Extinction & Global Biotic Change through Time

14 1

Earth's biota has changed [redacted]
in life's nearly **4 billion years**

Life's many lineages follow diverse fates:

diversification and **extinction**;

the **balance** between these processes affects
the **composition** &
the **diversity** of earth's biota.

sometimes extinction permits diversification;
other times diversification drives extinction

14 2

recall that life was dominated for over
half its extent by **PROKARYOTES**

>2 BILLION YEARS

development of **oxygenic photosynthesis**
about 2.8 billion y.a.
radically changed the earth's atmosphere

triggered massive **extinctions of some lineages**
and **proliferations of others.**

thus altering the composition of the biota

14 3

somewhere between **2 -1.5 b.y.a.**
eukaryotes arise (S.E.T.)

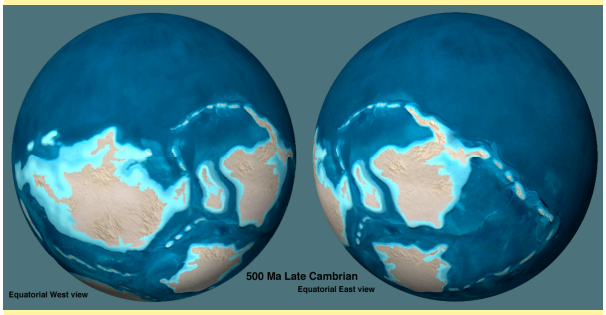
contribute greatly to speed of rise of global oxygen levels; reached ~5%
by ~1b.y.a. - ***first metazoans inferred***

long hidden history until ~6-700 m.y.a., when
first clear metazoan fossils appear (~10% O_2)

PHANEROZOIC begins

14 4

an unrecognisable world



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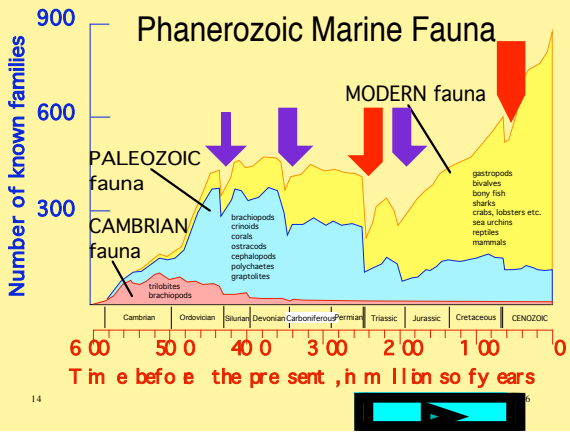


14 6

CAMBRIAN FAUNA

trilobites

brachiopods

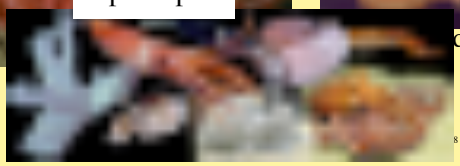
Cambrian & Ordovician - 700-450m.y.a.

14 7

PALEOZOIC FAUNA

450 - 250m.y.a.

cephalopods



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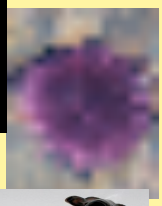
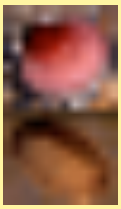
MODERN FAUNA

250m.y.a. - now





MODERN FAUNA

250m.y.a. - now

bony fish

mammals

14 sharks

The "Big Five"

though each are dramatic events
and have profound effects on
composition of the biota
(define Eras)

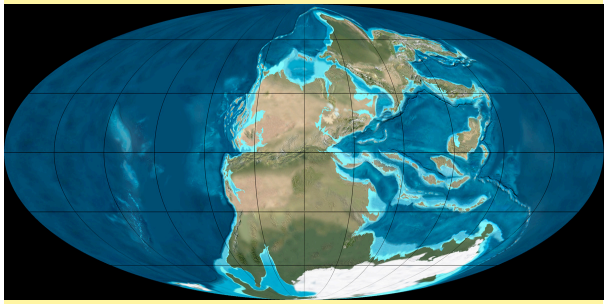
they account for only ~5% of all extinctions

majority goes on "in background"

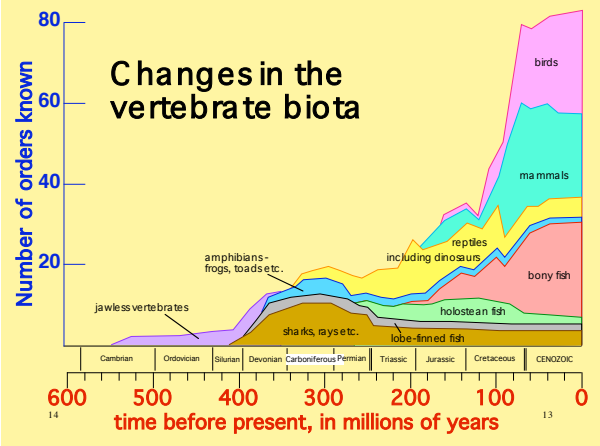
CATASTROPHES COMPETITION

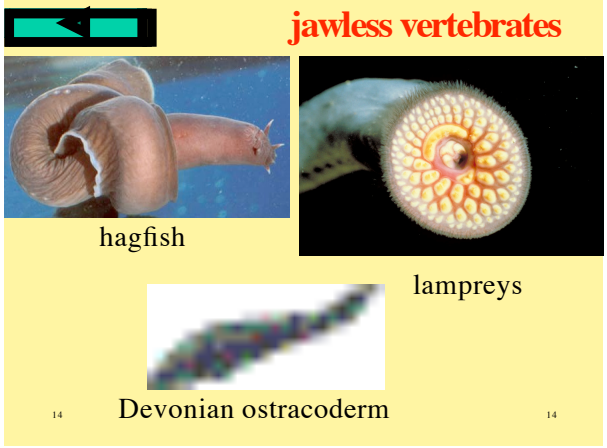
14 11

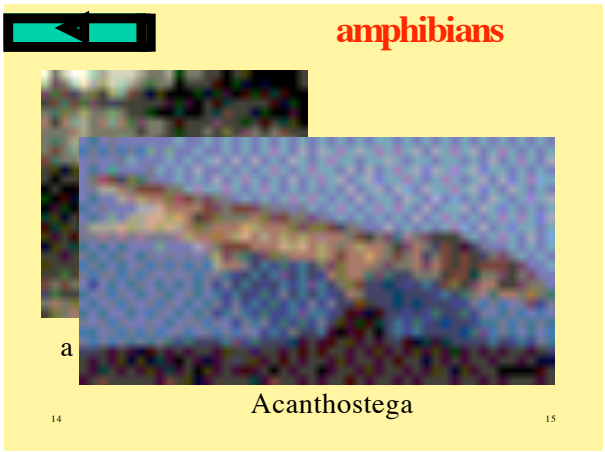
a world continent

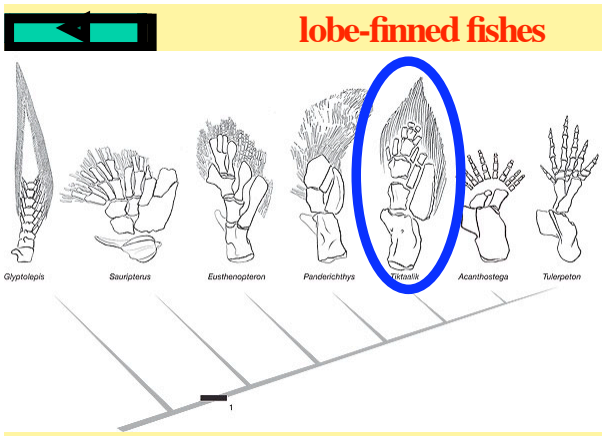


end-Permian ~255 m.y.a.

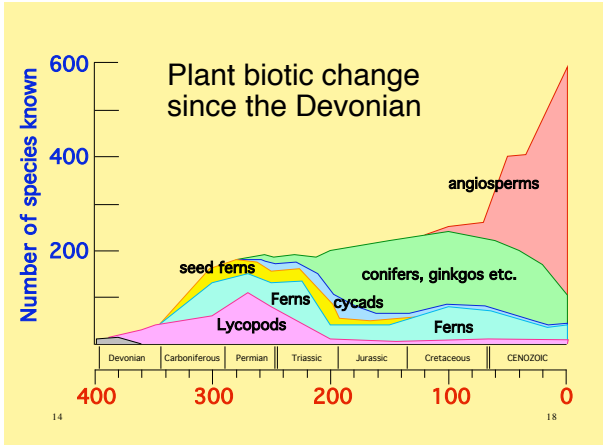

Changes in the vertebrate biota
Number of orders known
80
60
40
20
birds
mammals
reptiles including dinosaurs
bony fish
holostean fish
lobe-finned fish
sharks, rays etc.
amphibians - frogs, toads etc.
jawless vertebrates
Cambrian
Ordovician
Silurian
Devonian
Carboniferous
Permian
Triassic
Jurassic
Cretaceous
CENOZOIC
600
500
400
300
200
100
0
time before present, in millions of years


jawless vertebrates
hagfish
lampreys
Devonian ostracoderm

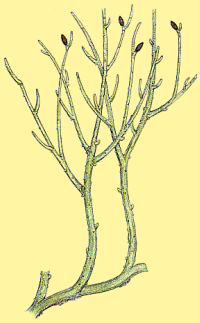

amphibians
a
Acanthostega


lobe-finned fishes
Glyptolepis
Sauripterus
Eusthenopteron
Panderichthys
Tiktaalik
Acanthostega
Tulerpeton


reptiles


Plant biotic change since the Devonian
Number of species known
600
400
200
angiosperms
seed ferns
conifers, ginkgos etc.
Ferns
cycads
Lycopods
Ferns
Devonian
Carboniferous
Permian
Triassic
Jurassic
Cretaceous
CENOZOIC
400
300
200
100
0

early Paleozoic vegetation



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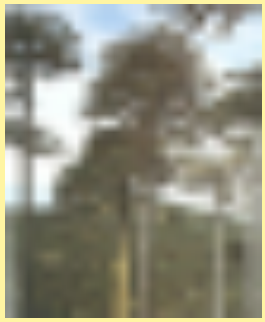
mid-Paleozoic vegetation

14 20

Mesozoic vegetation

cycads



gymnosperms

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based on current knowledge of fossil record
average species endures ~4 million years

given a working total of ~10 million species,
we expect ~ 4 s pp. to disappear / year

current rates are higher than this

perhaps we are on the brink of a major period of biotic turnover, of unpredictable severity and consequences

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NEXT CLASS

Historical Biogeography:

how evolutionary lineages came to be where they are now

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