

The Case For and Against Evolution

The Fossil Record and Evolution

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The Fossil Record

- ❖ Fossils are the mineralized remains or impressions of past organisms.
- ❖ There are two major groups of fossils:
 - ❖ Body fossils: *Actual parts* of plants, animals, or microorganisms.
 - ❖ Trace fossils (ichnofossils): traces of the *activities* of organisms: footprints, burrows, borings, etc.

Fossils of Skeletal Parts



Sea star (Echinoderm). Solnhofen Limestone, Germany. Jurassic



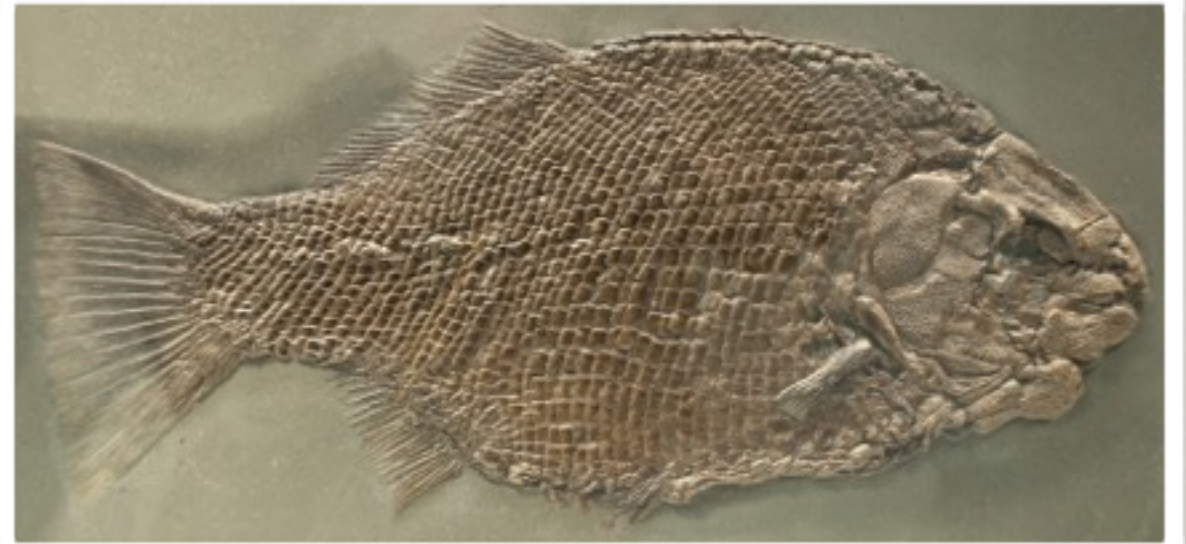
Dragonfly. Solnhofen Limestone, Germany. Jurassic



Exceptional fossilization of a frog. Miocene.



Psittacosaurus mongoliensis. Cretaceous, Mongolia



Fossil fish—*Pacgycormus curtus*. Solnhofen Limestone, Jurassic, Germany



Alligator prenasalis. Oligocene, North Dakota



Chasmosaurus



Pteranodon



Fossil whale. Pliocene, Peru



Mesohippus barbouri. Oligocene, Nebraska, USA



Rhinoceros Trigonias osborni. Eocene



Petrified tree logs, Peru



Acer pseudoplatanus



Perisphinctes maximus

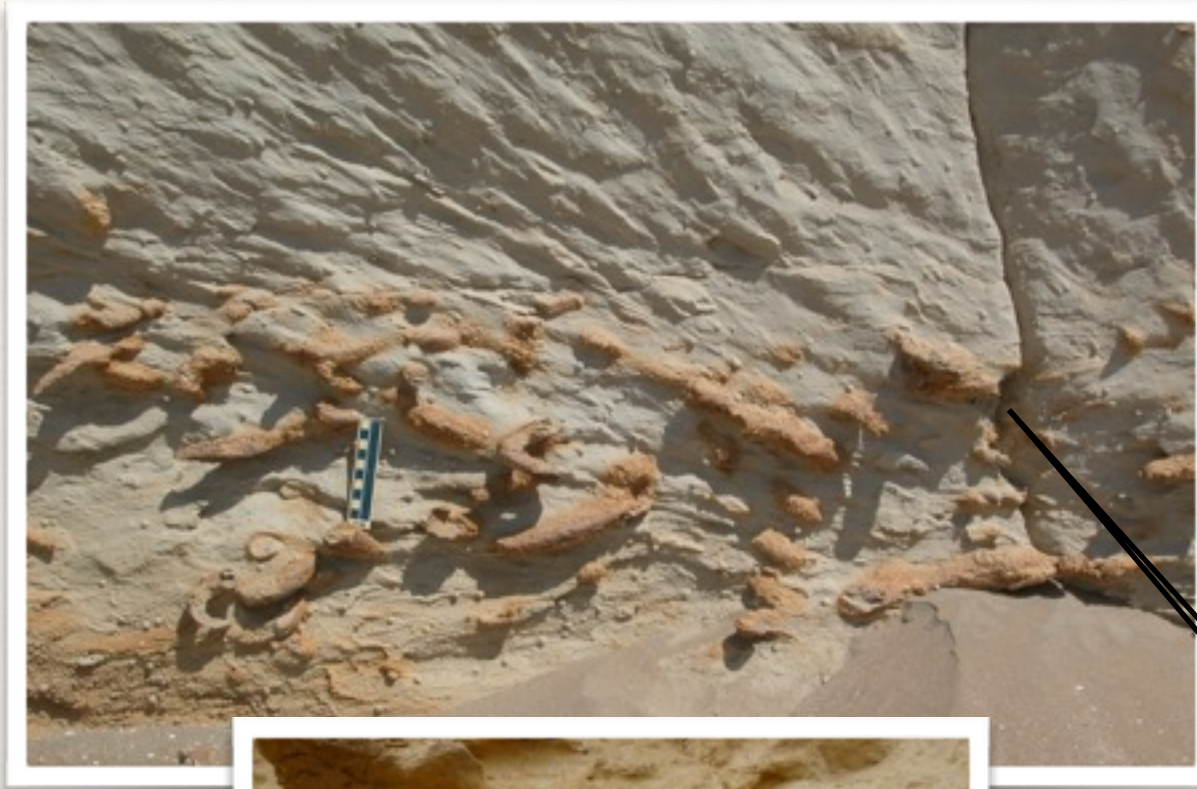
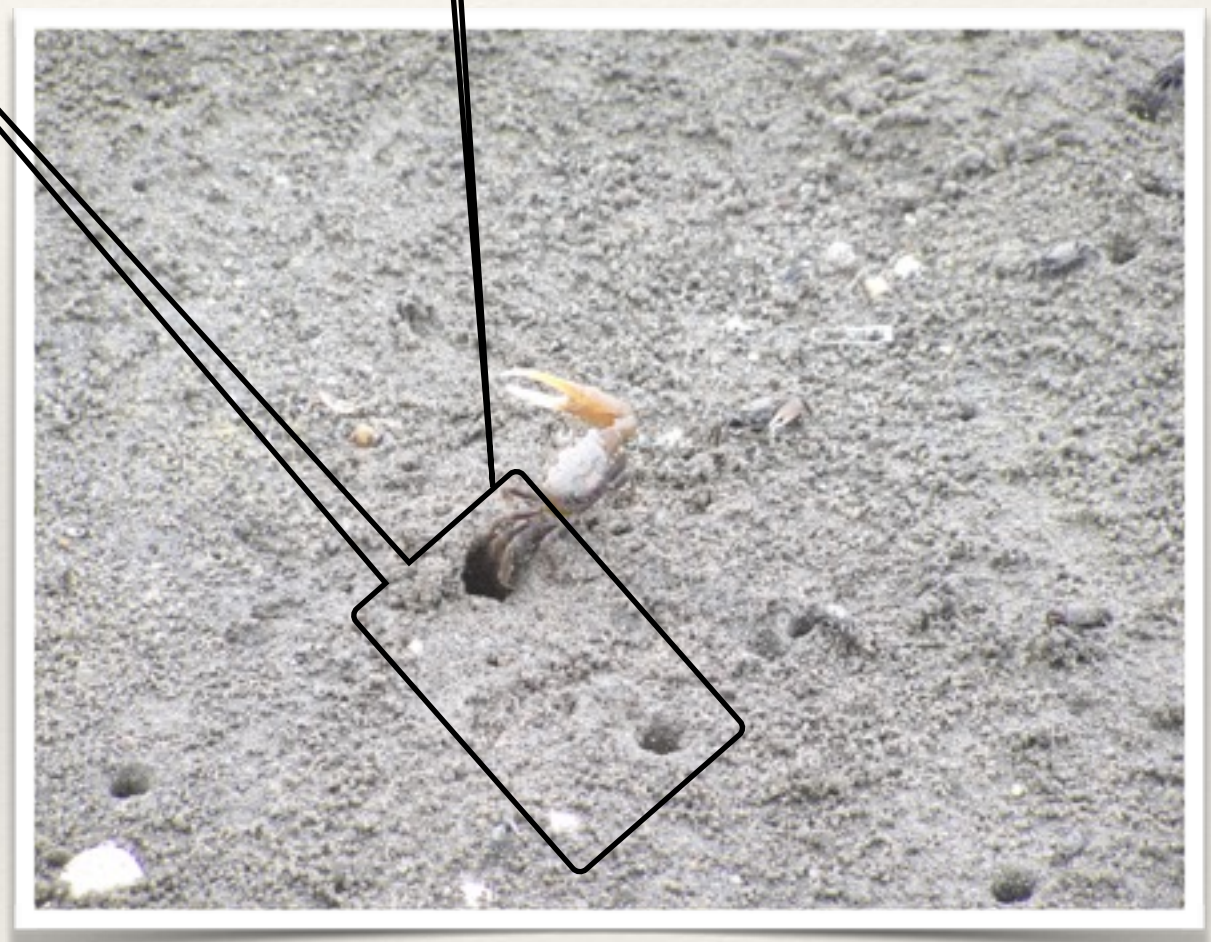


Pecten

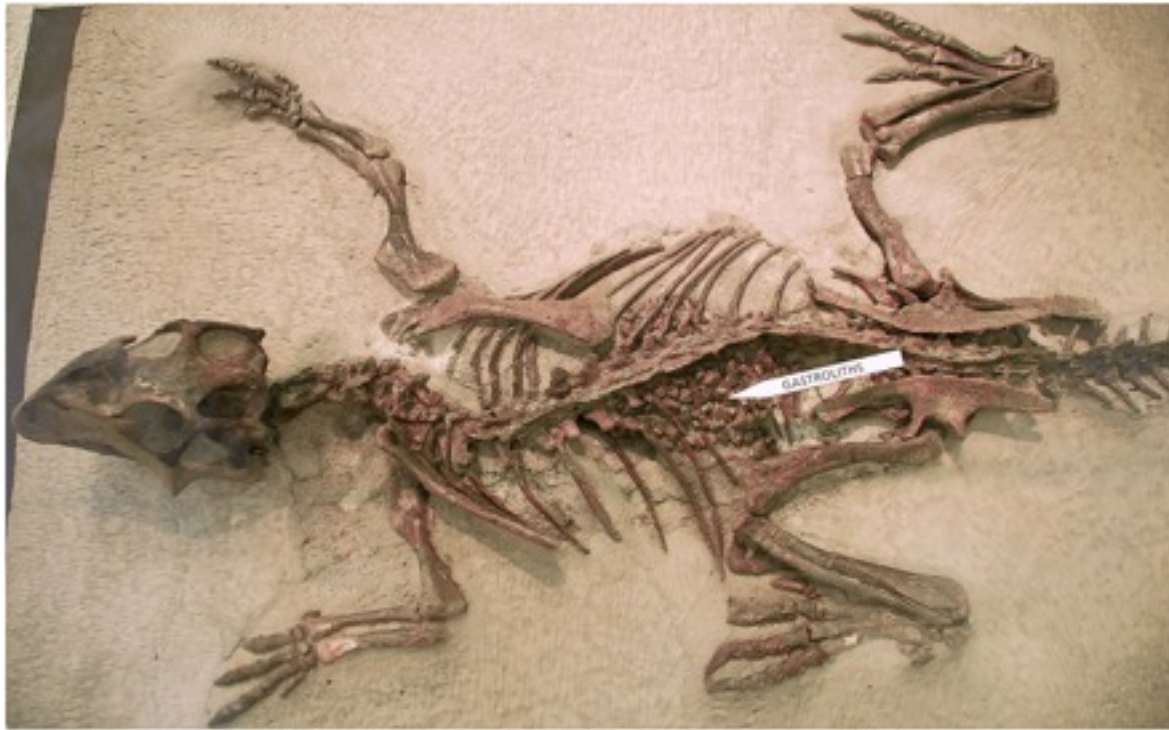


Aquatic plant

Trace Fossils



Gyrolithes



Gastrolith in *Psittacosaurus mongoliensis*



Feces of Galapagos tortoise

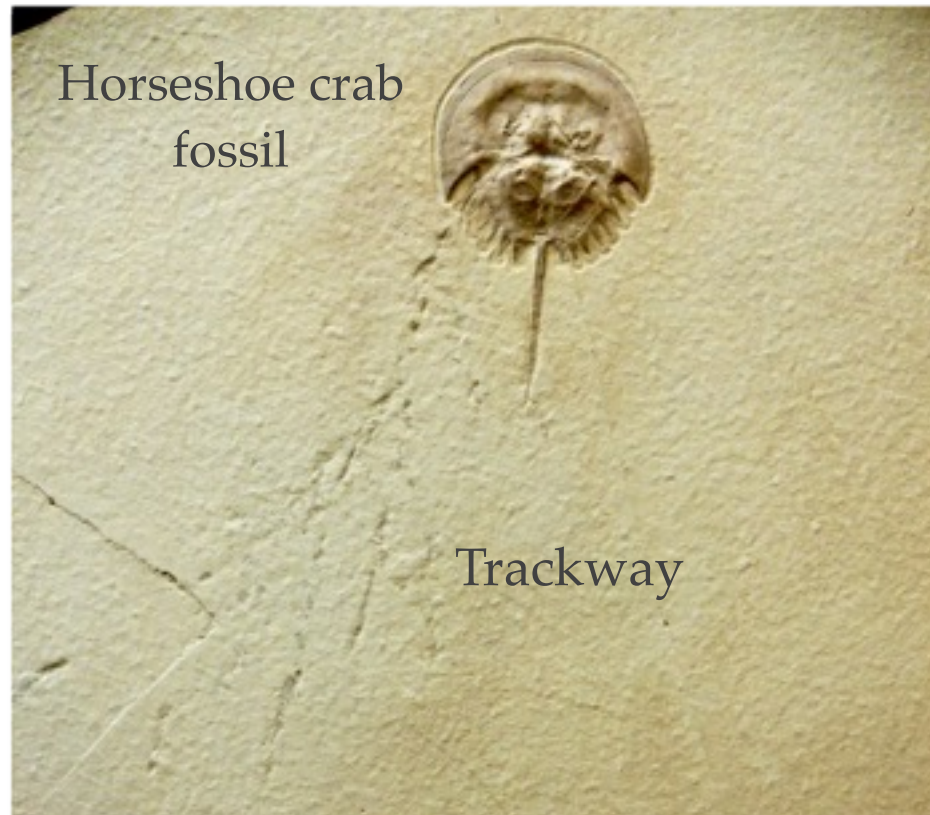


Dinosaur skin impression on the bones of the vertebral column



Coprolite of carnivore feces

Horseshoe crab
fossil



Trackway



Shark tooth marks on a whale bone



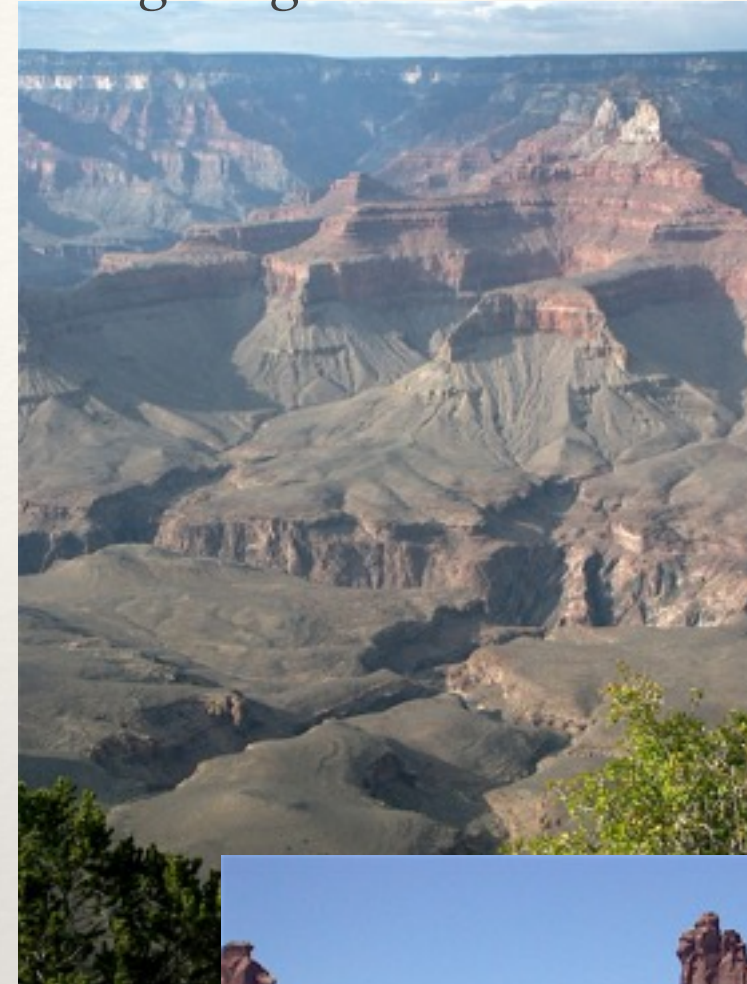
Dinosaur trackway (Plagne, Francia)

Dinosaur footprints (Enciso, Spain)



Avian footprints

- The *fossil record* is the variety of fossils found in the rocks.
- Fossils are found in *sedimentary layers*.
- The stacking of all the sedimentary layers is called *geologic column*.



The Geological Column and Time Scale

- ❖ Scientists have divided the strata in eras, periods and epochs.



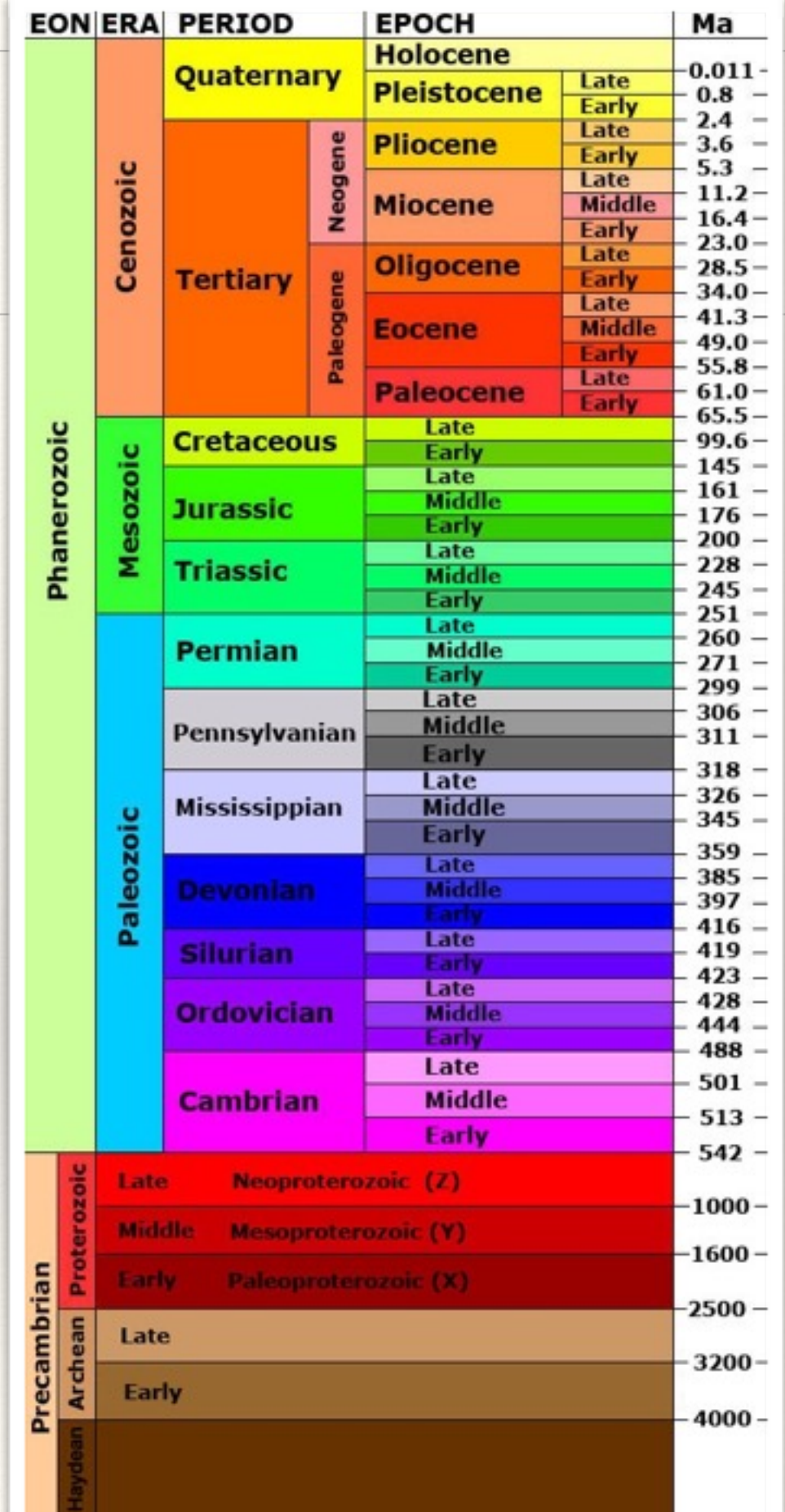
Geoscience Research Institute
www.grisda.org
11060 Campus St., Loma Linda, CA 92350

Era	System ¹	Series ²	Representative Fossils
Phanerozoic	Cenozoic	Holocene	Modern organisms
		Pleistocene	"Ice Age" - Large mammals
		Pliocene	Many mammals & birds
		Miocene	Many angiosperms, whales
		Oligocene	Apes, modern birds, insects
		Eocene	Mammals - bats & monkeys
	Paleogene	Paleocene	No dinosaurs or ammonoids
	Mesozoic	Cretaceous ³	Dinosaurs, ammonoids, frogs, birds, mammals, cycads, & flowers
		Jurassic	Dinosaurs, trackways & ammonoids
		Triassic	Conifers, cycadeoids & diverse reptiles
	Paleozoic	Permian	Highest level of many marine organisms
		Carboniferous	Coal "forests," amphibia and reptiles
		Devonian	Abundant diverse fish, small plants, coal
		Silurian	Jawless fish, few vascular plants
		Ordovician	Many marine organisms including clams
		Cambrian	Many complex organisms e.g., Trilobites
Precambrian	Proterozoic		Rare odd marine animals (Ediacaran) Sparse fossils, few Cambrian taxa
		Archean	Very few fossils, all single-celled Some pseudofossils

¹Also referred to as Periods. ²Also referred to as Epochs.

³The Cretaceous/Paleogene contact is commonly called the "KT boundary"

- ❖ Each Epoch or Series shows characteristic fossils.
- ❖ Different groups of animals and plants appear in different strata or stratigraphic levels.
- ❖ Some groups go extinct and no longer appear in the sedimentary record.
- ❖ Other groups, such as fish, molluscs, and many others, appear in the lower strata of the geological column and continue to appear in the rest of the strata.



From Wikimedia Commons

The Fossil Record and Evolution

- ❖ Evolutionists claim that the fossil record proves evolution.
- ❖ The books tend to have bold assertions like this by George G. Simpson:
 - ❖ “Currently it makes no sense to continue collecting and studying fossils simply to determine whether evolution is a fact. The question has been definitively answered in affirmative way.”

What Did Darwin See?

Darwin and the Fossil Record

- ❖ Darwin saw that the fossil record shows an ordered pattern of appearances and disappearances of species and entire groups of organisms.
- ❖ For example, trilobites are found first in the Lower Cambrian layers.
- ❖ When appear fully formed, without intermediate or transitional ancestors.
- ❖ As we move upward in the sedimentary strata we continue to find trilobites, up to the Permian when they become extinct and never show up again in the layers above.
- ❖ Both their appearance and disappearance are sudden.



Arctinurus boltoni

Darwin and the Fossil Record

- ❖ The first dinosaurs appear in the Triassic strata and disappear in the Upper Cretaceous layers.
- ❖ Both their appearance and disappearance are sudden.
- ❖ They had no ancestors; there are not known intermediate forms between a pre-dinosaur and a dinosaur.



Darwin and the Fossil Record

- ❖ Mammals appear for the first time in Triassic strata, after trilobites went extinct.

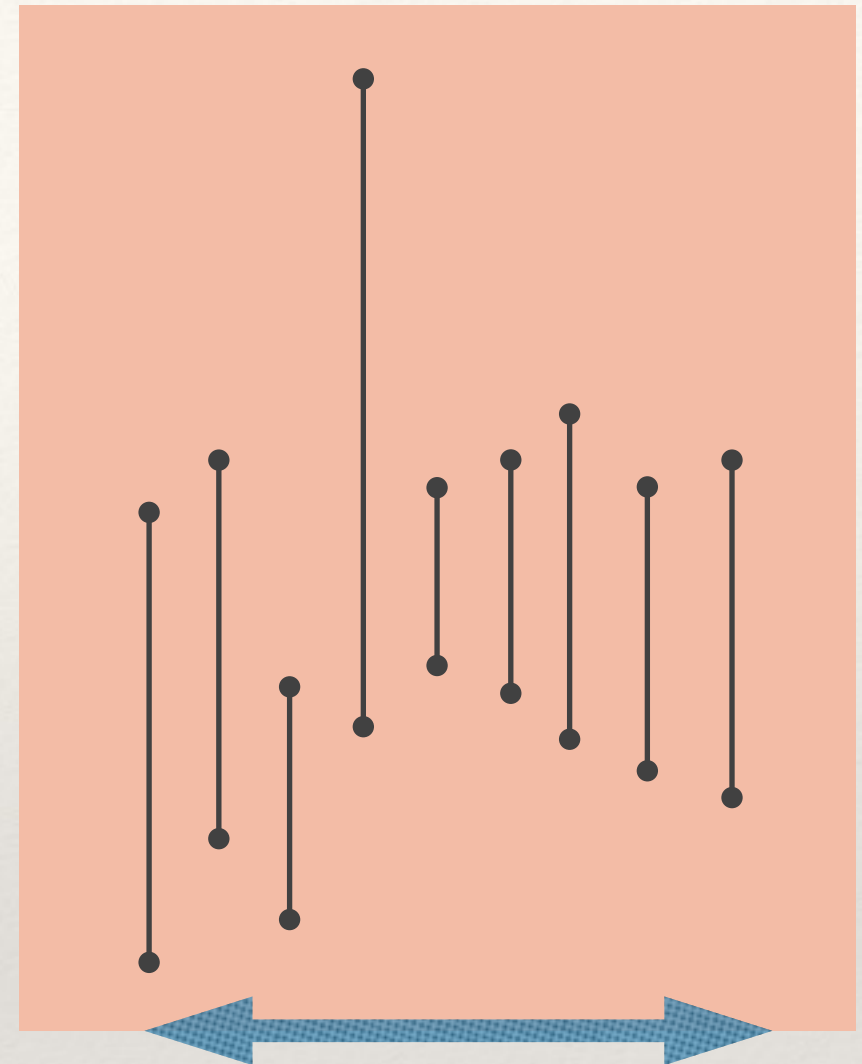


Coelophysis bauri

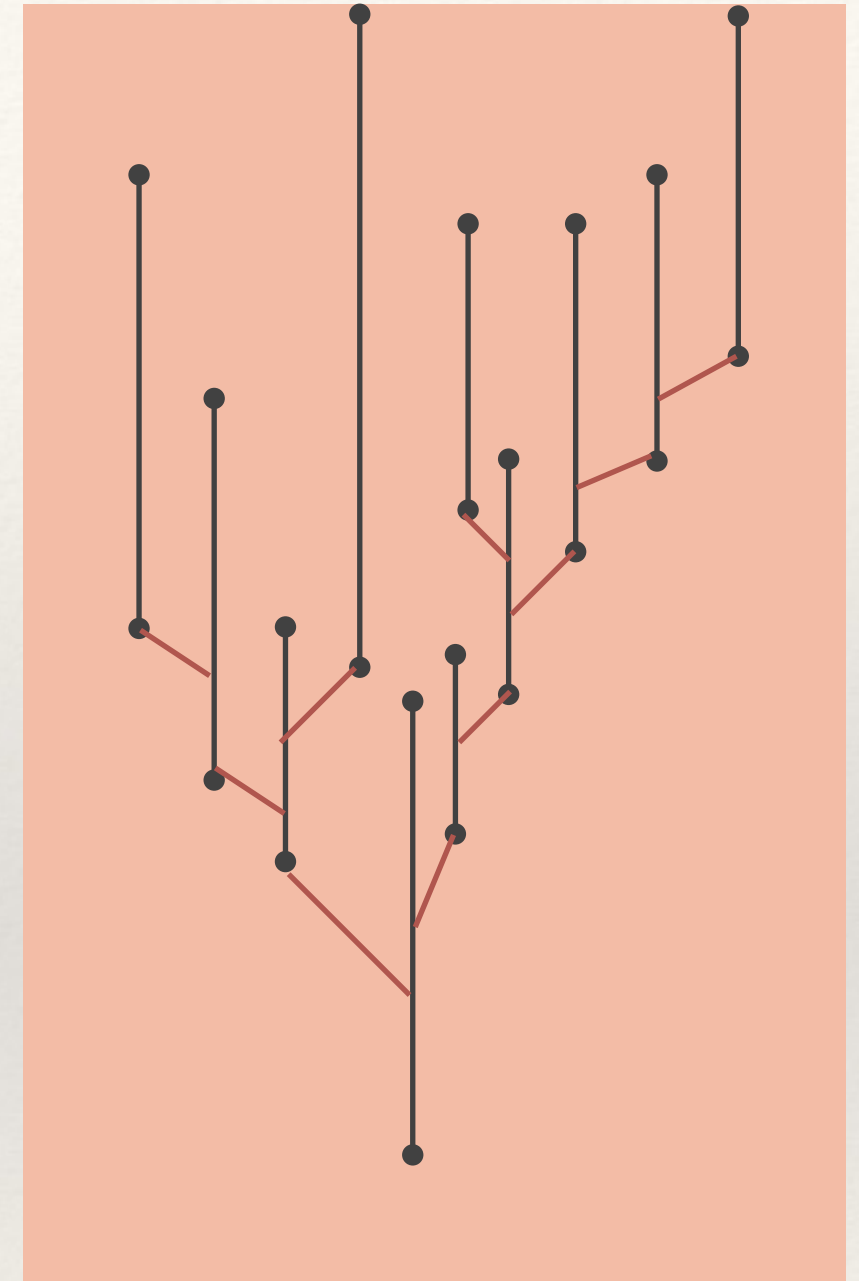
Darwin y el Registro Fósil

- ❖ Darwin saw a pattern of appearances and disappearances of fossil forms and he called it "geological succession", which is also called "succession of fossils."
- ❖ Darwin also saw a pattern of variation from simple to complex: the higher up in the sedimentary strata the more complex were organisms (fossils).
- ❖ He also saw a third pattern.

- ❖ He drew lines indicating appearance and disappearance of species.
- ❖ The longer the line the longer the species lasted.
- ❖ When comparing two species of animals or plants, the farther apart one line is from another (↔) the greater is the difference in the morphology of the two.



- ❖ Darwin connected the dots and he obtained a branching tree.
- ❖ He interpreted the tree as a relationship between younger and older forms, the former deriving from the latter.
- ❖ Lines the are close indicate relationship and a common intermediate ancestor.
- ❖ There is only one original form, called *Universal Common Ancestor*.



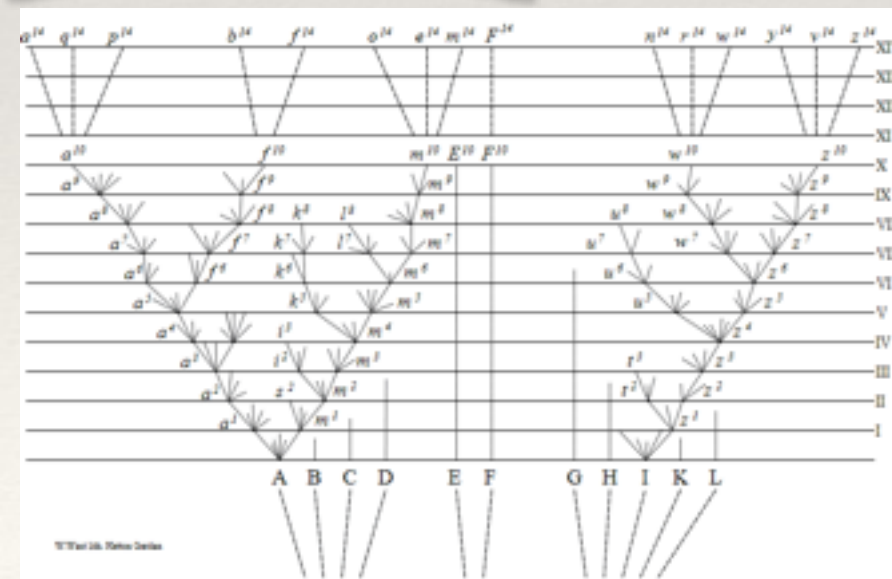
El Árbol de la Vida de Darwin

- ❖ Based on these connections and knowledge of the existing fossil record, Darwin suggested that the current biodiversity could be depicted as the development of a tree.
- ❖ The branches represent the different groups of organisms that emerged over time.
- ❖ All the branches (groups of organisms) derive from a common ancestor, which is the trunk.
- ❖ Darwin was proposing a *monophyletic* origin of life diversity.



Darwin's first evolutionary tree of life drawn in his notebook in 1837, with the words "I think" scrawled above it. (From Darwin's Notebook B now stored in Cambridge University library)

Tree of life published by Darwin in the *Origin of Species*, in 1859. (from http://commons.wikimedia.org/wiki/File:Origin_of_Species.svg)



Intermediate Forms

- ❖ In order to make sense of the tree, Darwin postulated that there must have been thousands of *intermediate forms* (also called *transitional forms*) between one branch and another.
- ❖ Evolutionary scientists claim that such forms have, in fact, been found.
- ❖ For instance, the *mammal-like reptiles*, which appear in strata of the Permian and Triassic, seem to have reptilian traits with some mammalian characteristics.



Dimetrodon (left, an alleged mammal-like intermediate, and *Eryops* (right, an amphibian)

Archaeopteryx

- ❖ In Darwin's time, the only alleged transitional form was *Archaeopteryx*.
- ❖ The first specimen was found in 1861, just two years after Darwin published his book *On the Origin of Species*.
- ❖ *Archaeopteryx* was a bird with a toothed jaw like a reptile, but with true feathers like a modern bird.



The Expected Fossil Record According to Evolution Theory

- ❖ If biological evolution occurred in a continuous and gradual way over many millions of years we should see in the sedimentary record (geological column):
 - ❖ Few fossil forms (*low diversity*) in the lower layers of the sedimentary record or geologic column.
 - ❖ More diversity as we move upward in the geologic column: increase of diversity toward the upper strata.
 - ❖ Lower biological specialization in the lower strata: the earliest forms should be more generalist and simple, not highly specialized.
 - ❖ Greater specialization in the organisms of the upper layers.
 - ❖ Fossil forms replacing ancestral forms, with evidence of gradual change (intermediate or transitional organisms).
 - ❖ Limited geographic distribution of the first fossils.
 - ❖ Evidence of a common ancestor.

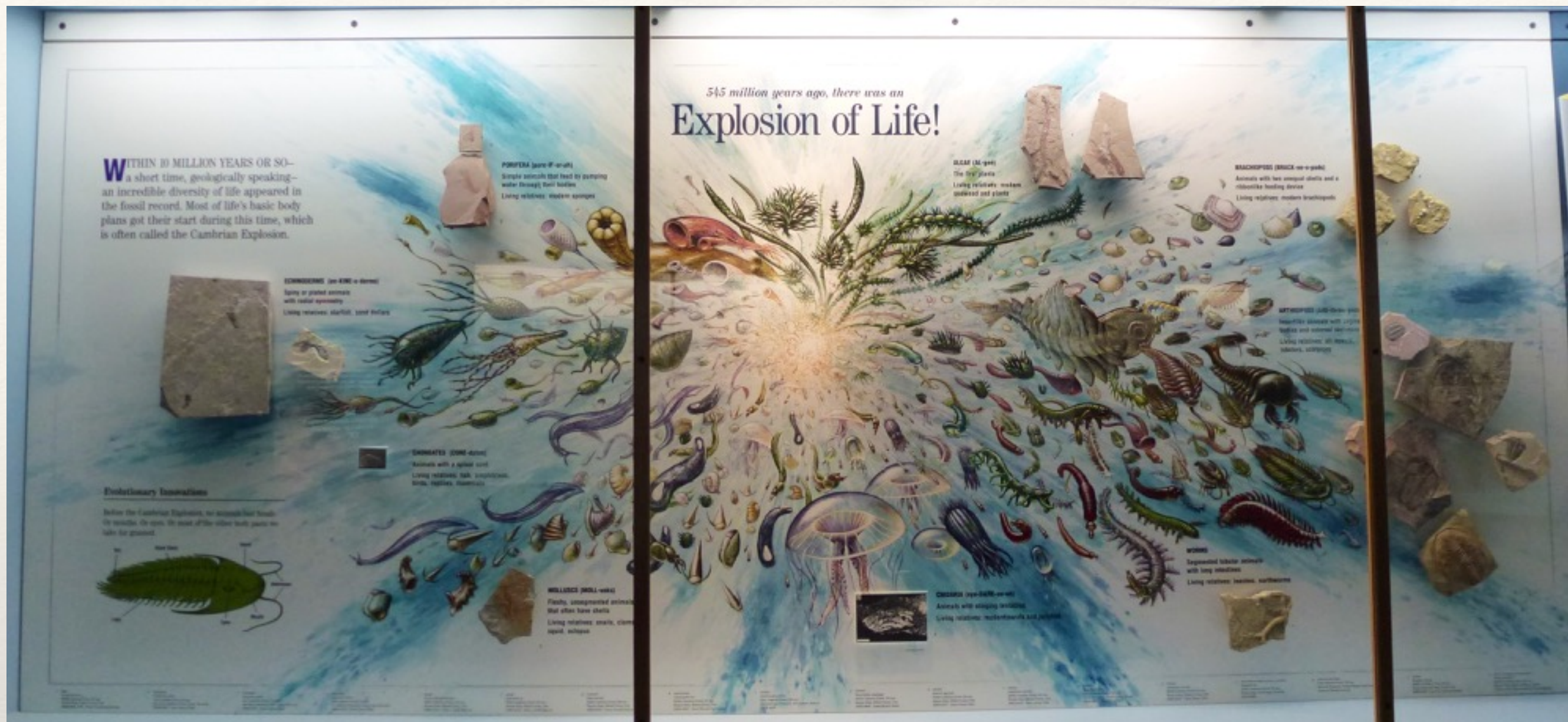
Does the Fossil Record Really Suggest
Evolution from a Common Ancestor?

- ❖ Most critics of the argument of fossil succession agree that:
 - ❖ The succession of fossils in the record is real.
 - ❖ The fossil record shows change over time.
 - ❖ They also accept that the forms found higher up in the strata are relatively more complex than those in the lower strata.
- ❖ However, evolution is an interpretation.

- ❖ These critics contend that the overall pattern of fossil evidence contradicts the evolutionary theory in five important aspects.
 - ❖ The various groups of organisms appear not gradually, but suddenly in the rock record.
 - ❖ The very first organisms in the fossil record already show high diversity and complexity.
 - ❖ The various groups appear widely spread geographically.
 - ❖ Once they appear in the rock record they do not show gradual change over time, but *stasis*.
 - ❖ Very few good examples of transitional forms exist, and those that are claimed as transitional are indeed questionable.

Abrupt Appearance

- ❖ First, paleontologists describe the fossil record as the *abrupt appearance of new forms*.
- ❖ The new forms appear suddenly in the scene without any connections to the forms that came before, with the exception of a few disputable intermediate forms.
- ❖ The most remarkable appearance is recorded in the Lower Cambrian layers (about 530 million years ago, in the evolutionary time scale), where more than half of the major phyla of animals appear suddenly.
- ❖ Paleontologists call this sudden appearance as the *Cambrian explosion*.



Denver Museum of Nature and Science. Photo by Raúl Esperante

- ❖ This diagram represents the 'explosion' of life in the lower Cambrian layers.
- ❖ Most of the modern phyla appeared suddenly without any ancestor.
- ❖ The organisms are fully formed, complex and diverse.
- ❖ Note that the diagram is somehow deceiving, because it seems to represent an 'gradual' explosion of life forms, more according to what the theory of evolution requires.

The Cambrian Explosion

- ❖ The Cambrian explosion was already perplexing for Darwin, who stated:
- ❖ “To the question why we do not find rich fossiliferous deposits belonging to these assumed earliest periods prior to the Cambrian system, I can give no satisfactory answer.”

The Origin of Species, 6th ed. Chapter 10.

- ❖ Many scientists think that the sudden appearance of many of the major groups of organisms in the Lower Cambrian strata contradicts Darwin's postulate that new forms would arise gradually from a Common Ancestor over long periods of time.
- ❖ Because the high diversity and complexity of the Lower Cambrian fauna, the Cambrian Explosion also contradicts the evolutionary postulate that the first organisms would show low diversity and complexity.
- ❖ Moreover, the Lower Cambrian fossil appear widely spread geographically.

- ❖ What is true of the phyla (the highest animal classification) is also true of the middle and lower classification (classes, orders, families)
- ❖ They also appear suddenly.
- ❖ For example, in the Paleocene epoch, 15 mammalian orders suddenly appear in the fossil record.
- ❖ These orders include the Carnivora (canids, cats, etc.), the Chiroptera (bats), the Perissodactyla (horses.), etc., all of them in the mammalian class.
- ❖ Scientists call it the *mammalian radiation*.
- ❖ This sudden appearance is not consistent with a scenario of gradual evolution.

Mammalian Radiation

- ❖ Not only do new mammalian orders appear suddenly, but when they appear they are already separated into their distinctive forms.
- ❖ For example, the first bat (Chiroptera) appear in Eocene strata and is fully formed, without any ancestral transitional form.



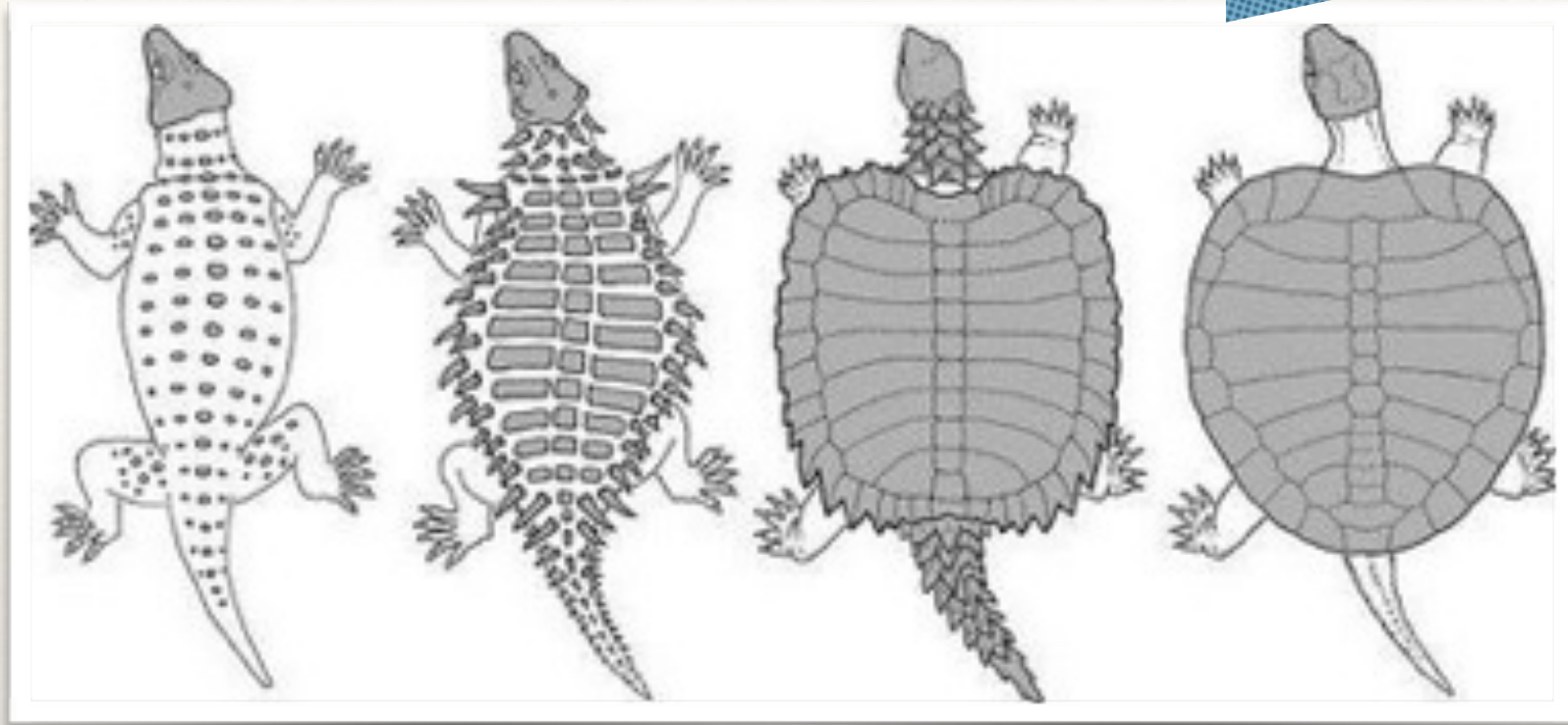
Turtles

- ❖ The first turtle fossil appear in Upper Triassic strata.
- ❖ These 'oldest' turtles already show their body plan fully developed.
- ❖ They appear in the fossil record without ancestral intermediates.
- ❖ Turtles that appear in upper strata only show slight variations.



By Ghedoghedo - Own work, CC BY-SA 4.0, <https://commons.wikimedia.org/w/index.php?curid=35328112>

Hypothesized Turtle Evolution

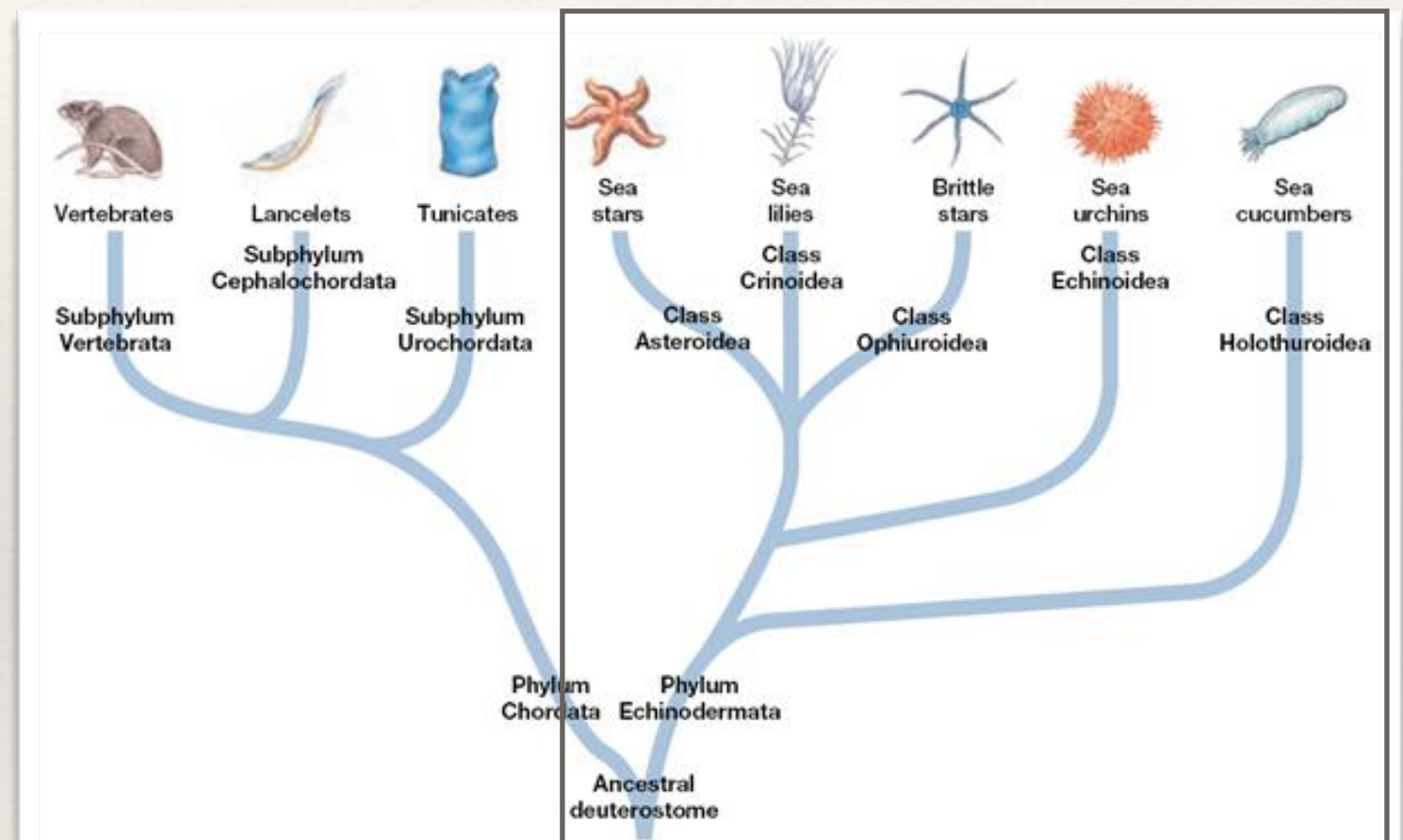


<http://chinleana.fieldofscience.com/2008/10/new-proto-turtle-from-late-triassic-of.html>

- ❖ This figure illustrates what paleontologists think turtle evolution was like.
- ❖ Ancestral forms did not have a carapace, but developed it gradually.
- ❖ But no intermediate form has been found in the fossil record.
- ❖ In reality, only the far right fossil is known.
- ❖ No ancestors or intermediates are known.

Evolution of Echinoderms According to a Textbook

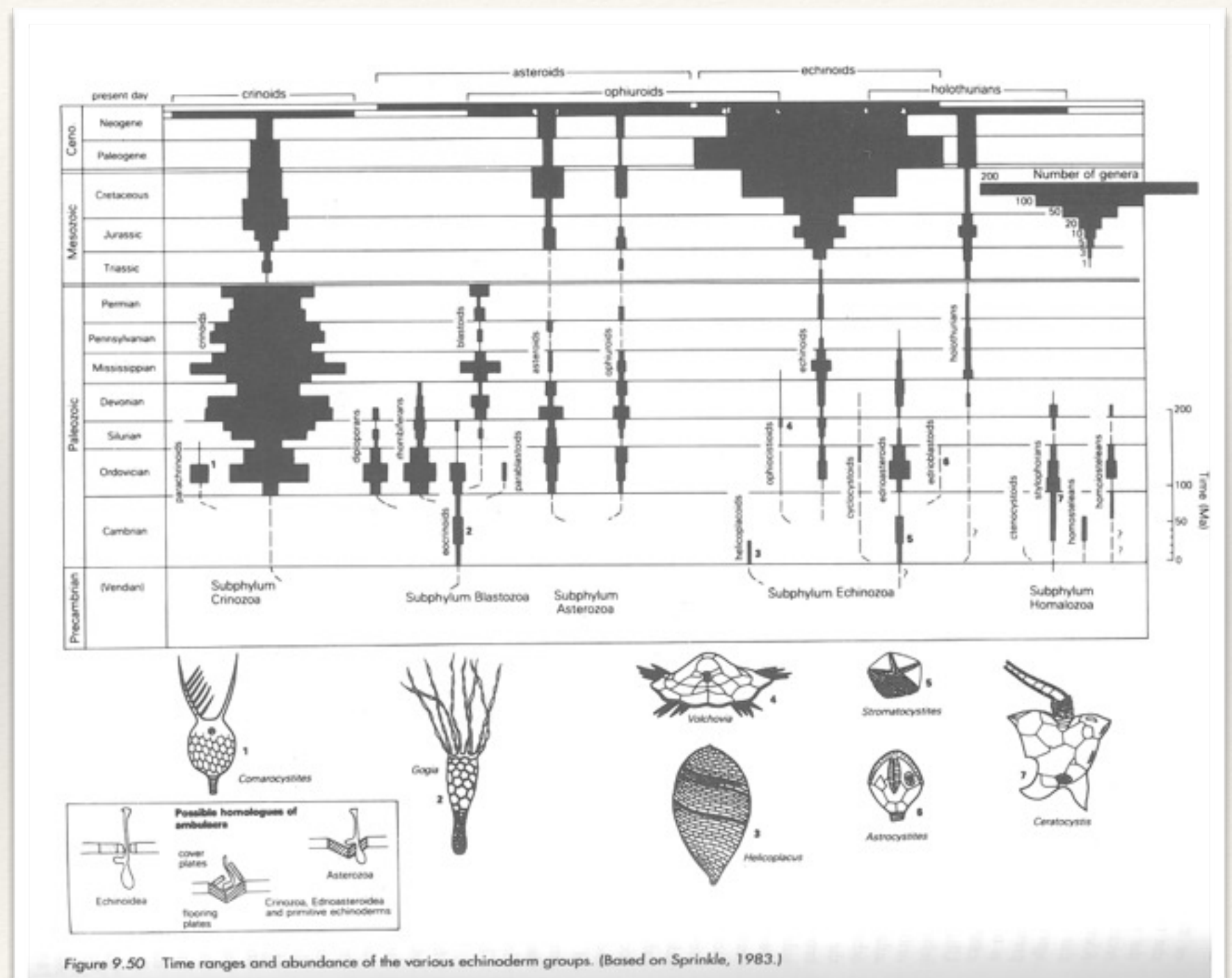
- ❖ Diagram of the alleged evolution of the phyla Echinodermata.
- ❖ The thick connecting lines intend to indicate the phylogenetic (evolutionary) relationships between the different groups of the phyla.
- ❖ However, no transitional form or ancestor is suggested.
- ❖ That is because no one is known. They do not exist.



<http://biologydiva.pbworks.com/w/page/14797002/Zoology%20Chapter%2032>

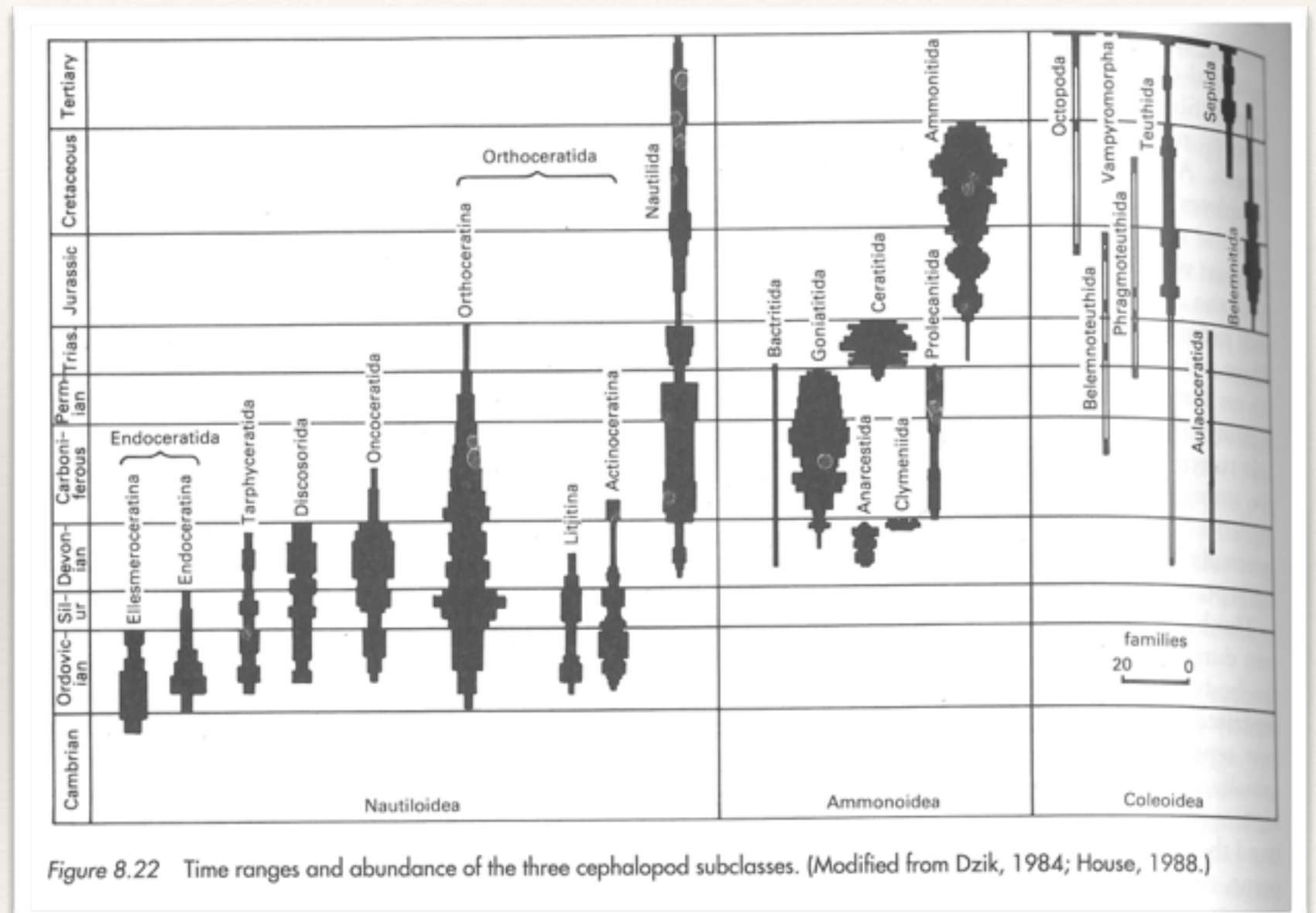
Time Range and Abundance of Echinoderms

- ❖ This diagram is what we truly know about the time range and abundance of three subphyla of Echinoderms.
- ❖ Some groups appear first in Lower Cambrian strata and others in the Lower Ordovician.
- ❖ All groups appear abruptly in the fossil record, without any common ancestor.



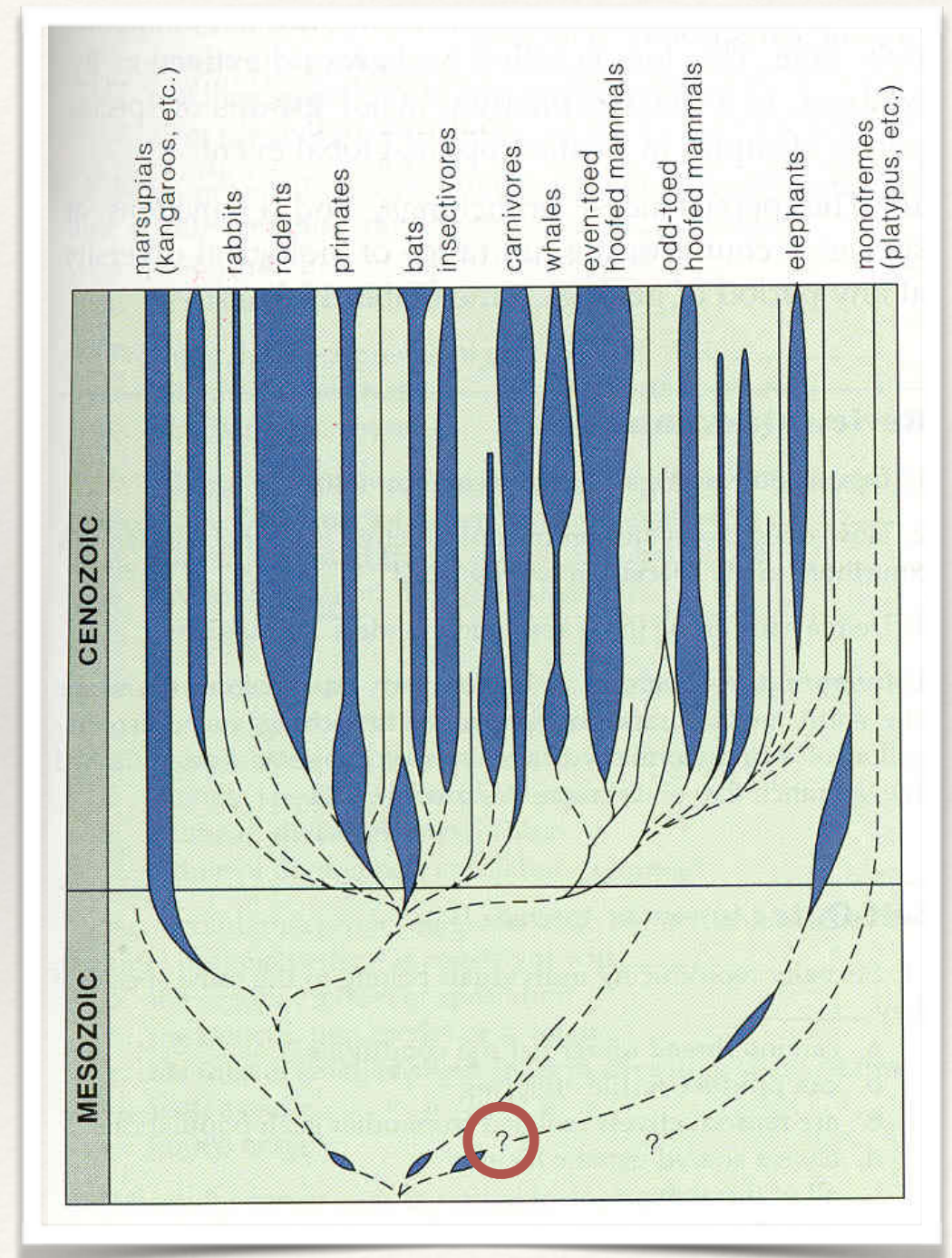
Time Range and Abundance of Cephalopods

- ❖ This diagram depicts the time range and abundance of three subclasses of Cephalopods.
- ❖ This is an honest representation of Cephalopod fossil record:
 - ❖ No lines connecting the subclasses and the orders in each subclass.
 - ❖ No suggestion of common ancestor or possible evolutionary relationships.



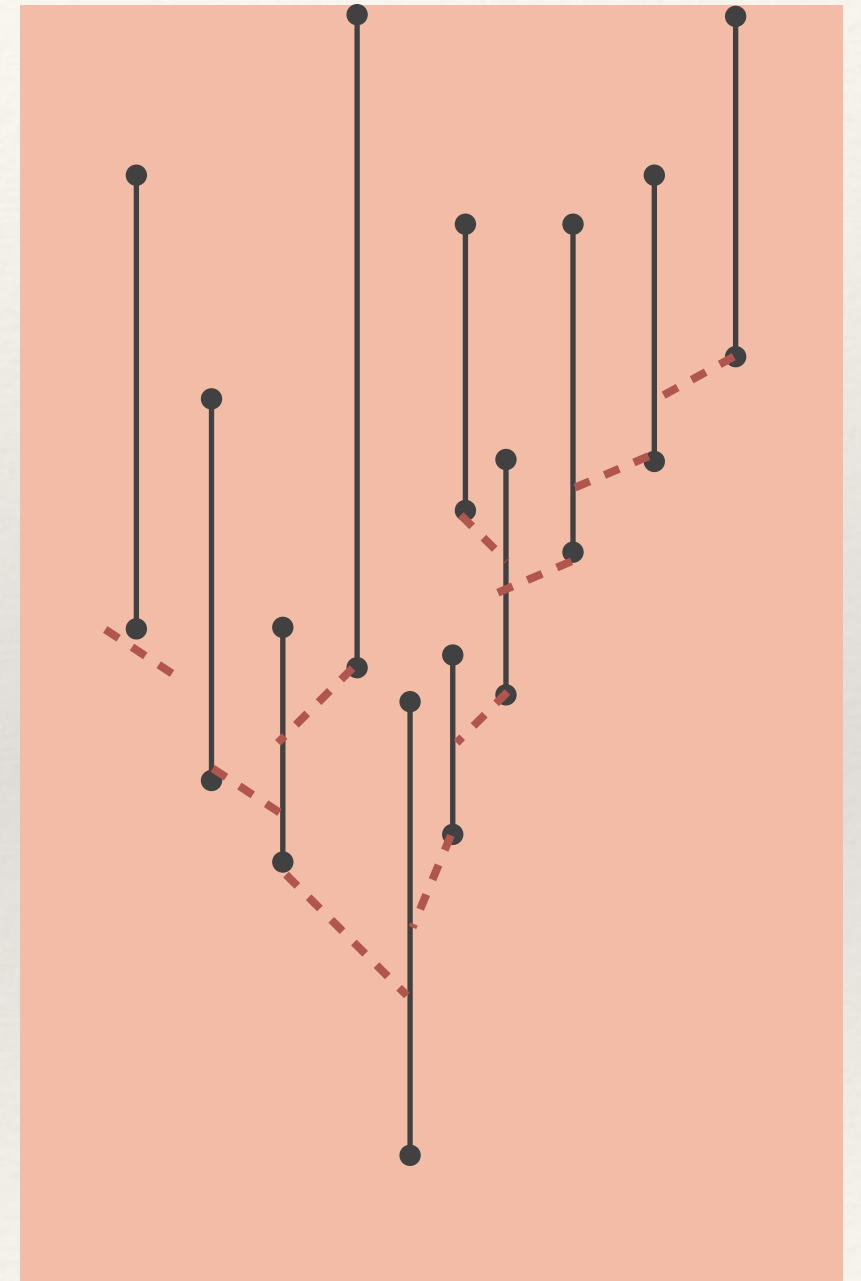
Time Range and Abundance of Mammals

- ❖ The fossil record of mammals also lacks transitional forms.
- ❖ Each group (order) of mammals is clearly different from the others from the beginning.
- ❖ The dotted lines indicate lack of “connecting” forms.
- ❖ However, it still depicts the idea that scientists have been able to relate the different groups.



Evolutionary Trees

- ❖ Evolution theory postulates that the different groups of organisms are linked together by transitional forms that should be found in the fossil record.
- ❖ Evolutionary biologists acknowledge that many gaps remain unfilled in the fossil record.
- ❖ Serious evolutionary tree diagrams represent these gaps with dotted lines, or no lines at all.
- ❖ This is a serious drawback for the theory of evolution, which is based on the existence of intermediate fossils.



Sudden Appearance

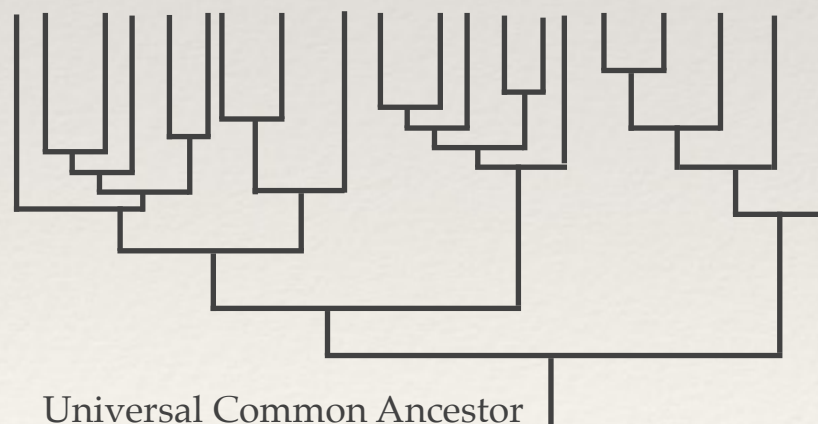
- ❖ The pattern of sudden appearance and the absence of good intermediate forms are the common features of the fossil record: many types of birds, all insects, crustaceans, echinoderms, mollusks appear abruptly without any ancestor.
- ❖ This is also true for plants.
- ❖ Flowering plants (angiosperms) appear suddenly in the Lower Cretaceous strata, without any obvious ancestor.
- ❖ This sudden appearance was so perplexing that Darwin himself referred to it as “an abominable mystery.”

- ❖ This pattern of sudden appearance of the different animal and plant forms does not support Darwinian picture of a gradually branching tree.
- ❖ Instead, it suggests a series of independent beginnings.
- ❖ A forest of trees, instead of a single branching tree.

This is what Darwin's theory of evolution postulates

Monophyletic tree

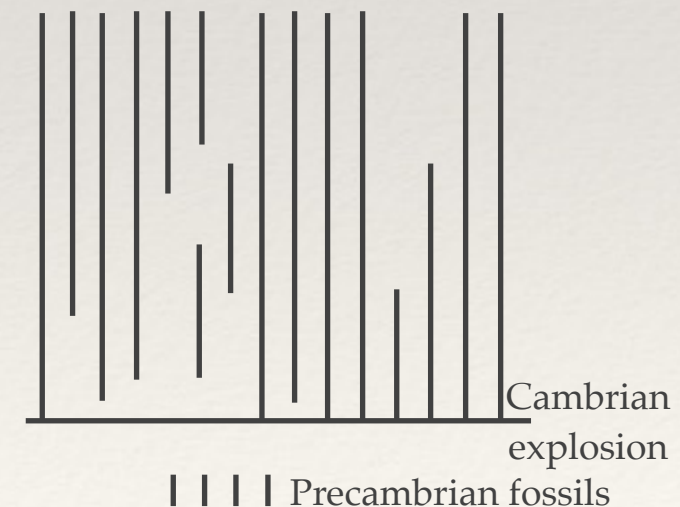
Gradual appearance of the different groups and many intermediate forms



This is what the fossil record shows

Polyphyletic "forest"

Groups appear abruptly in the fossil record and there are no transitional forms



- ❖ Darwin acknowledge that the lack of intermediate forms was the most important objection to his theory of gradual evolution:
- ❖ “... The number of intermediate varieties, which have formerly existed on the earth, (must) be truly enormous. 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.” (Darwin, 1859, p. 292).

The Stability of Life Forms

- ❖ Not only the fossil succession shows sudden appearance of animal and plant groups, but those groups remain stable throughout their occurrence in the strata.
- ❖ Paleontologists call this stability of form *stasis* when it occurs at the species level.
- ❖ But stability also characterizes the higher categories of life (orders, classes, phyla).
- ❖ David Raup, a paleontologist of the University of Chicago states that “what geologists of Darwin’s time, and geologists of the present day actually find is a highly uneven or jerky record; that is, species appear in the sequence very suddenly, show little or no change during their existence, then abruptly go out of the record.” (Raup 1979)



Wikipedia, CC BY-SA 3.0, <https://commons.wikimedia.org/w/index.php?curid=6532895>



https://commons.wikimedia.org/wiki/File:%3AGinkgo_biloba_scanned_leaf.jpg

- ❖ The left photo shows a fossilized *Ginkgo biloba* leaf, and the right photo shows a modern *Ginkgo* leaf, showing virtually no change in morphology in allegedly 135 million years.

And the Transitional Forms?

- ❖ But what about the transitional forms like the mammal-like reptiles and *Archaeopteryx*?
- ❖ Don't they suggest that Darwin's model of gradual evolution was right?
- ❖ They don't. The prevailing pattern in the fossil record is that of sudden appearance followed by stasis.
- ❖ The alleged transitional forms are the rare exception, and many of them are disputable, including those mentioned.

More Problems with Transitional Forms

- ❖ There are statistical reasons to suspect that the few transitional sequences that have been found are not relevant in the whole scheme of the theory.
- ❖ Millions of different fossil forms have been found, and we would expect to find at least a few fossil forms that could be arranged in plausible evolutionary sequence.
 - ❖ The same can be done with human artifacts and objects, which can be arranged in a historical evolutionary succession.
- ❖ Is it possible that the mammal-like reptile sequence is a statistical anomaly rather than a legitimate sequence of ancestors and descendants?

- ❖ Another problem is that fossil do not always appear in the stratigraphic order that the theory of evolution predicts.
- ❖ Evolutionary biologists analyze the morphological characters of organisms looking for similarities.
- ❖ Then they generate hypothetical branching-tree diagrams, called *cladograms*, which represent the alleged evolutionary pathway for that group of organisms.
- ❖ These diagrams are used to predict which organisms should appear in the fossil record and their order in the stratigraphic column.

- ❖ Sometimes the organisms appear in the predicted order, but often they do not match the predictions.
- ❖ Many “older” organisms (as depicted in cladograms) appear above, not below the supposedly “younger” ones in the stratigraphic column.
- ❖ This is the case with the primate fossil record, which poorly reflects the predicted evolutionary theory.
- ❖ The problem is not a serious with the sequence of mammal-like reptiles.
- ❖ However, five of the intermediate forms that the cladograms predict should appear in sequence order over a long time actually appear suddenly at the same time in the stratigraphic record.
- ❖ The sequence predicted by the cladograms does not match the real sequence in the fossil record.

The Problem of Size

- ❖ Some textbooks alter the size of pictures showing the order of appearance of groups such as the mammal-like reptiles.
- ❖ This practice creates the impression of a close genealogical relationship and a gradual phylogenetic transition.
- ❖ This is the case of the representations of the mammal-like reptiles.

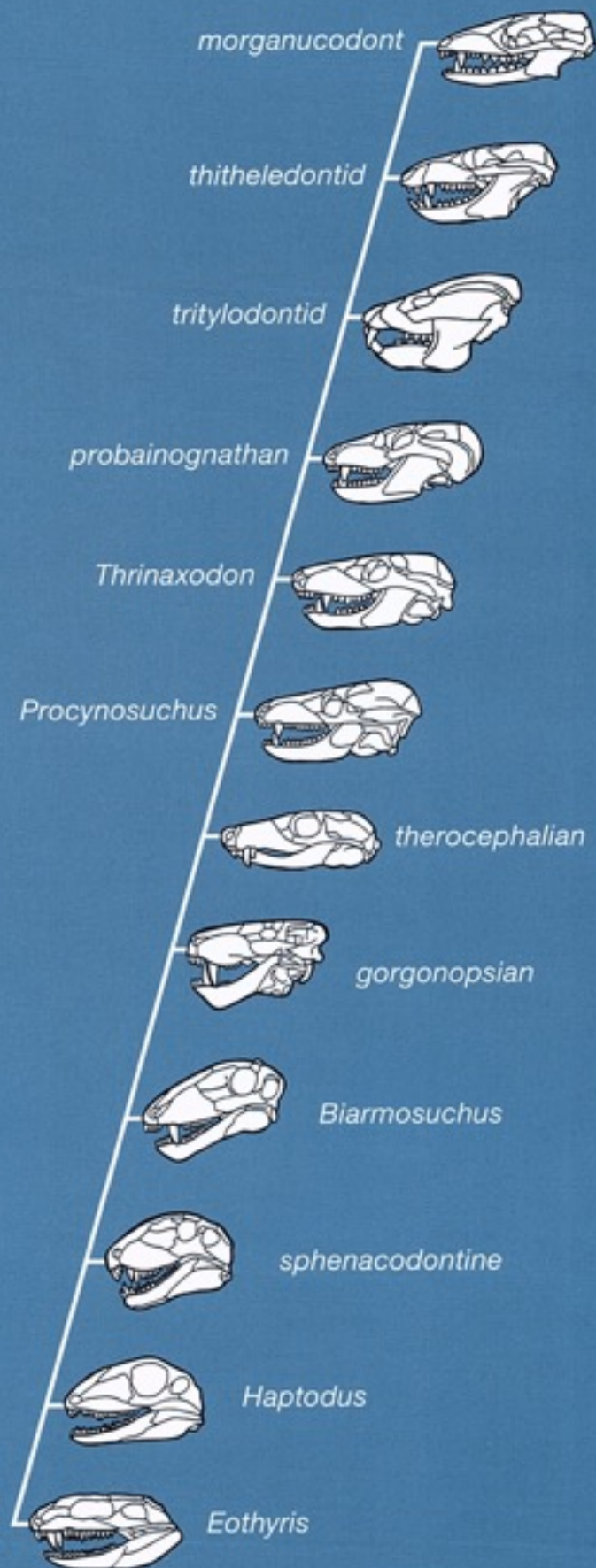


Figure 1:6 Sequence of Mammal-like reptiles as typically presented in textbooks.
 From T.S. Kemp, *The Origin & Evolution of Mammals* (2005): 89.

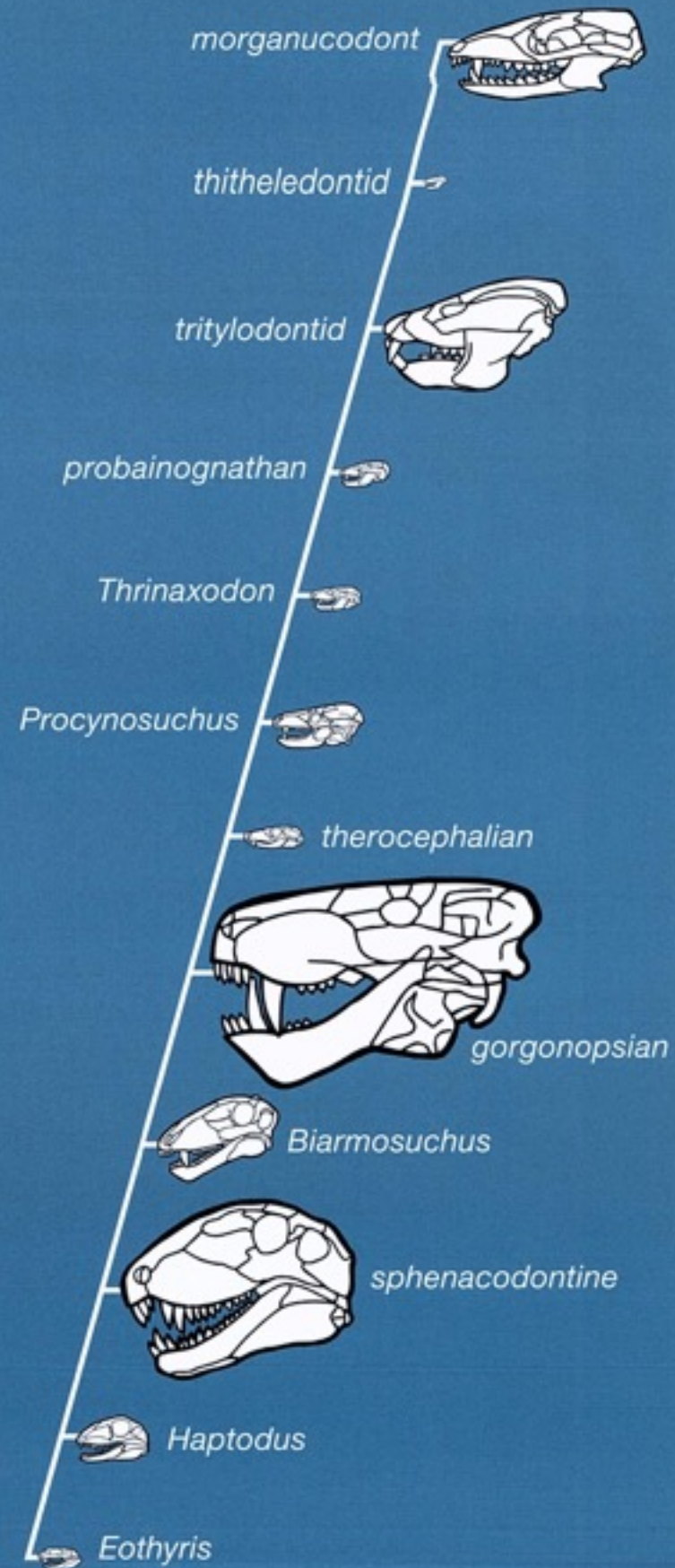


Figure 1:8 Sequence of Mammal-like reptiles, shown to scale (compare to Figure 1:6 on page 21).
 Recalculated, from T.S. Kemp, *The Origin & Evolution of Mammals* (2005).

The Problem of Time

- ❖ The evolutionary sequences presented in textbooks imply that the successive fossil forms appear in the fossil record in the predicted time and stratigraphical position according to cladograms.
- ❖ However, that's often not the case.
- ❖ The fossil record shows not such precision.
- ❖ Different skeletons, including the mammal-like reptiles, were not found in the predicted stratigraphic order.
- ❖ Some supposed ancestors and descendants appear in widely separated strata, representing tens of millions of years.

- ❖ In this sense, zoologist Henry Gee (1999) points out,
 - ❖ “The intervals of time that separate the fossils are so huge that we cannot say anything definitive about their possible connection through ancestry and descent.”
- ❖ The same author, referring to the sequence of hominids that allegedly supports evolution of humans from apes, states,
 - ❖ “New fossil discoveries are fitted into this [evolutionary] preexisting story. We call these new discoveries 'missing links', as if the chain of ancestry and descent were a real object for our contemplation, and not what it really is: a completely human invention created after the fact, shaped to accord with human prejudices. In reality, the physical record of human evolution is more modest. Each fossil represents an isolated point, with no knowable connection to any other given fossil, and all float around in an overwhelming sea of gaps.”

The Fossil Record and Evolution

- ❖ Evolutionists claim that the fossil record proves evolution.
- ❖ Some authors make bold assertions like this one by George G. Simpson:
 - ❖ “Currently it makes no sense to continue collecting and studying fossils simply to determine whether evolution is a fact. The question has been definitively answered in affirmative way.”
- ❖ However, other authors indicate that the fossil record is not fully supportive of evolution,
 - ❖ “The observed fossil pattern is invariably not compatible with a gradualistic evolutionary process.” (Kemp 1996)

Conclusion

- ❖ Fossils are not randomly distributed in the geological column.
- ❖ A broad look at the fossil record seems to suggest gradual appearance of the major groups of animals and plants.
- ❖ This seems to fit the theory of gradual evolution of life.
- ❖ However, a detail analysis shows that that is not the case.

Conclusion

- ❖ Several patterns of the fossil record are contrary to what we expect in the Darwinian gradual evolution:
 - ❖ The scarcity of good transitional forms between the different orders or families of organisms.
 - ❖ The abrupt appearance of new groups of organisms (plants and animals).
 - ❖ The Cambrian Explosion, in which the majority of the groups of animals arise abruptly fully formed and highly complex without ancestors.
 - ❖ Other sudden appearances in the fossil record above the Cambrian.
 - ❖ High morphological and functional disparity at the Cambrian explosion.
 - ❖ High biological and ecologic specialization from the very beginning.
 - ❖ High biological diversity from the beginning.

Conclusion

- ❖ Different groups of organisms (plants and animals) appear abruptly in the fossil record.
- ❖ Sedimentary rocks do not contain a detailed record of organisms that show a gradual evolution from "simple" organisms to more complex.
- ❖ Plant and animal fossils do not form a continuous change as Darwin suggested, but are discrete elements.
- ❖ There seems to be either a problem with the fossil record or with the idea of gradual evolution.
- ❖ Maybe evolution is not the best model to explain the fossil record.
- ❖ The absence of clear and abundant transitional forms is exactly what we would expect to find in a creation model.

References

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