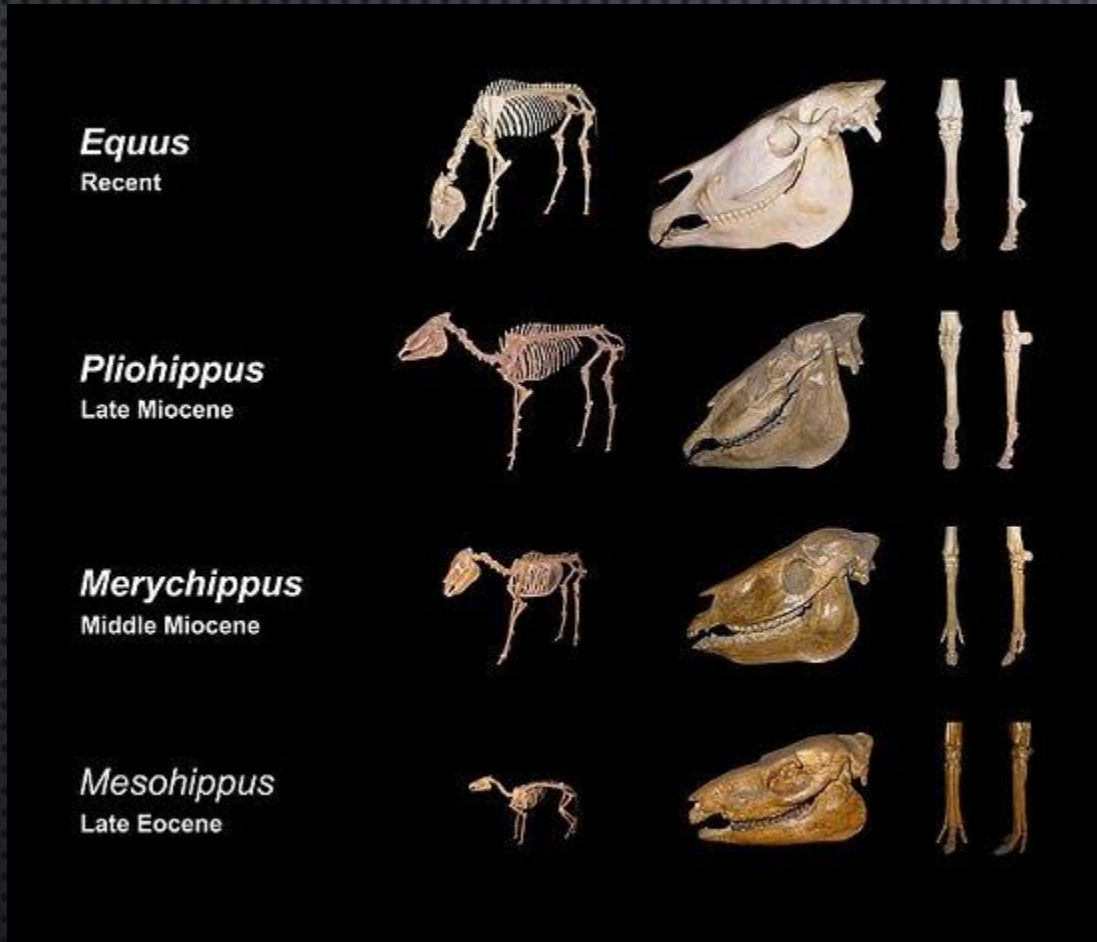
Darwin's "Red Notebook B", 1837-1838

DARWIN'S NEW IDEA: NATURAL SELECTION & SLOW CHANGE

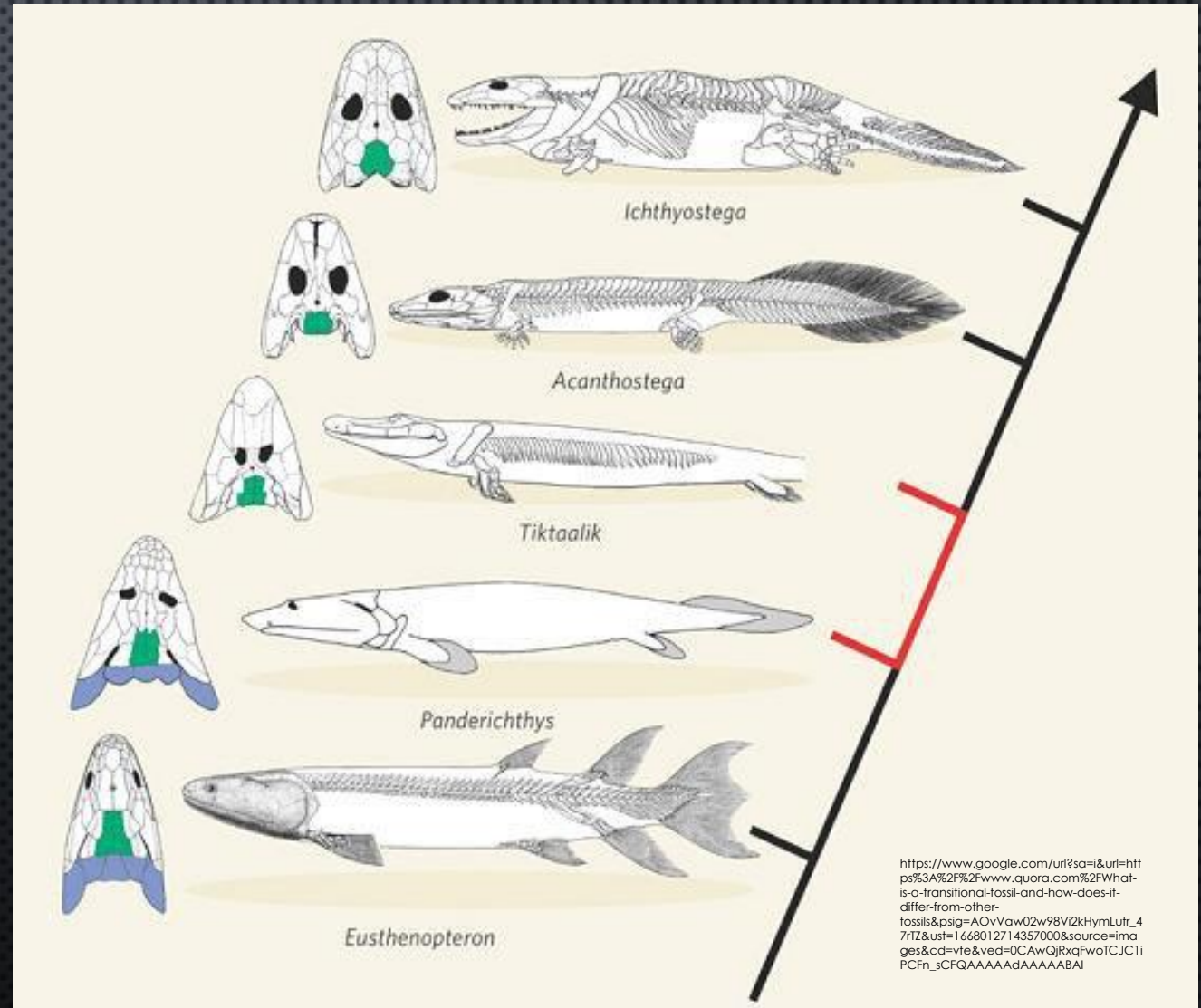
- PHYLETIC GRADUALISM: ONE SPECIES GRADUALLY CHANGES INTO ANOTHER OVER TIME



PHYLETIC GRADUALISM REQUIRES TRANSITIONAL FORMS



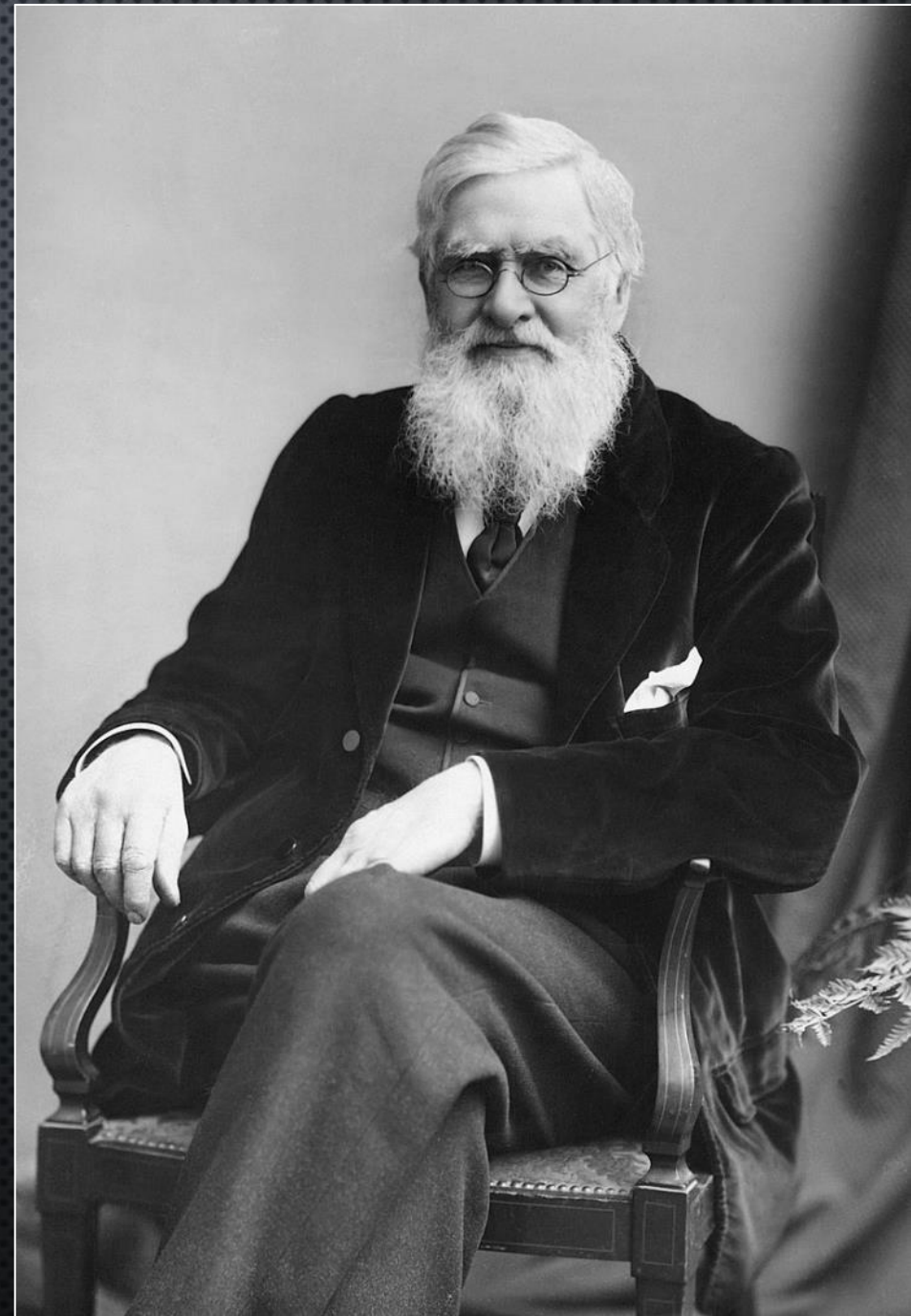
https://www.google.com/url?sa=i&url=https%3A%2F%2Fwww.quora.com%2FWhat-is-a-transitional-fossil&psig=AOvVaw02w98Vl2kHymLufR_47rTZ&ust=1668012714357000&source=images&cd=vfe&ved=0CAwQjRxaFwoTCJC1iPCFn_sCFQA AAAAAdAAAAABAN



https://www.google.com/url?sa=i&url=https%3A%2F%2Fwww.quora.com%2FWhat-is-a-transitional-fossil-and-how-does-it-differ-from-other-fossils&psig=AOvVaw02w98Vl2kHymLufR_47rTZ&ust=1668012714357000&source=images&cd=vfe&ved=0CAwQjRxaFwoTCJC1iPCFn_sCFQAAAAAdAAAAABAN

ALFRED RUSSELL WALLACE (1823-1913)

- BRITISH NATURALIST
- WORKED IN INDONESIA
- SUBMITTED MANUSCRIPT ON NATURAL SELECTION BEFORE DARWIN, LYELL UNFAIRLY “STALLED” THE PROCESS



II. IN DARWIN'S OWN WORDS— QUOTES FROM *THE ORIGIN*

DARWIN MADE PREDICTIONS AND RECOGNIZED PROBLEMS WITH HIS THEORY

“LONG BEFORE HAVING ARRIVED AT THIS PART OF MY WORK, A **CROWD OF DIFFICULTIES** WILL HAVE OCCURRED TO THE READER. SOME OF THEM ARE **SO GRAVE** THAT TO THIS DAY I CAN NEVER REFLECT ON THEM WITHOUT BEING STAGGERED; BUT, TO THE BEST OF MY JUDGMENT, THE GREATER NUMBER ARE ONLY APPARENT, AND THOSE THAT ARE REAL ARE NOT, I THINK, FATAL TO MY THEORY.”

ORIGIN OF SPECIES, 1859, p. 171.

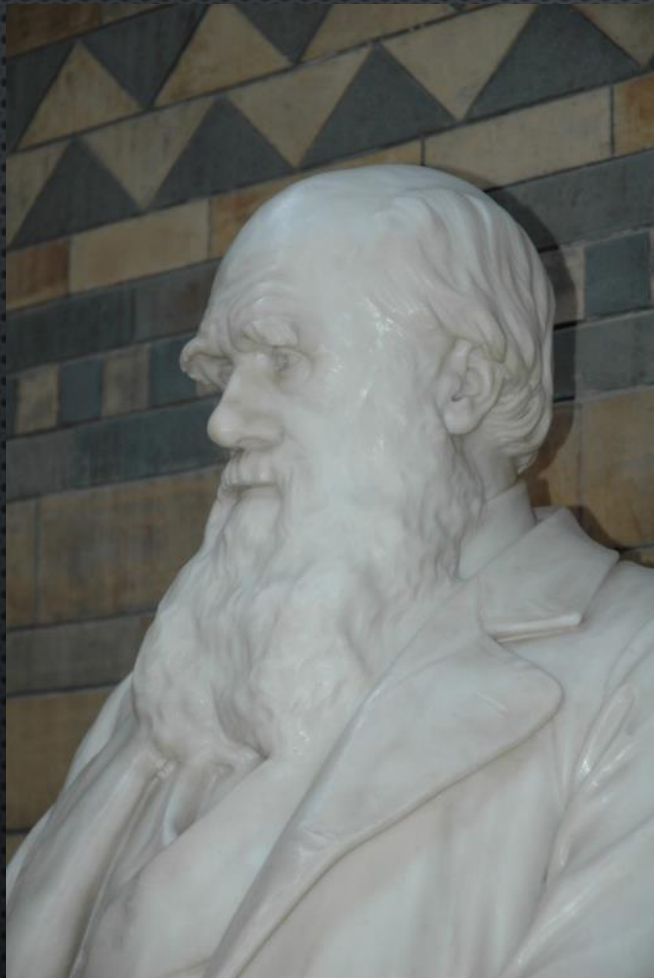
DARWIN ON TRANSITIONAL FOSSILS



“WHY THEN IS NOT EVERY GEOLOGICAL FORMATION AND EVERY STRATUM FULL OF SUCH INTERMEDIATE LINKS? GEOLOGY ASSUREDLY DOES NOT REVEAL ANY SUCH FINELY GRADUATED ORGANIC CHAIN; AND THIS, PERHAPS, IS THE MOST OBVIOUS AND GRAVEST OBJECTION WHICH CAN BE URGED AGAINST MY THEORY. THE EXPLANATION LIES, AS I BELIEVE, IN THE EXTREME IMPERFECTION OF THE GEOLOGICAL RECORD.”

ORIGIN OF SPECIES, 1859, p. 280 (CHAPTER 9, ON THE IMPERFECTION OF THE GEOLOGIC RECORD).

DARWIN ON TRANSITIONAL FOSSILS



“LASTLY, LOOKING NOT TO ANY ONE TIME, BUT TO ALL TIME, IF MY THEORY BE TRUE, **NUMBERLESS INTERMEDIATE VARIETIES, LINKING MOST CLOSELY ALL THE SPECIES OF THE SAME GROUP TOGETHER, MUST ASSUREDLY HAVE EXISTED...** CONSEQUENTLY EVIDENCE OF THEIR FORMER EXISTENCE COULD BE FOUND ONLY AMONGST FOSSIL REMAINS, WHICH ARE PRESERVED... IN AN EXTREMELY IMPERFECT AND INTERMITTENT RECORD.”

ORIGIN OF SPECIES, 1859, p. 179 (CHAPTER 6, DIFFICULTIES ON THEORY).

DARWIN ON THE SUDDEN APPEARANCE OF CLOSELY RELATED SPECIES

ON THE SUDDEN APPEARANCE OF GROUPS OF ALLIED SPECIES IN THE LOWEST KNOWN FOSSILIFEROUS STRATA.— “THERE IS ANOTHER AND ALLIED DIFFICULTY, WHICH IS MUCH GRAVER. I ALLUDE TO THE MANNER IN WHICH NUMBERS OF SPECIES OF THE SAME GROUP, SUDDENLY APPEAR IN THE LOWEST KNOWN FOSSILIFEROUS ROCKS. MOST OF THE ARGUMENTS WHICH HAVE CONVINCED ME THAT ALL THE EXISTING SPECIES OF THE SAME GROUP HAVE DESCENDED FROM ONE PROGENITOR, APPLY WITH NEARLY EQUAL FORCE TO THE EARLIEST KNOWN SPECIES. FOR INSTANCE, I CANNOT DOUBT THAT ALL THE SILURIAN TRILOBITES HAVE DESCENDED FROM SOME ONE CRUSTACEAN, WHICH MUST HAVE LIVED LONG BEFORE THE SILURIAN AGE, AND WHICH PROBABLY DIFFERED GREATLY FROM ANY KNOWN ANIMAL.”

ORIGIN OF SPECIES, 1859, p. 306 (CHAPTER 9, ON THE IMPERFECTION OF THE GEOLOGICAL RECORD).



In a search of the Paleobiology database (March 2009), I found 160 different species of trilobites listed as having first appearances of 530 Ma (this is when trilobites are first recorded in the geologic record).

Darwin predicted that something like this would be problematic to his theory.

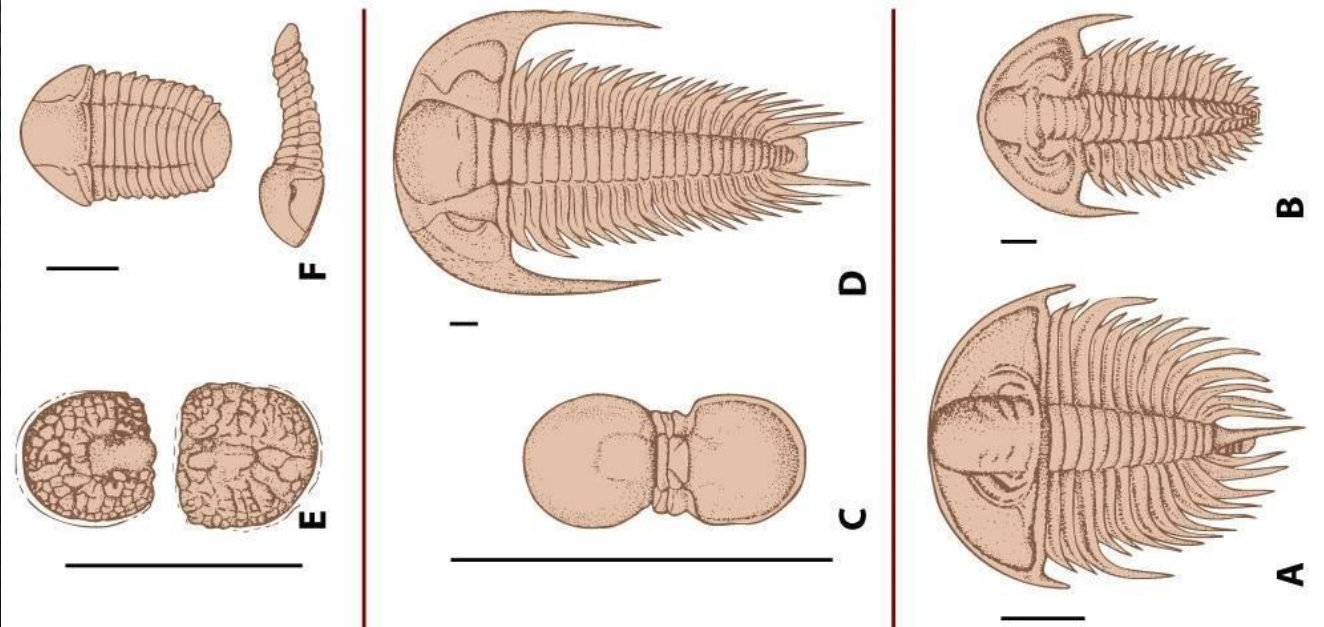


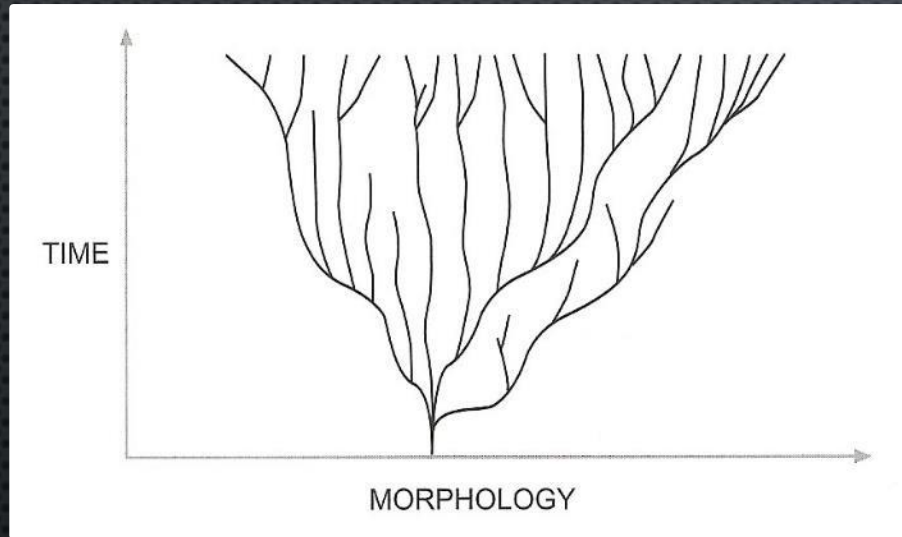
Figure 3-30
Earth System History, Third Edition
© 2009 W. H. Freeman and Company

PROBLEM: SUDDEN APPEARANCE OF MULTIPLE PHYLA WITHIN THE SAME LAYERS (THE CAMBRIAN EXPLOSION)

ON THE SUDDEN APPEARANCE OF WHOLE GROUPS OF ALLIED SPECIES.— “THE ABRUPT MANNER IN WHICH WHOLE GROUPS OF SPECIES SUDDENLY APPEAR IN CERTAIN FORMATIONS, HAS BEEN URGED BY SEVERAL PALAEOONTOLOGISTS, FOR INSTANCE, BY AGASSIZ, PICTET, AND BY NONE MORE FORCIBLY THAN BY PROFESSOR SEDGWICK, AS A FATAL OBJECTION TO THE BELIEF IN THE TRANSMUTATION OF SPECIES. **IF NUMEROUS SPECIES, BELONGING TO THE SAME GENERA OR FAMILIES, HAVE REALLY STARTED INTO LIFE ALL AT ONCE, THE FACT WOULD BE FATAL TO THE THEORY OF DESCENT WITH SLOW MODIFICATION THROUGH NATURAL SELECTION.** FOR THE DEVELOPMENT OF A GROUP OF FORMS, ALL OF WHICH HAVE DESCENDED FROM SOME ONE PROGENITOR, MUST HAVE BEEN AN EXTREMELY SLOW PROCESS ; AND THE PROGENITORS MUST HAVE LIVED LONG AGES BEFORE THEIR MODIFIED DESCENDANTS.”

THE PATTERN OF THE FOSSIL RECORD

Predicted



Actual

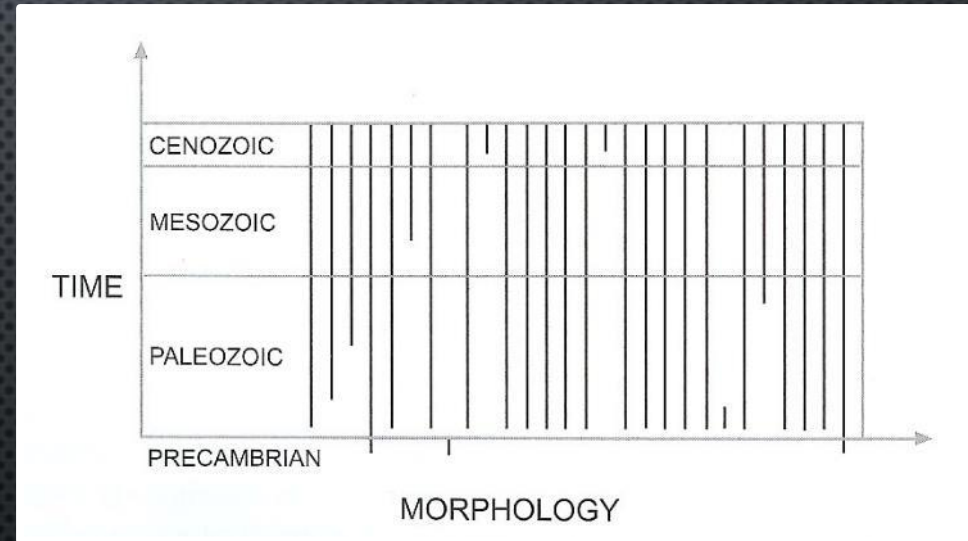
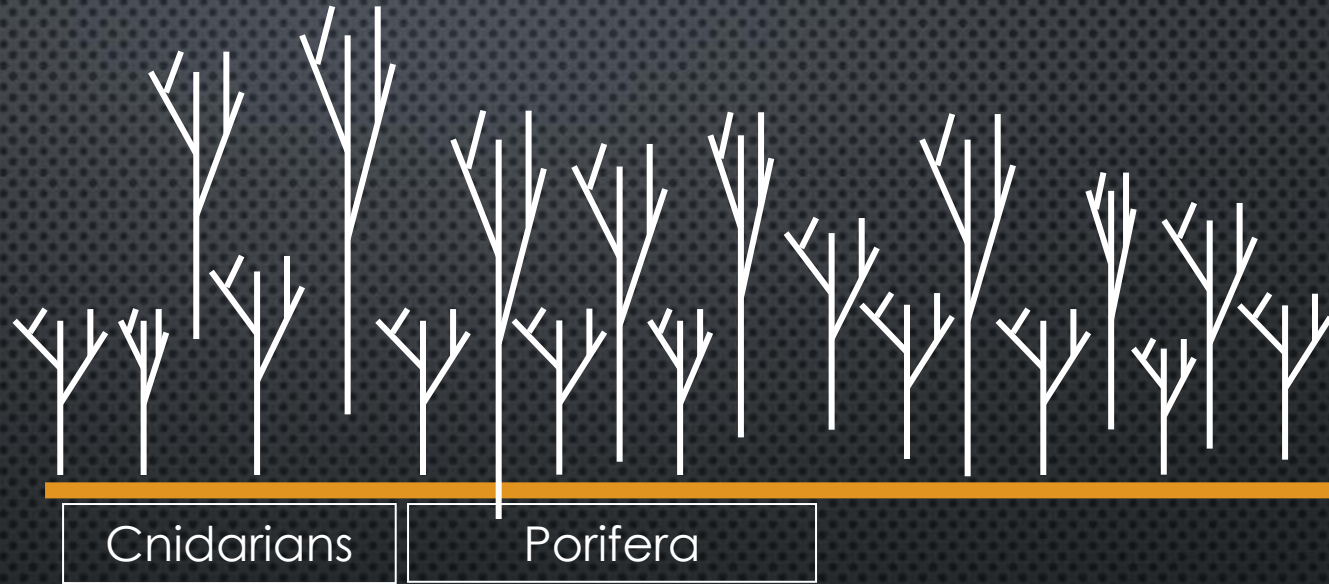


Figure 11 from Meyer et al., 2003, *The Cambrian Explosion: Biology's Big Bang*

THE CAMBRIAN EXPLOSION



The Cambrian



40
"bushes"!

("Ediacaran
fauna")

The Vendian



Algae

Bacteria

CONSEQUENTLY, IF MY THEORY BE TRUE, IT IS INDISPUTABLE THAT BEFORE THE LOWEST SILURIAN STRATUM WAS DEPOSITED, LONG PERIODS ELAPSED, AS LONG AS, OR PROBABLY FAR LONGER THAN, THE WHOLE INTERVAL FROM THE SILURIAN AGE TO THE PRESENT DAY; AND THAT DURING THESE VAST, YET QUITE UNKNOWN, PERIODS OF TIME, THE WORLD SWARMED WITH LIVING CREATURES.

TO THE QUESTION WHY WE DO NOT FIND RECORDS OF THESE VAST PRIMORDIAL PERIODS, I CAN GIVE NO SATISFACTORY ANSWER. SEVERAL OF THE MOST EMINENT GEOLOGISTS, WITH SIR R. MURCHISON AT THEIR HEAD, ARE CONVINCED THAT WE SEE IN THE ORGANIC REMAINS OF THE LOWEST SILURIAN STRATUM THE DAWN OF LIFE ON THIS PLANET. OTHER HIGHLY COMPETENT JUDGES, AS LYELL AND THE LATE E. FORBES, DISPUTE THIS CONCLUSION.

BUT THE DIFFICULTY OF UNDERSTANDING THE ABSENCE OF VAST PILES OF FOSSILIFEROUS STRATA, WHICH ON MY THEORY NO DOUBT WERE SOMEWHERE ACCUMULATED BEFORE THE SILURIAN EPOCH, IS VERY GREAT.

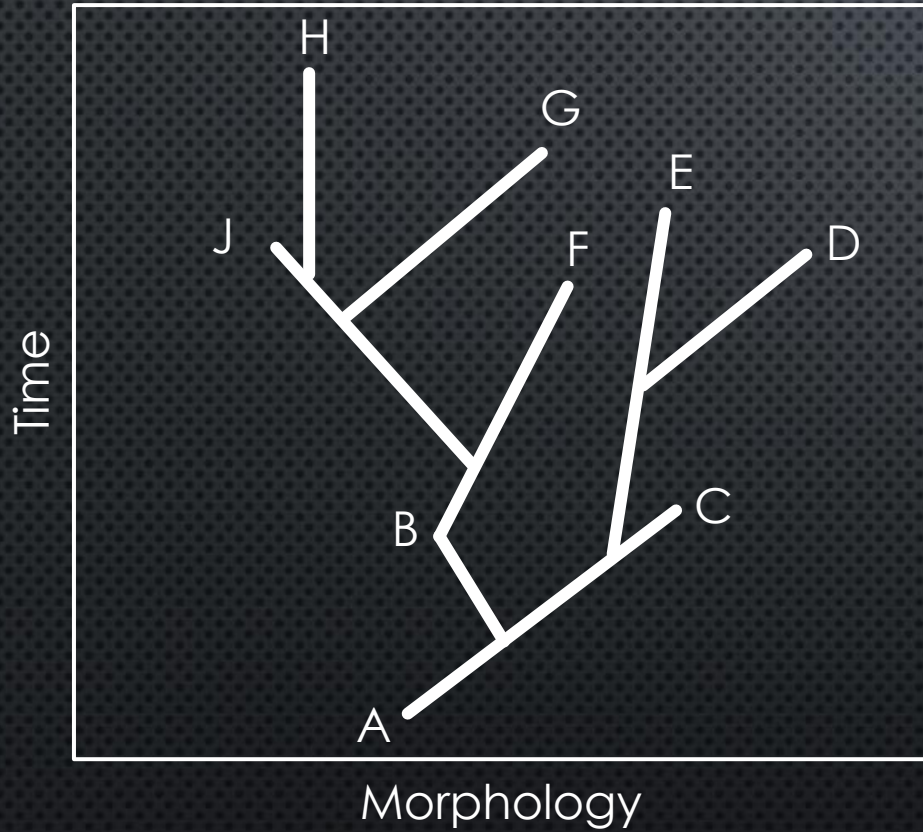
One of the **major unsolved problems of geology and evolution** is the occurrence of diversified, multicellular marine invertebrates in Lower Cambrian rocks on all the continents and their absence in rocks of greater age. These Early Cambrian fossils include porifera, coelenterates, brachiopods, mollusca, echinoids, and arthropods. In the Arthropoda are included the well-known trilobites, which were complexly organized, with well-differentiated head and tail, numerous thoracic parts, jointed legs, and -- like the later crustaceans-- a complex respiratory system. . . Their high degree of organization clearly indicates that a long period of evolution preceded their appearance in the record.

However, when we turn to examine the Precambrian rocks for the forerunners of these Early Cambrian fossils, they are nowhere to be found. Many thick (over 5,000 feet) sections of sedimentary rock are now known to lie in unbroken succession below strata containing the earliest Cambrian fossils. **These sediments apparently were suitable for the preservation of fossils because they often are identical with overlying rocks which are fossiliferous,** yet no fossils are found in them. Clearly, a significant but unrecorded chapter in the history of life is missing from the rocks of Precambrian time.

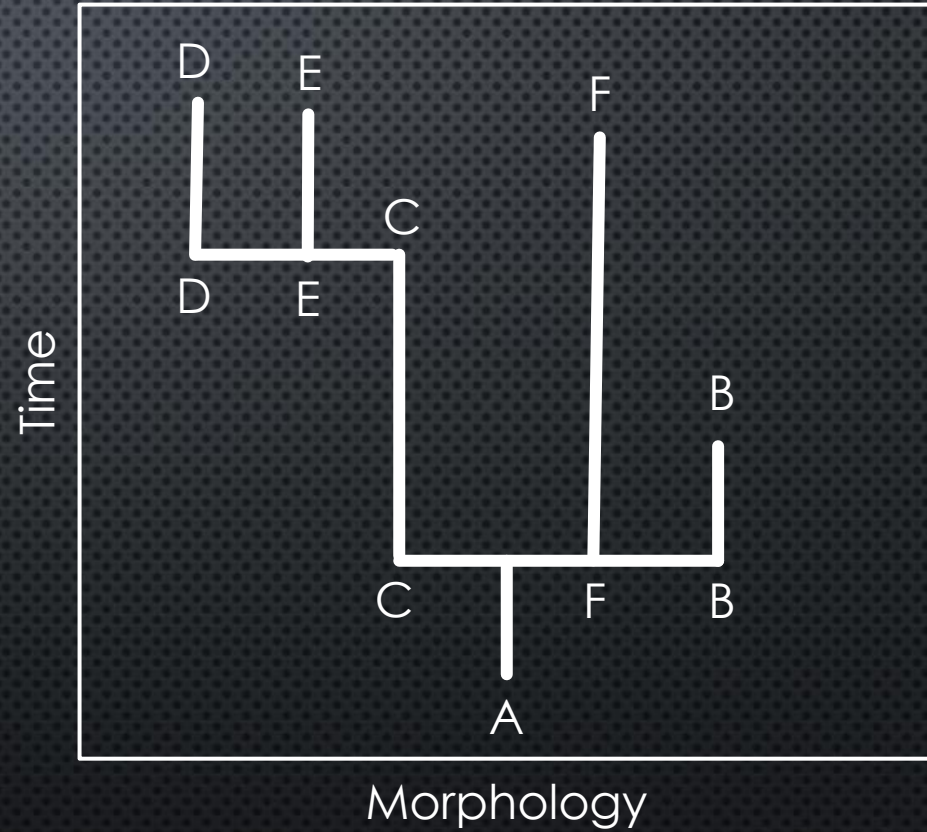
D.I. Axelrod, 1958. Early Cambrian Marine Fauna. *Science*, 128(3314): 7-9.

III. THE MODERN IDEA OF PUNCTUATED
EQUILIBRIA:
DOES IT SOLVE THE PROBLEM?

PUNCTUATED EQUILIBRIA



Phyletic Gradualism



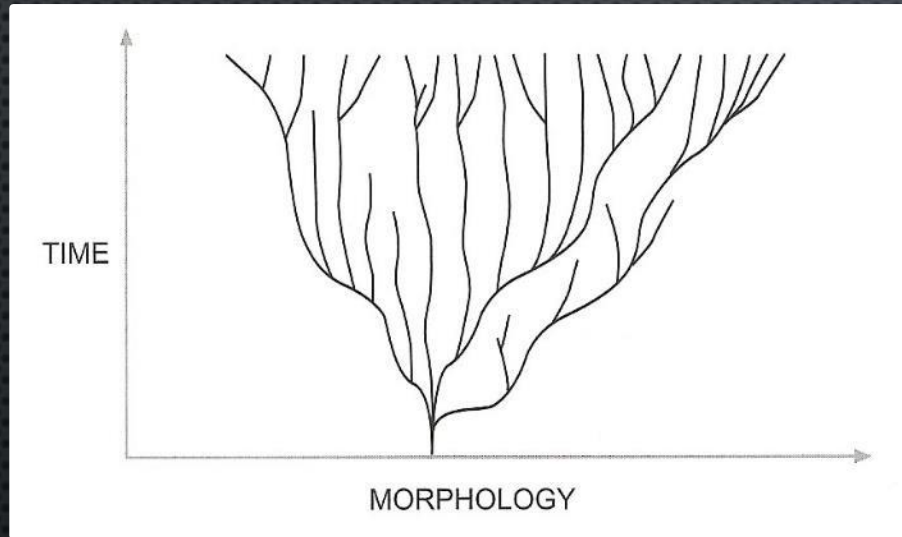
Punctuated Equilibria

THE IMPORTANCE OF LIVING FOSSILS

“LIVING FOSSILS” SHOW STASIS, NOT CHANGE

THE PATTERN OF THE FOSSIL RECORD

Predicted



Actual

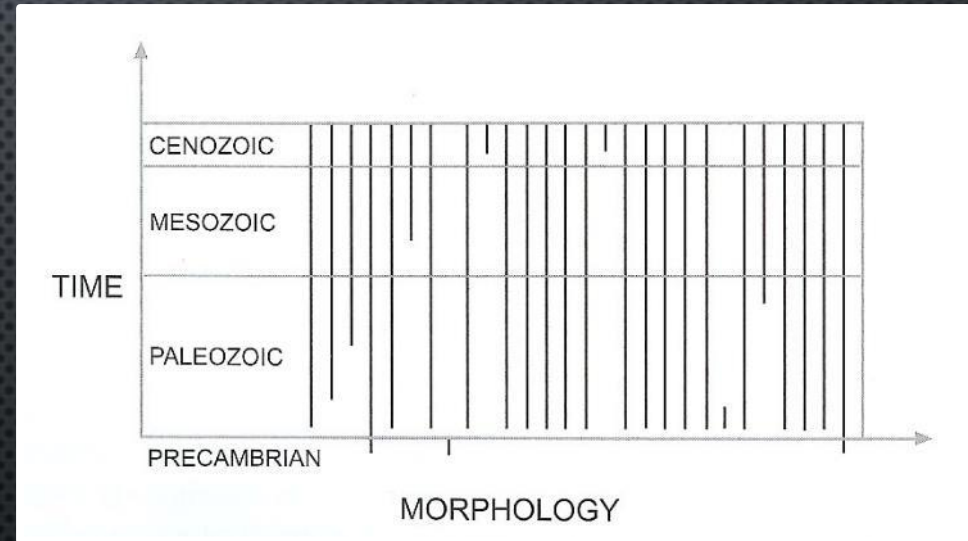
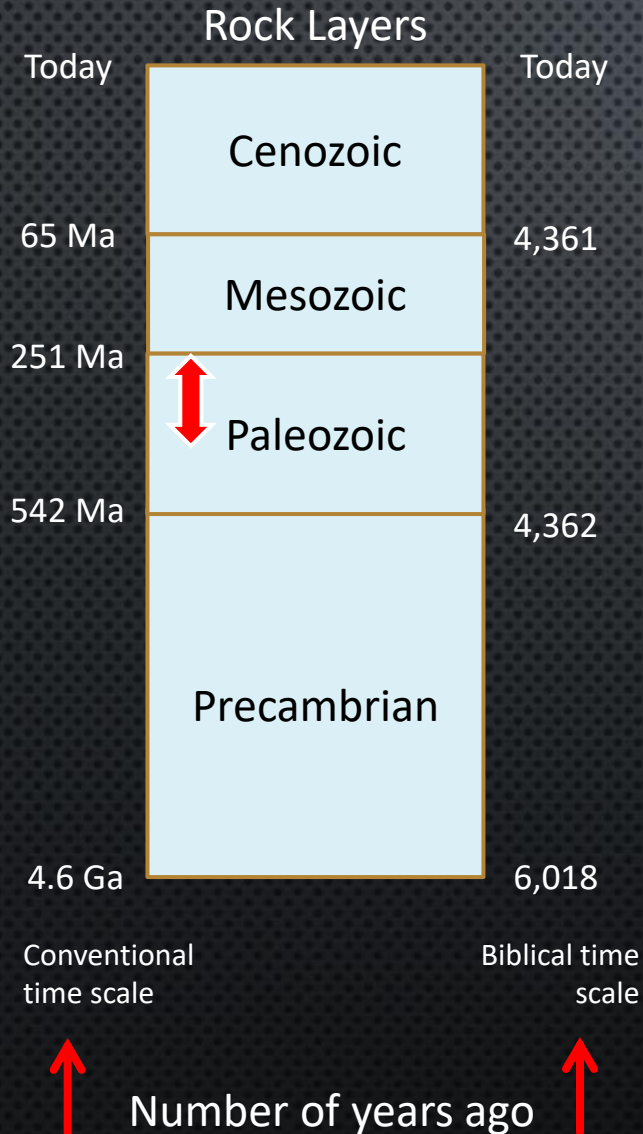


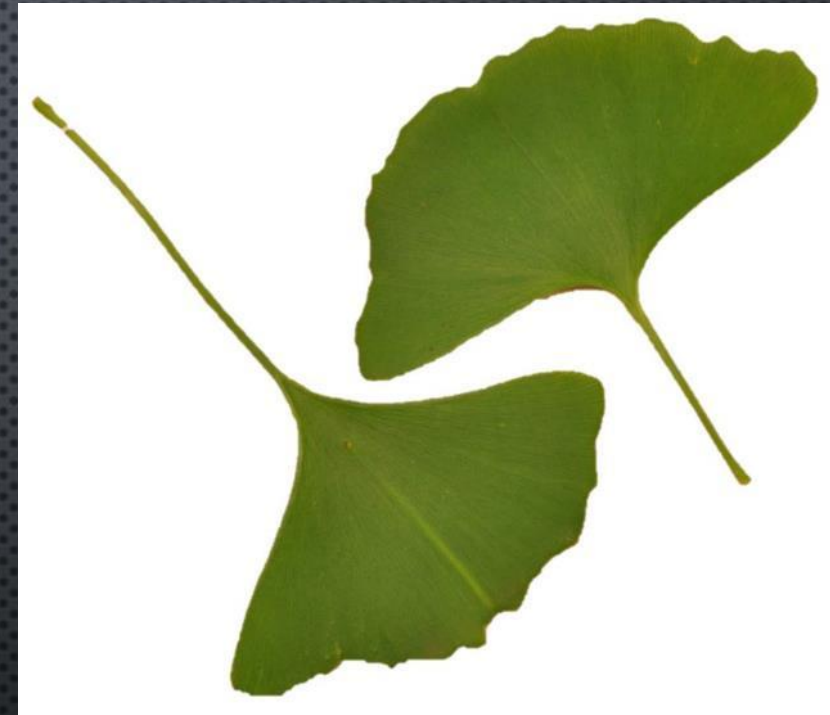
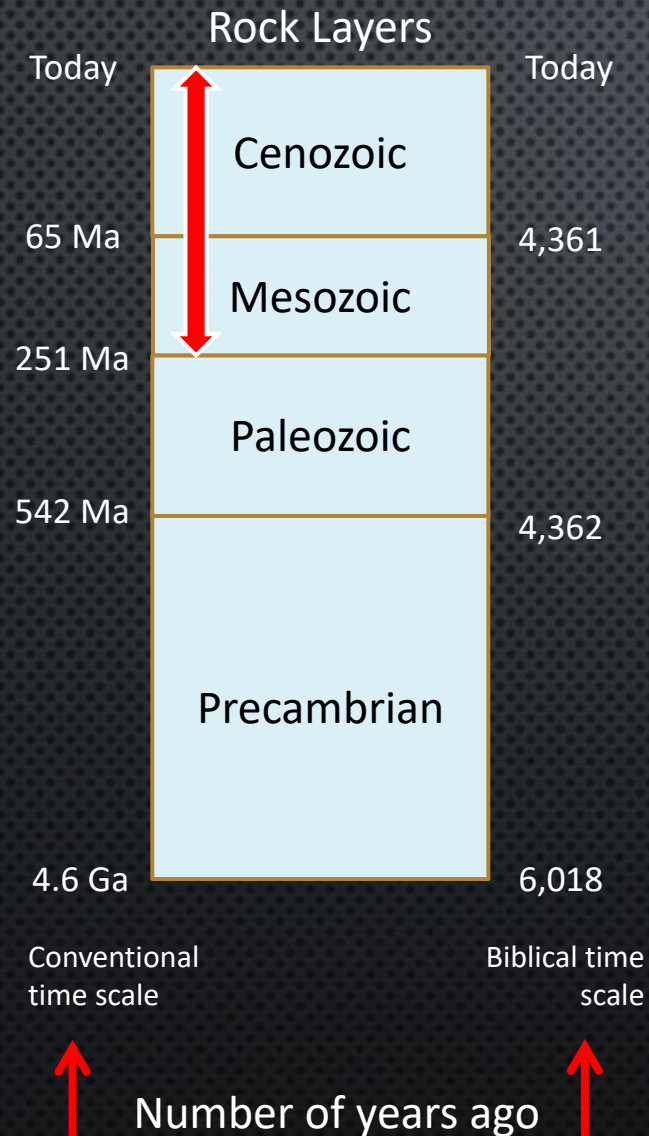
Figure 11 from Meyer et al., 2003, *The Cambrian Explosion: Biology's Big Bang*

EXAMPLES OF LIVING FOSSILS



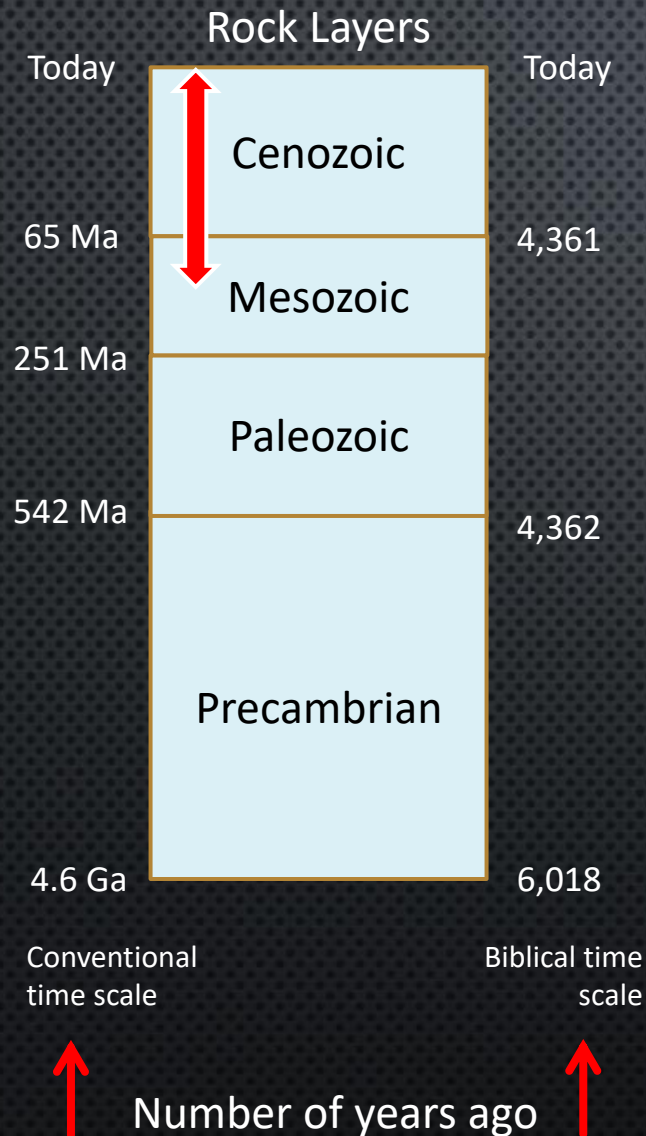
A preserved specimen of a coelacanth caught in the ocean. *Coelacanthus* has a range in the fossil record of 318-247 Ma.

EXAMPLES OF LIVING FOSSILS



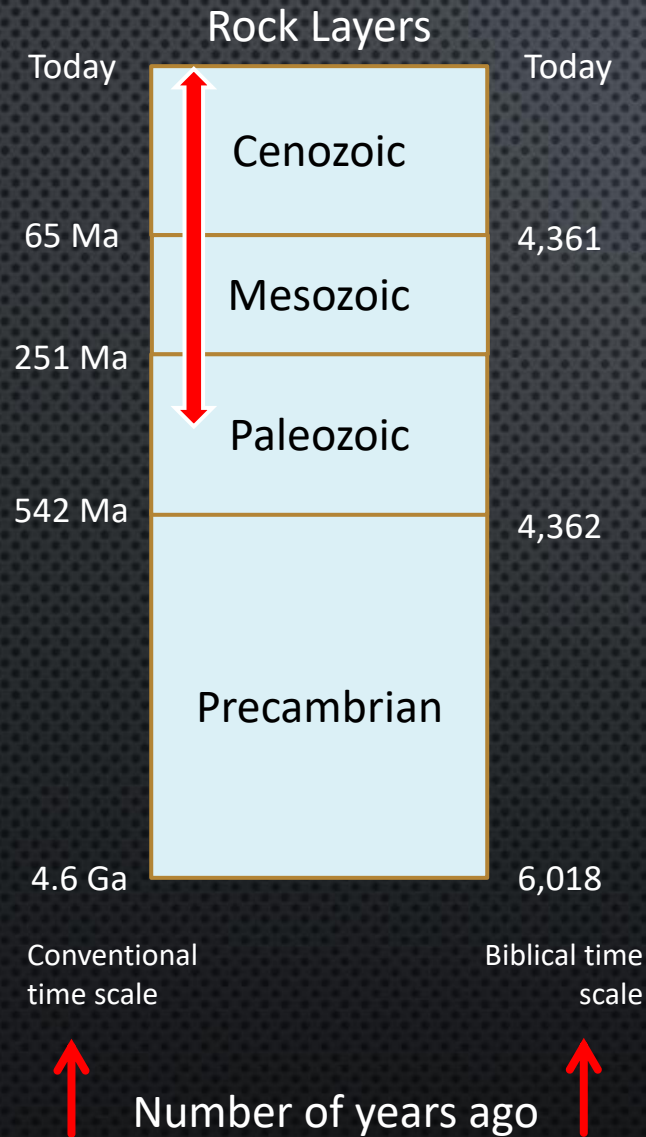
Ginkgo leaves collected from a living tree. *Ginkgo* has a range from 252-0 Ma.

EXAMPLES OF LIVING FOSSILS



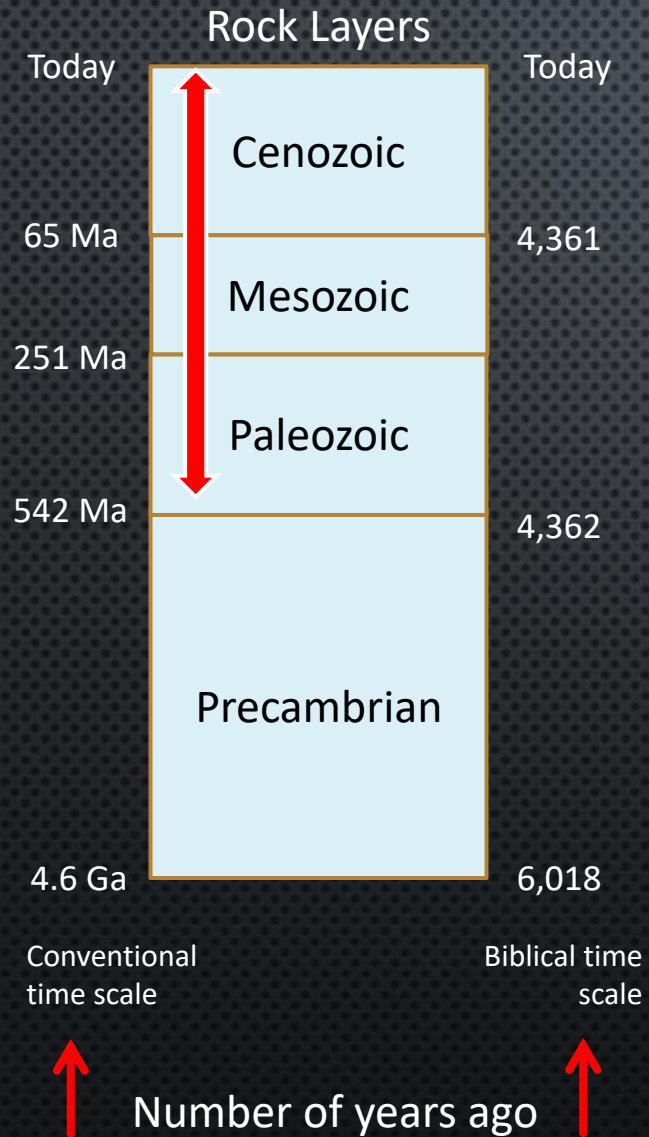
A living coast redwood or *Sequoia* tree.
Sequoia has a range of 151-0 Ma.

EXAMPLES OF LIVING FOSSILS



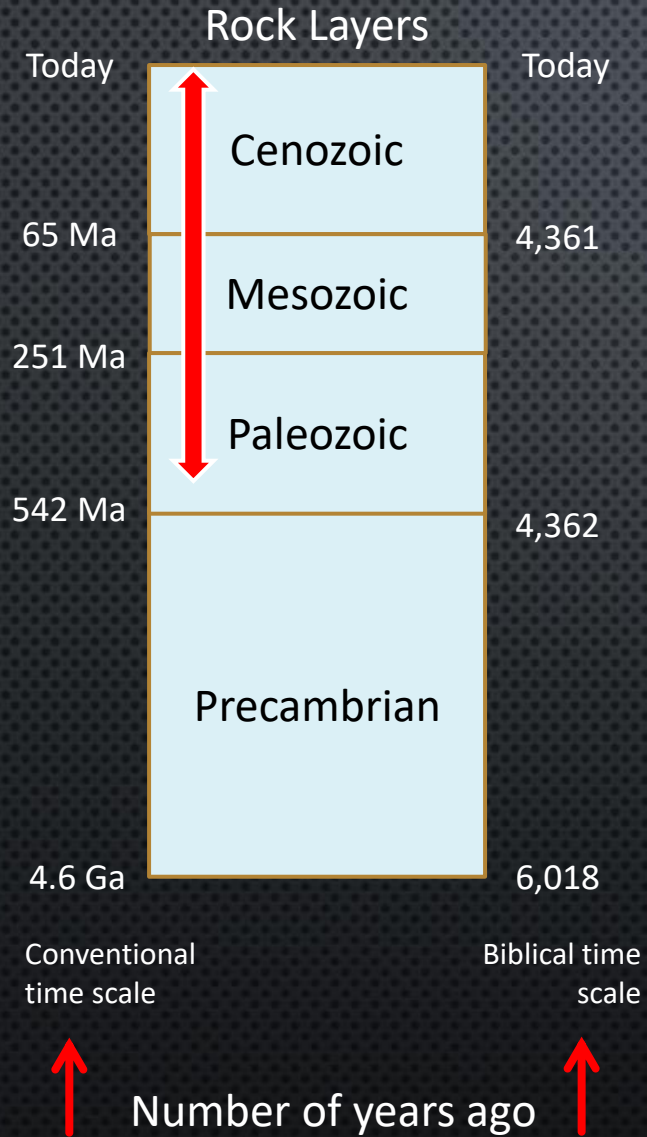
Horsetails or *Equisetum* has a range of 361-0 Ma.

EXAMPLES OF LIVING FOSSILS



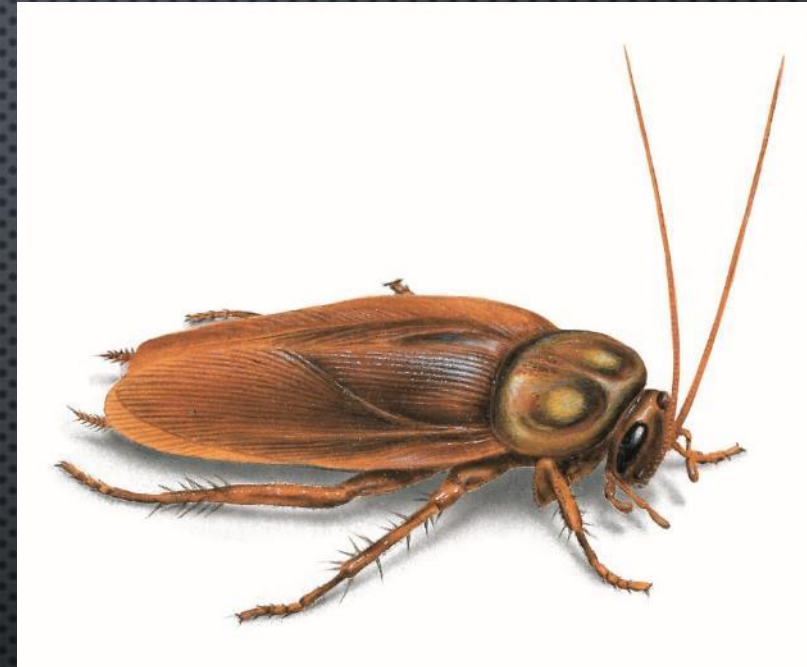
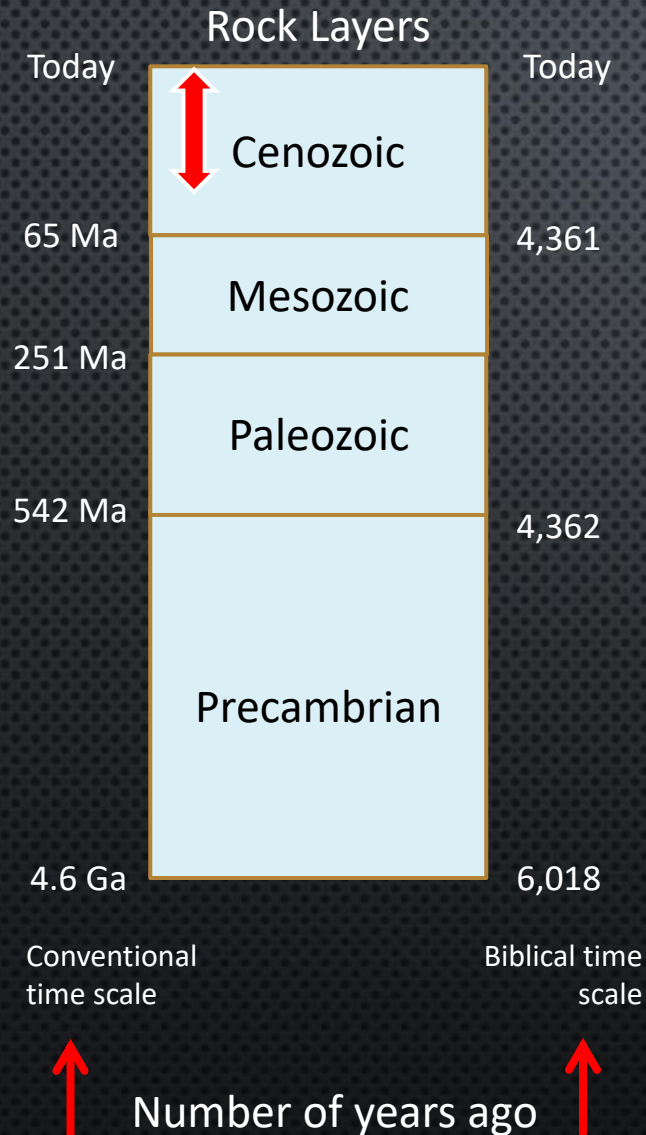
The brachiopod *Lingula* has a range of 513-0 Ma.

EXAMPLES OF LIVING FOSSILS



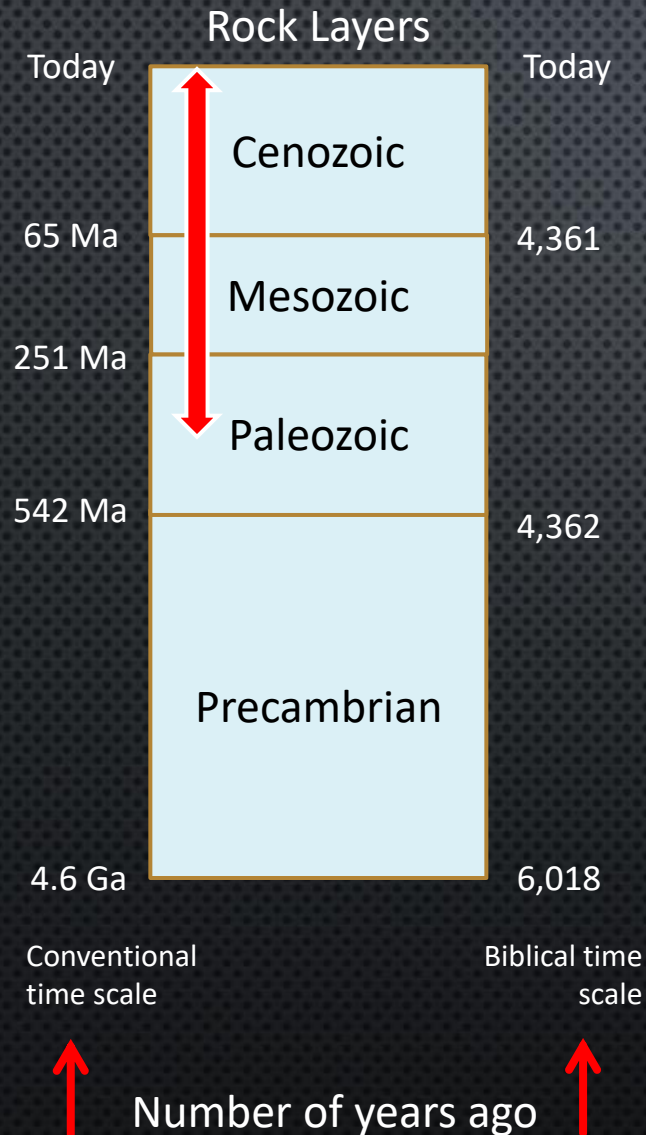
The annelid marine worm *Spirorbis* has a range of 488-0 Ma.

EXAMPLES OF LIVING FOSSILS



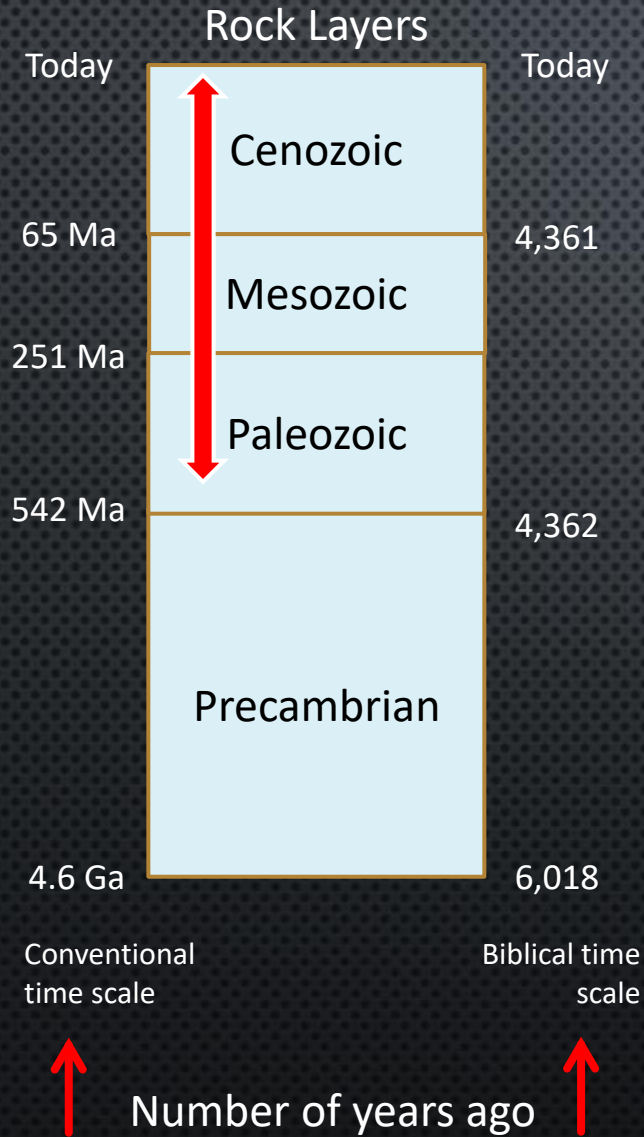
The cockroach *Periplaneta* has a range from 49-0 Ma.

EXAMPLES OF LIVING FOSSILS



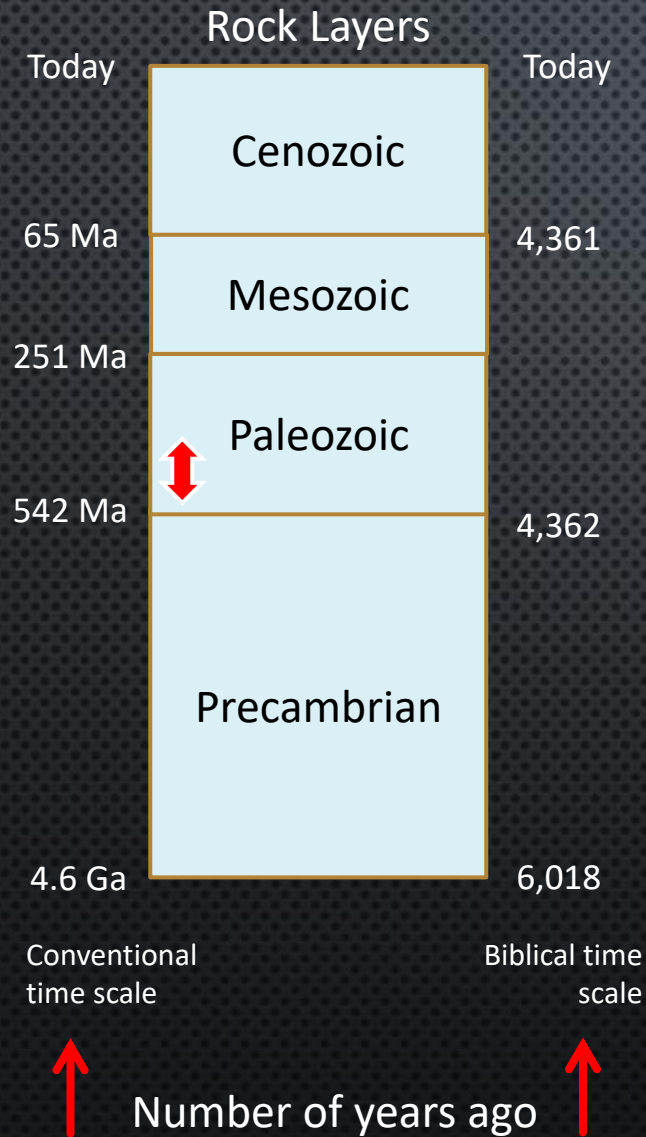
The chambered *Nautilus* has a range from 340-0 Ma

EXAMPLES OF LIVING FOSSILS



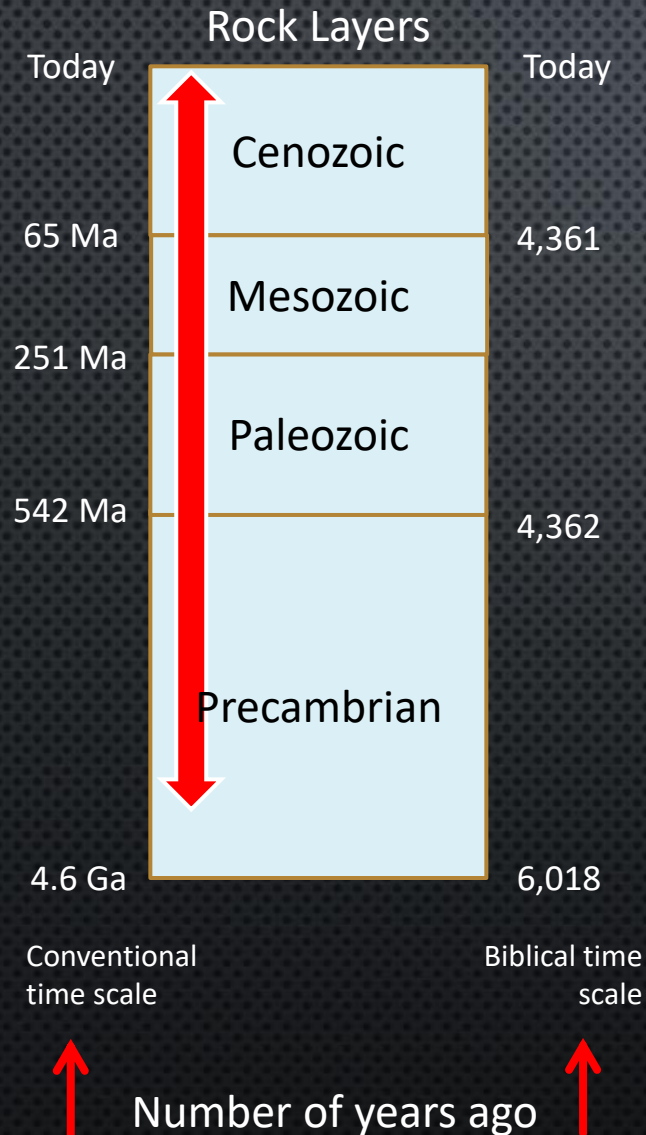
The sea mussel, *Mytilus*, has a range from 419-0 Ma.

EXAMPLES OF LIVING FOSSILS



The living horseshoe crab is very similar to *Limuloides*, a fossil horseshoe crab (419-416 Ma).

EXAMPLES OF LIVING FOSSILS



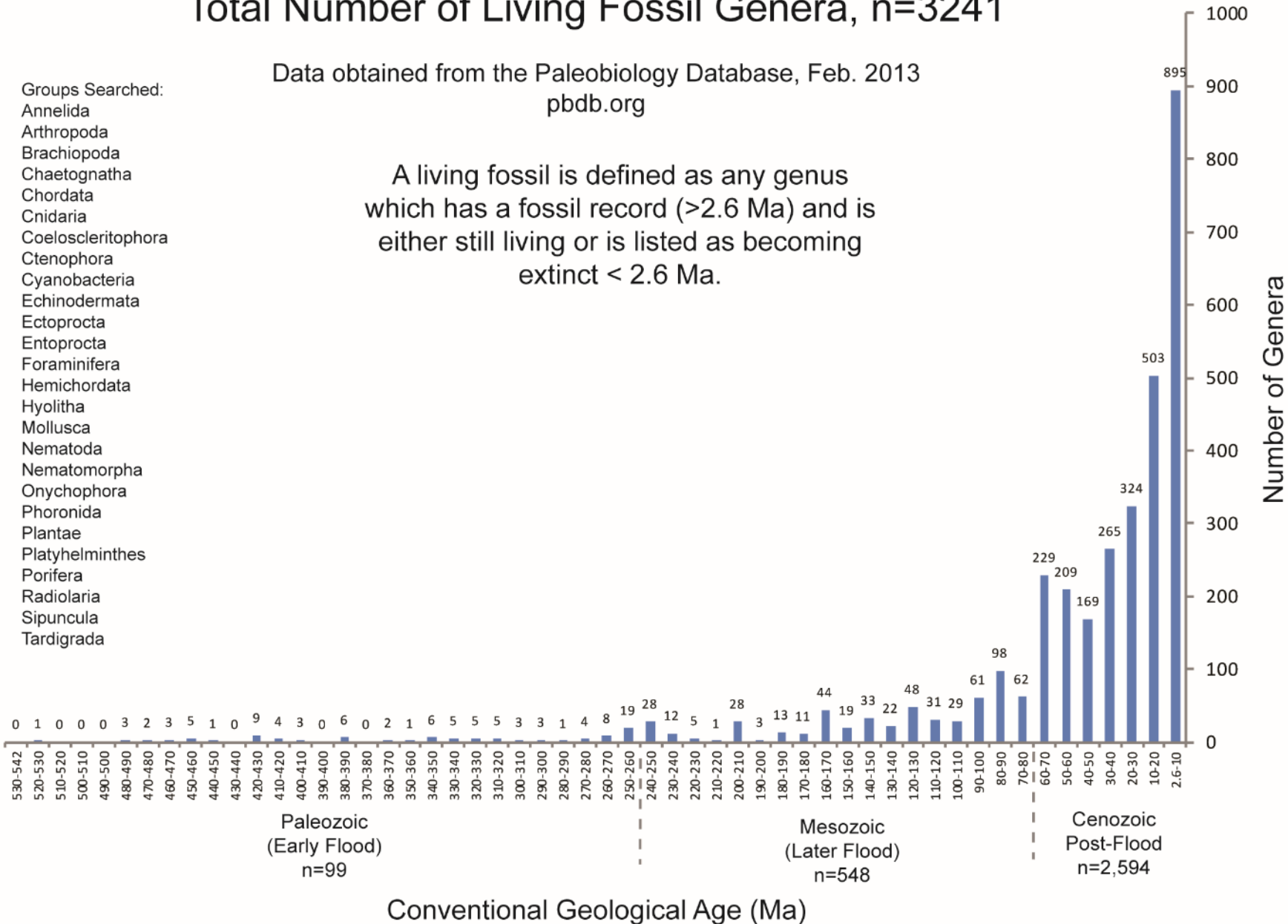
Cyanobacteria first show up in the fossil record 3.5 billion years ago! They are still with us today and look the same!

Total Number of Living Fossil Genera, n=3241

Data obtained from the Paleobiology Database, Feb. 2013
pbdb.org

A living fossil is defined as any genus which has a fossil record (>2.6 Ma) and is either still living or is listed as becoming extinct < 2.6 Ma.

- Groups Searched:
- Annelida
 - Arthropoda
 - Brachiopoda
 - Chaetognatha
 - Chordata
 - Cnidaria
 - Coeloscleritophora
 - Ctenophora
 - Cyanobacteria
 - Echinodermata
 - Ectoprocta
 - Entoprocta
 - Foraminifera
 - Hemichordata
 - Hyalitha
 - Mollusca
 - Nematoda
 - Nematomorpha
 - Onychophora
 - Phoronida
 - Plantae
 - Platyhelminthes
 - Porifera
 - Radiolaria
 - Sipuncula
 - Tardigrada



Whitmore,
2013, The
New
Answers
Book 4

IV. HOW TO RESPOND

HOW TO RESPOND

- BE RESPECTFUL (1 PETER 3:15)
- LEARN WHAT THE TEACHER IS TEACHING
- DON'T BE AFRAID
- KNOW THE FACTS, BE CAREFUL OF "STRAW-MAN" ARGUMENTS
- ASK GOOD QUESTIONS, CONSIDER PRIVATE CONVERSATIONS WITH THE TEACHER
- BE HUMBLE, BE GRACIOUS IN POINTING OUT ERRORS
- TRY TO HAVE A "DISCUSSION," AND NOT AN "ARGUMENT" OR "DEBATE"
- A CREATIONIST IN THE CLASSROOM—GOALS AND STRATEGIES