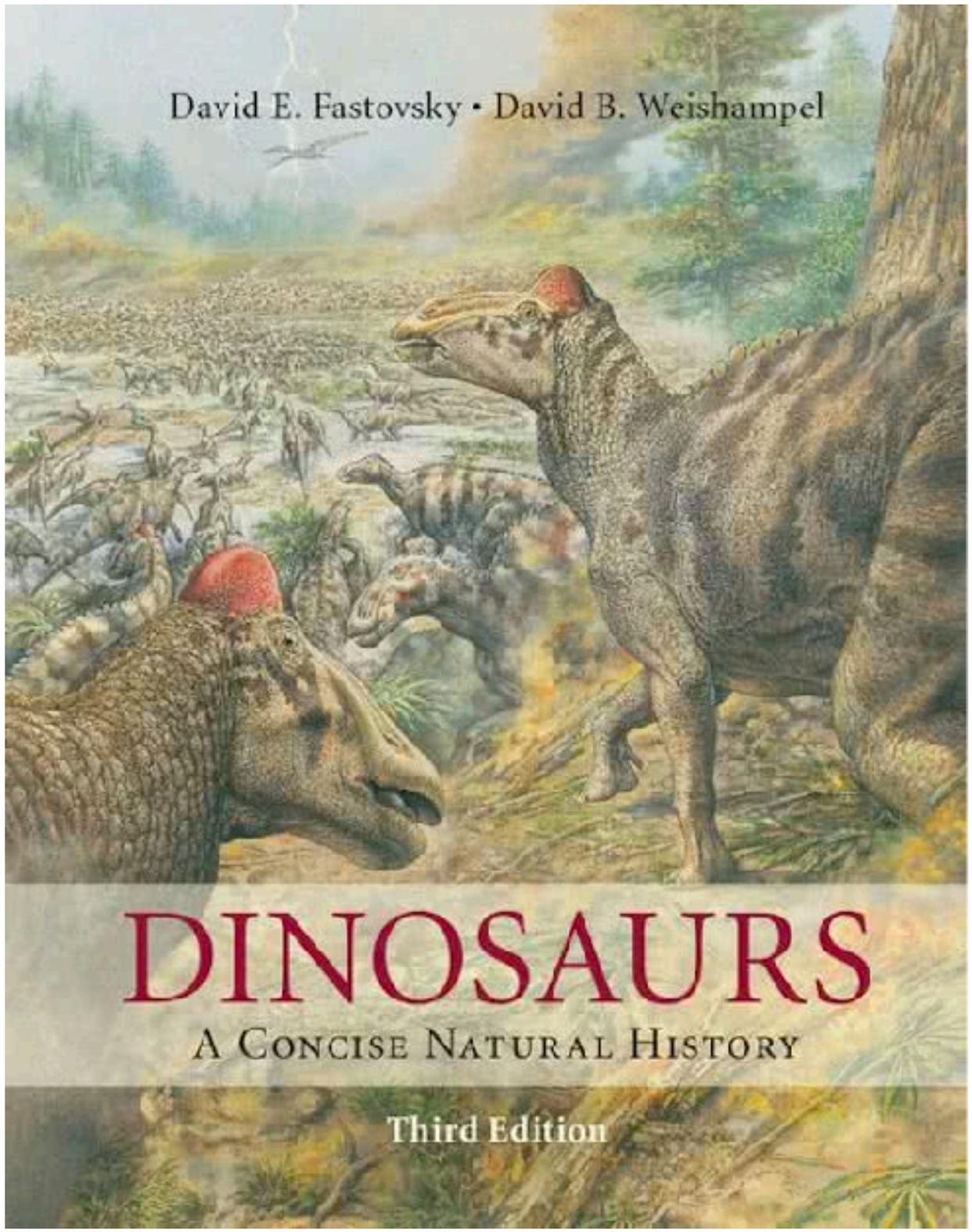


Reading for this week:
Fastovsky & Weishampel

Chapter 4: Who are the dinosaurs?

Chapter 5: Dinosaurs in the beginning

After this we will start skipping around

CHANGE TO THE SYLLABUS AND EXAM DATE

Today: End-Permian and Intro to Dinosauria

Monday (2/5): DinoFilm - attendance required

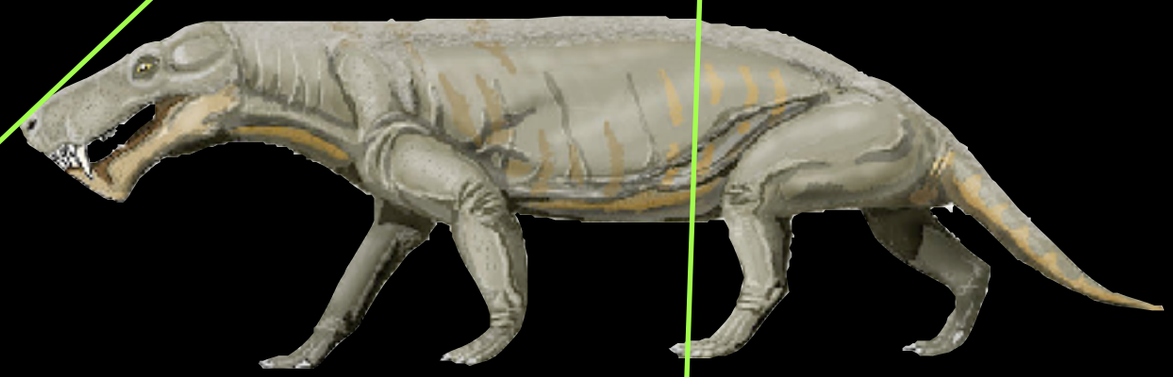
Wednesday (2/7): Finish up / Exam review

Monday (2/12): EXAM I

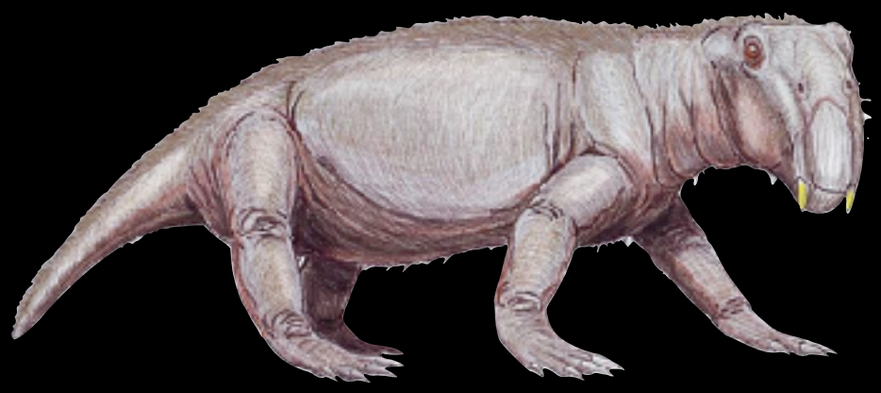
Tetraceratops

- Basal
- Dinocephalia
- Dicynodontia
- Gorgonopsids
- Mammal Ancest.

Moschops



Arctognathus



Lystrosaurus

Cynodontia

Derived Synapsids
Therapsida: Mid-Late Permian

Synapsida

Anapsida

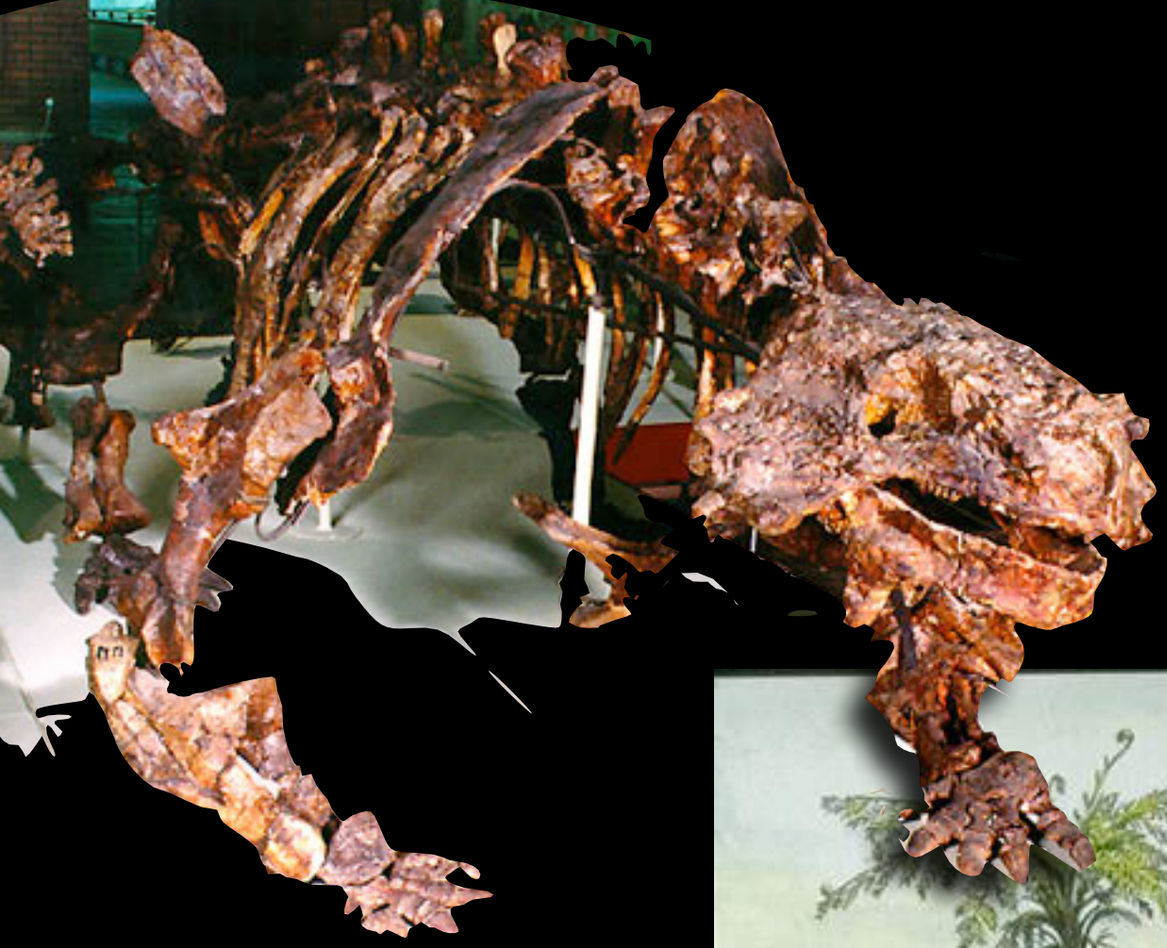
Lepidosauria

Archosauria

Diapsida

Eureptilia

Amniotes



Scutosaurus

Anapsids

-Late Permian

Pareiasaurs

-Vegetarians

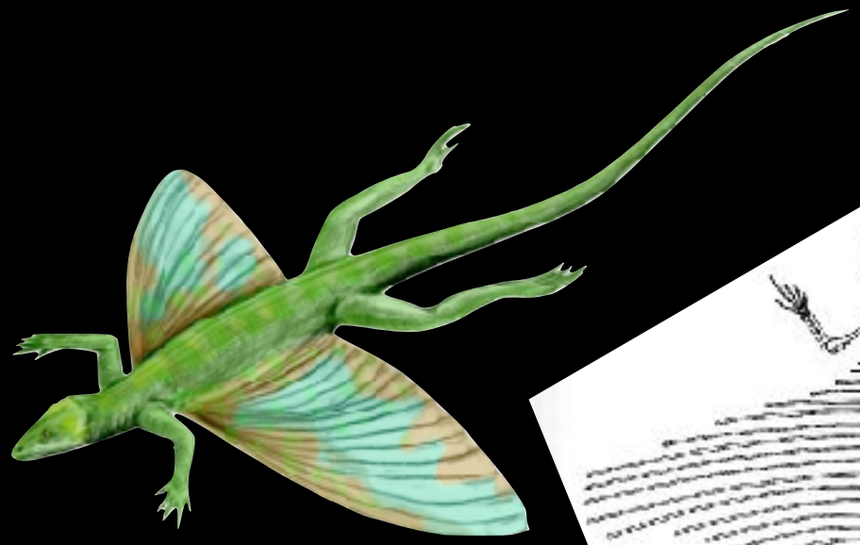
Lepidosauria

Archosauria

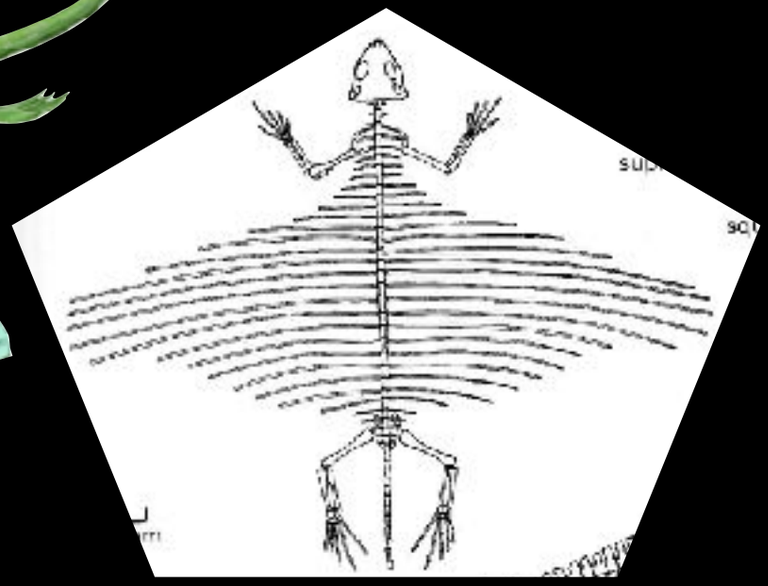
Diapsida

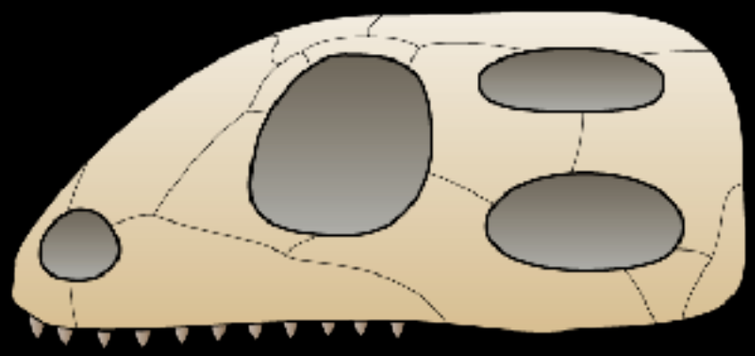
Diapsids in the Permian

Weird, Wonderful,
and Rare



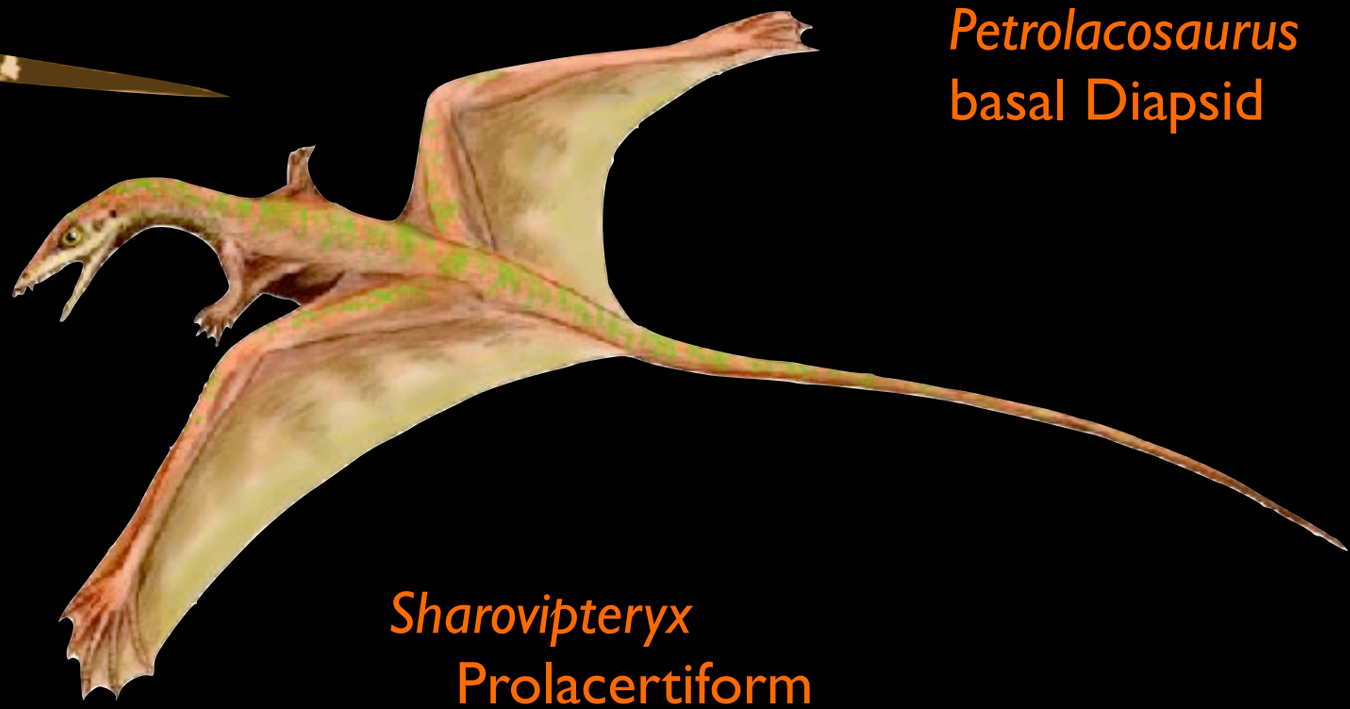
Coelurosauravus





Petrolacosaurus
basal Diapsid

Protorosaurus
Prolacertiform

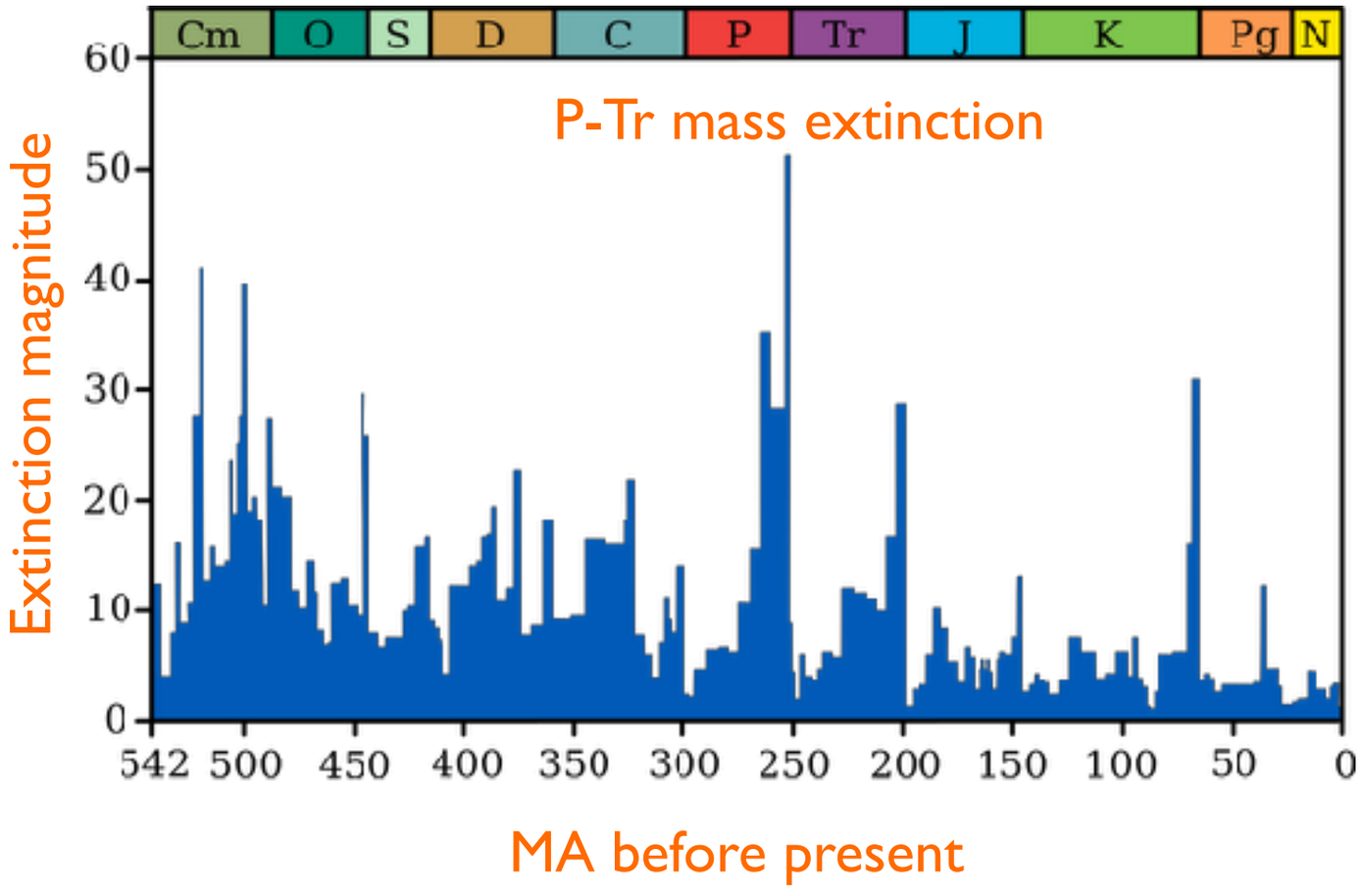


Sharovipteryx
Prolacertiform

The Permo-Triassic Extinction:

The 'Great Dying'

The ‘Death Curve’



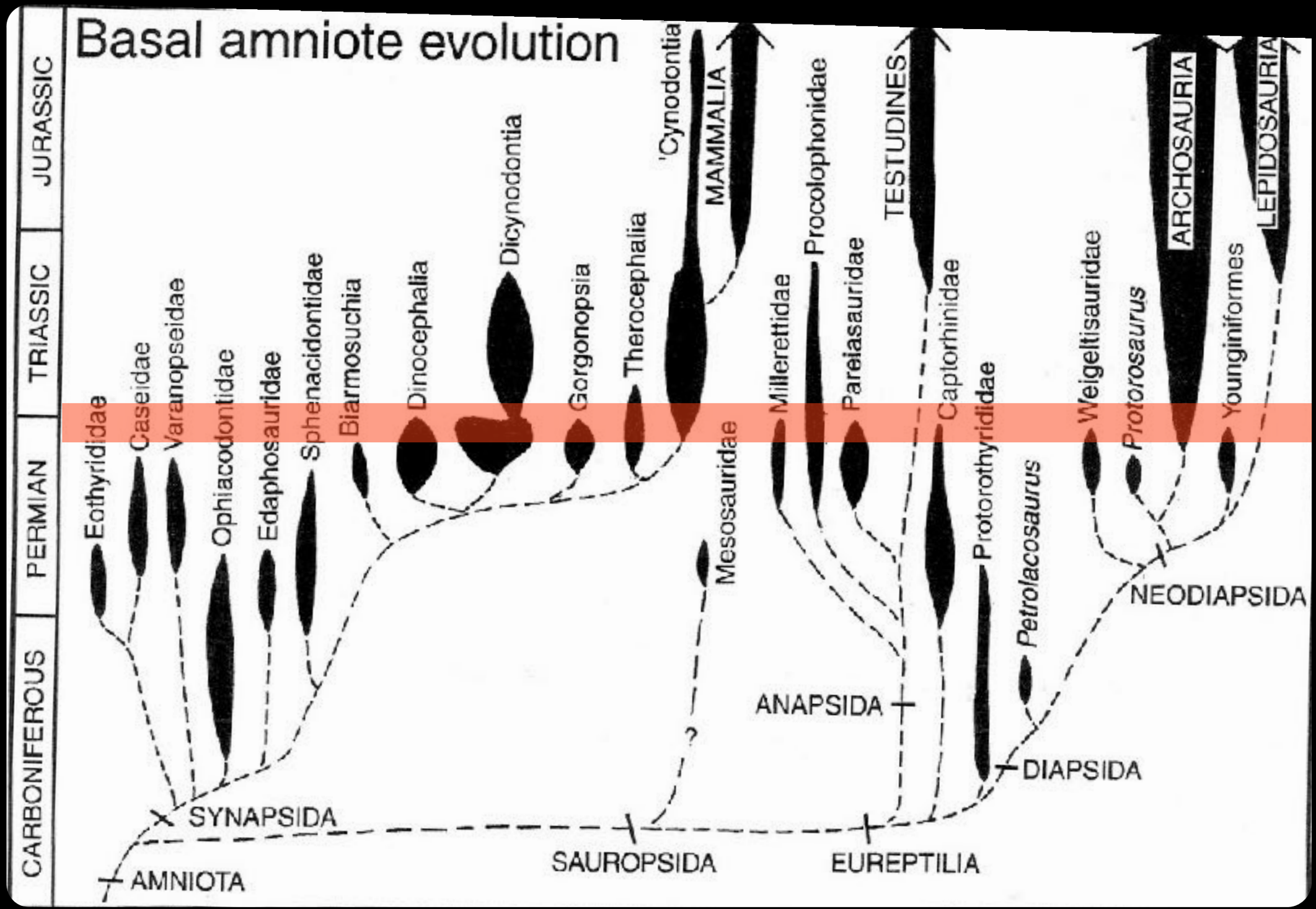
50% of marine families were lost across the Permo-Triassic @ 251 Ma

scales to ca. 96% species loss in the sea

70% vertebrate species lost on land

Only known mass extinction of insects

Basal amniote evolution



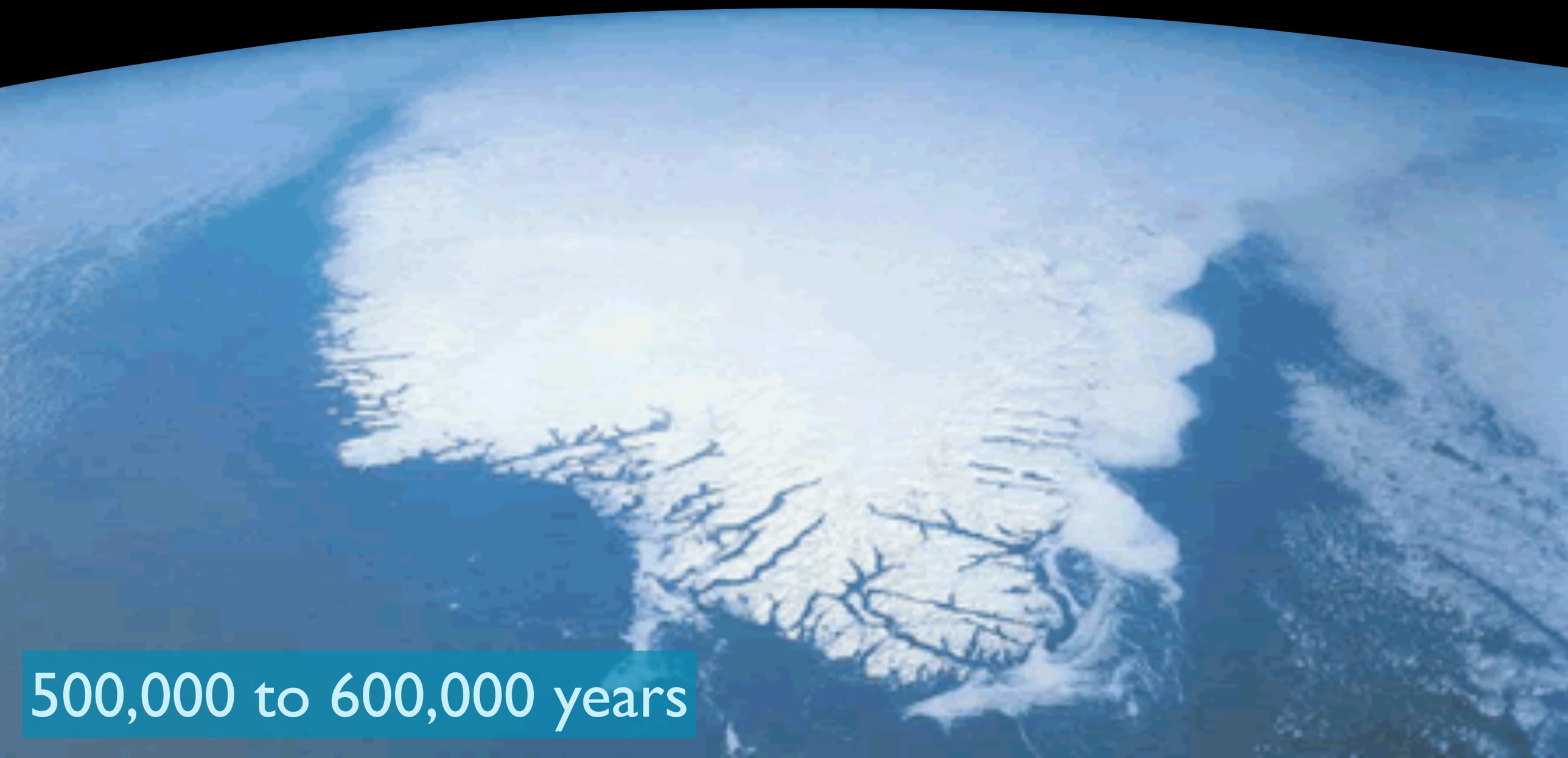
Plant Dieback => Catastrophic Erosion

Evidence:

- Increased erosion
- Fungal explosion
- Worldwide distribution
- Coal Gap

Slow Terrestrial Floral Collapse- Greenland Pollen/Spore Cores

- Fungal activity followed loss of forests and herbaceous veg
- Successional weedy vegetation takes hold
- Fern and cycad expansion
- Most successional plants vanish, lycopsids remain
- Plant abundance is drastically reduced (few pollen/spores)



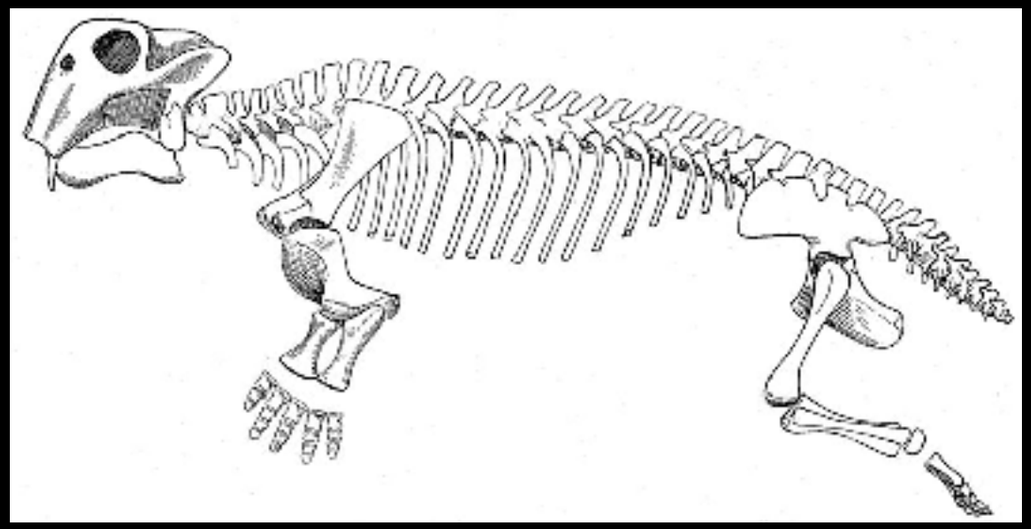
500,000 to 600,000 years

If plant collapse initiated terrestrial extinctions, what caused the plant collapse???

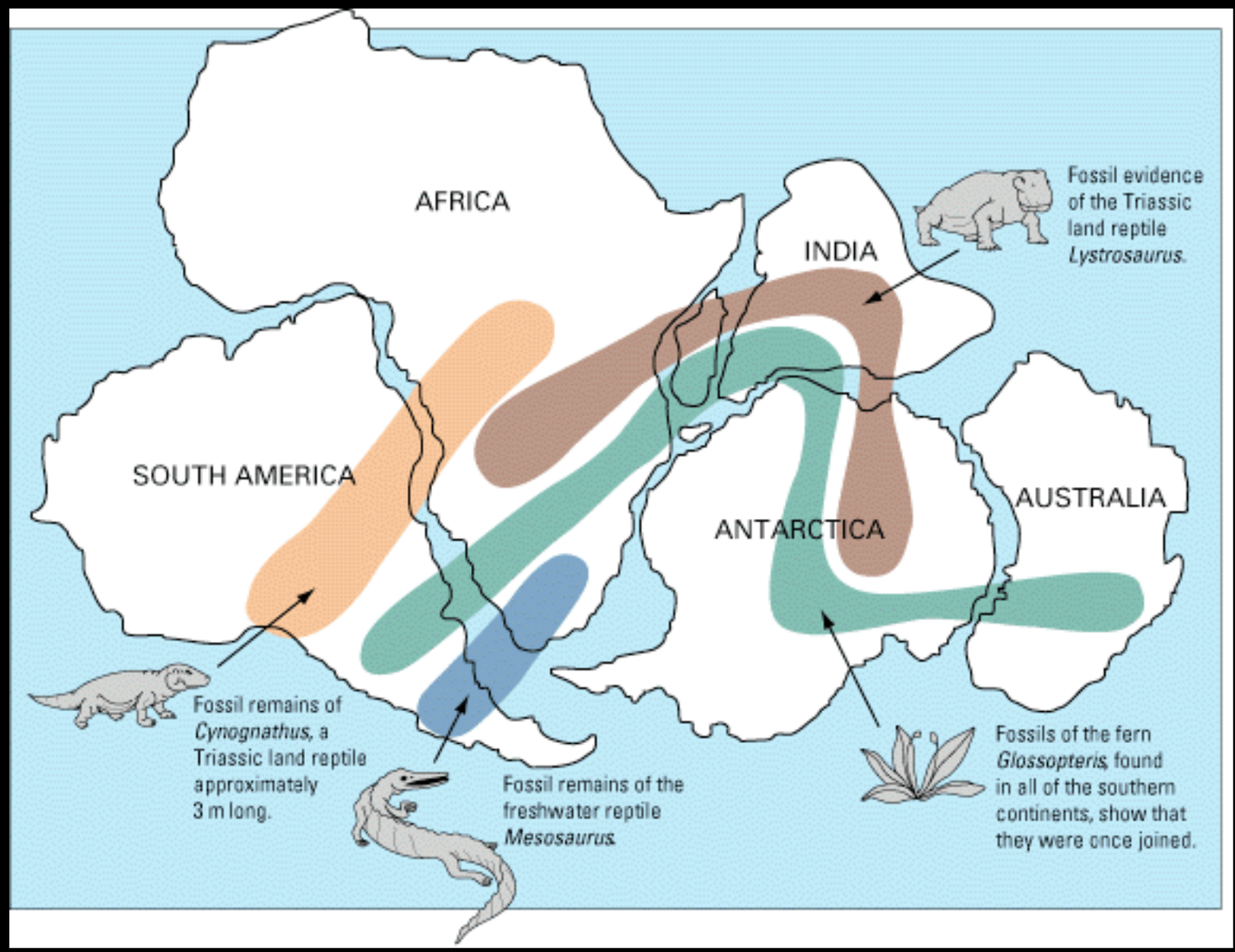
Flavor of the Day: The Siberian Traps

Poisoned the atmosphere and led to massive plant death

Lystrosaurus: the Disaster Taxon



Expansion
-Few herbivorous competitors
-Few carnivorous predators
95% terrestrial faunas!
-@ 1 meter, the largest animal on earth

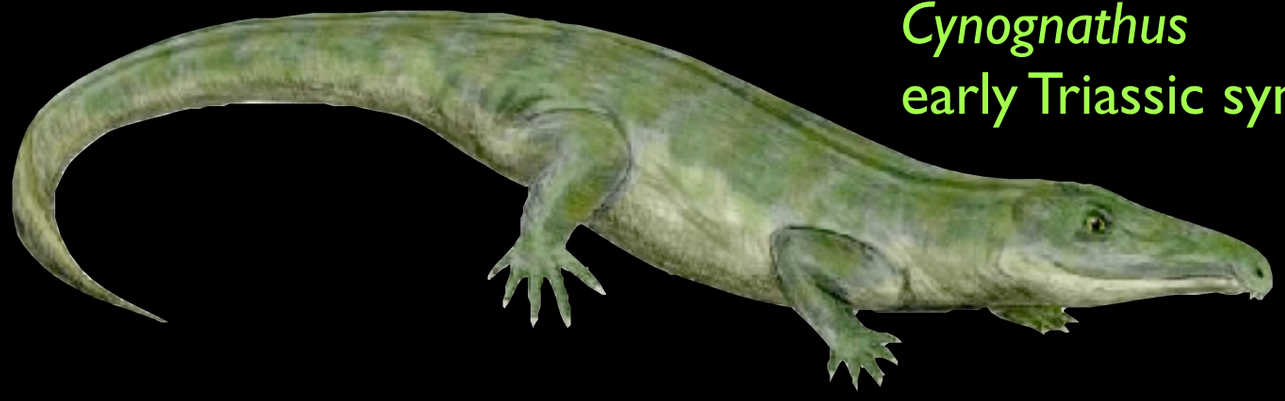


There was probably nothing 'special' about *Lystrosaurus*...
It was just lucky... this is a pattern in extinction events.

Temnospondyl amphibians

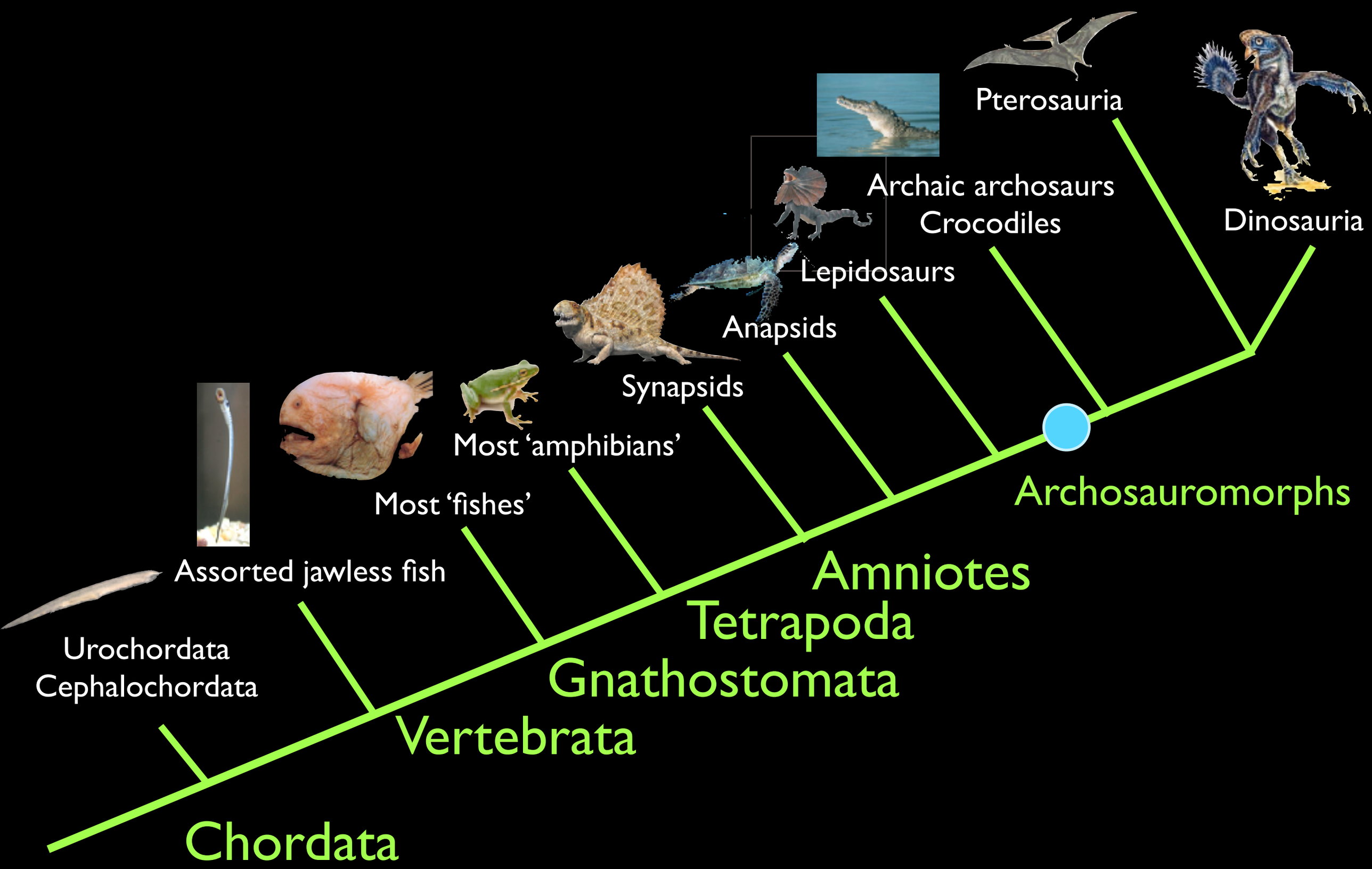
Mastodonsaurus
(aquatic)

Cynognathus
early Triassic synapsid

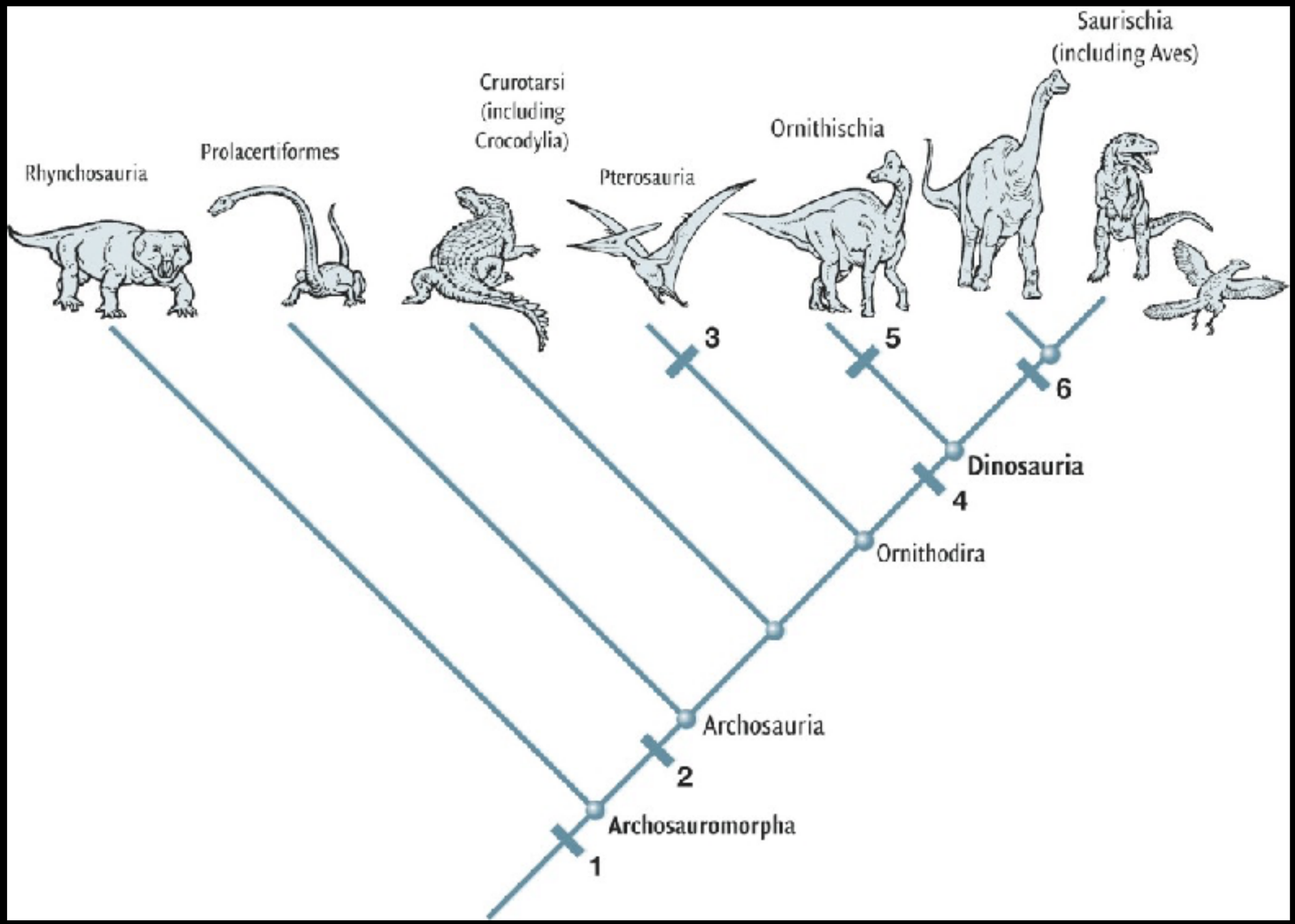


Proterosuchus
Archosaur

Dicynodonts	Remained important
Cynodonts	Herbivores


Pterosauria
Dinosauria
Archaic archosaurs
Crocodiles
Lepidosaurs
Anapsids
Synapsids
Most ‘amphibians’
Most ‘fishes’
Assorted jawless fish
Urochordata
Cephalochordata
Archosauromorphs
Amniotes
Tetrapoda
Gnathostomata
Vertebrata
Chordata

The RISE of the ARCHOSAUROMORPHS!



Rhyncosauria

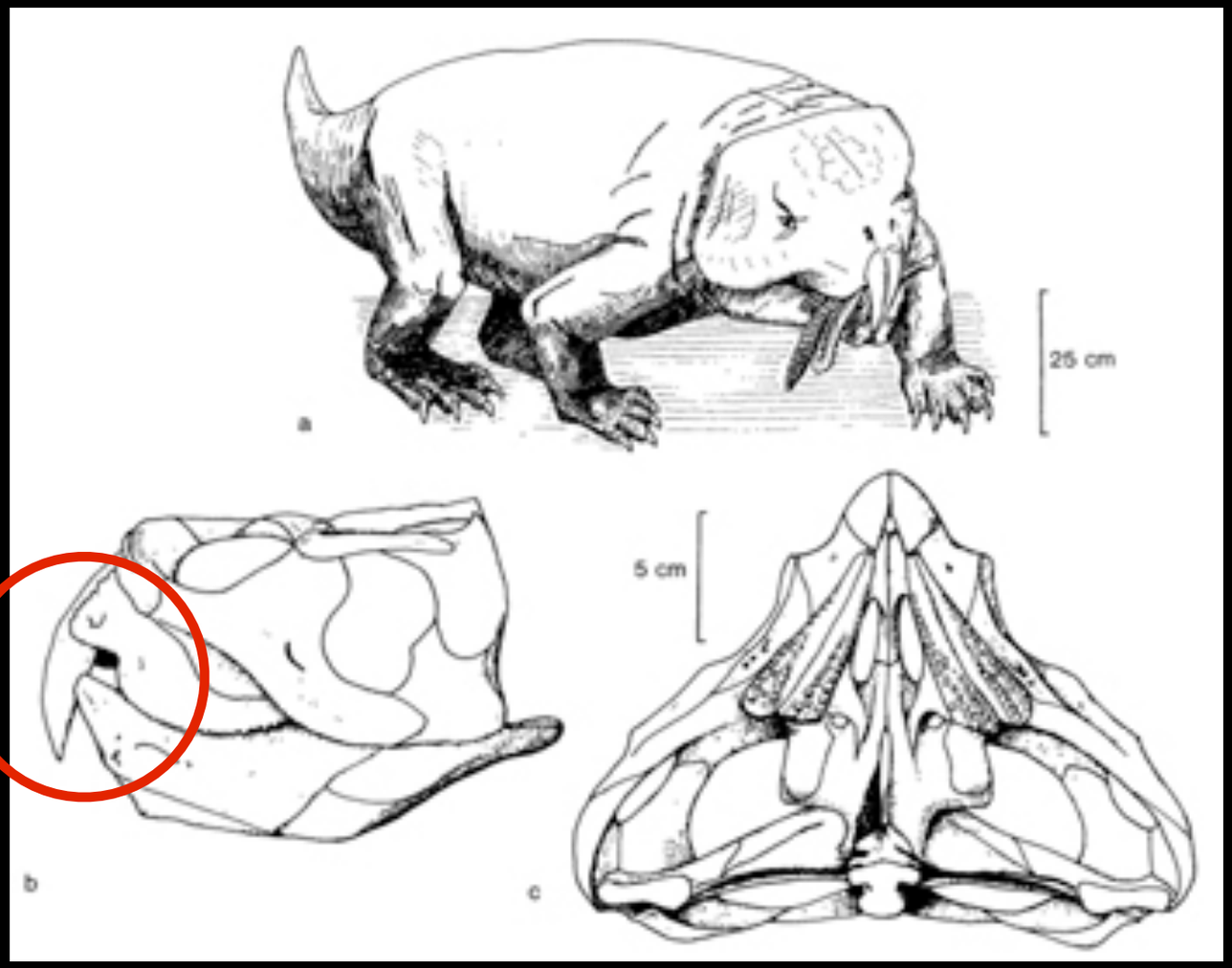
early Triassic

VERY abundant

Herbivorous

Pen-Knife Premaxilla/Dentary vs. 'rostral bone'

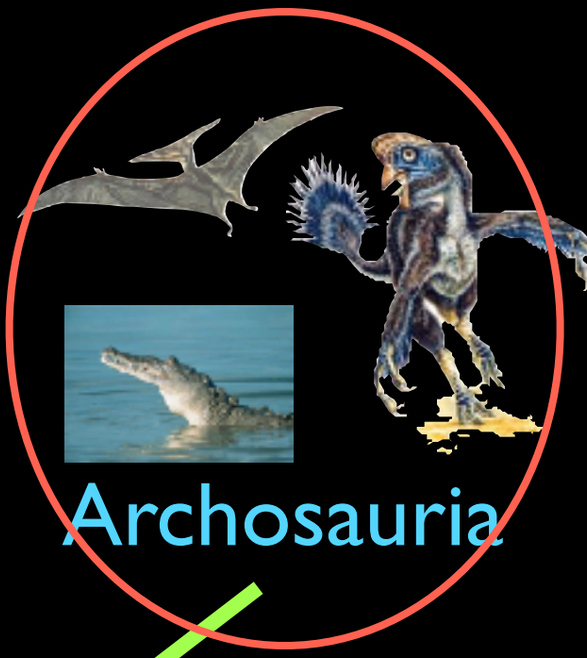
Precision Shear



Synapsida

Anapsida

Lepidosauria



Archosauria

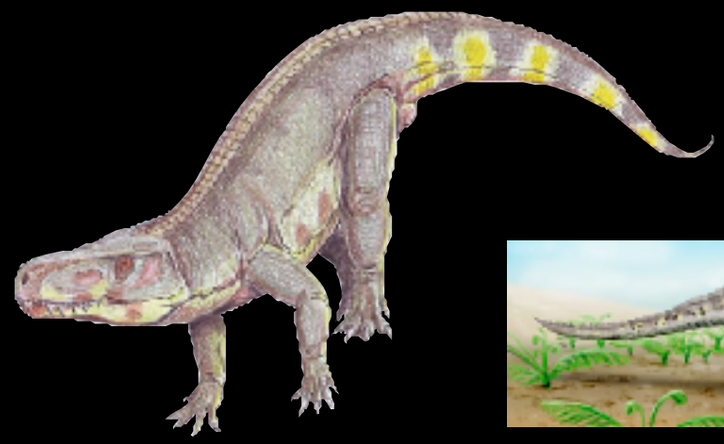
Archosauromorpha

Diapsida

Eureptilia

Amniotes

Crocodylomorpha



"Rauisuchia"

Ornithosuchidae

Pterosauria

Dinosauria

Ornithodira

Crurotarsi

Basal archosaurs

Crown-clade Archosauria

Archosauria

Archosauria: synapomorphies

Antorbital fenestra (in front of eye)
Teeth with serrated margins
Mandibular fenestra

Proterosuchus
Basal Archosaur

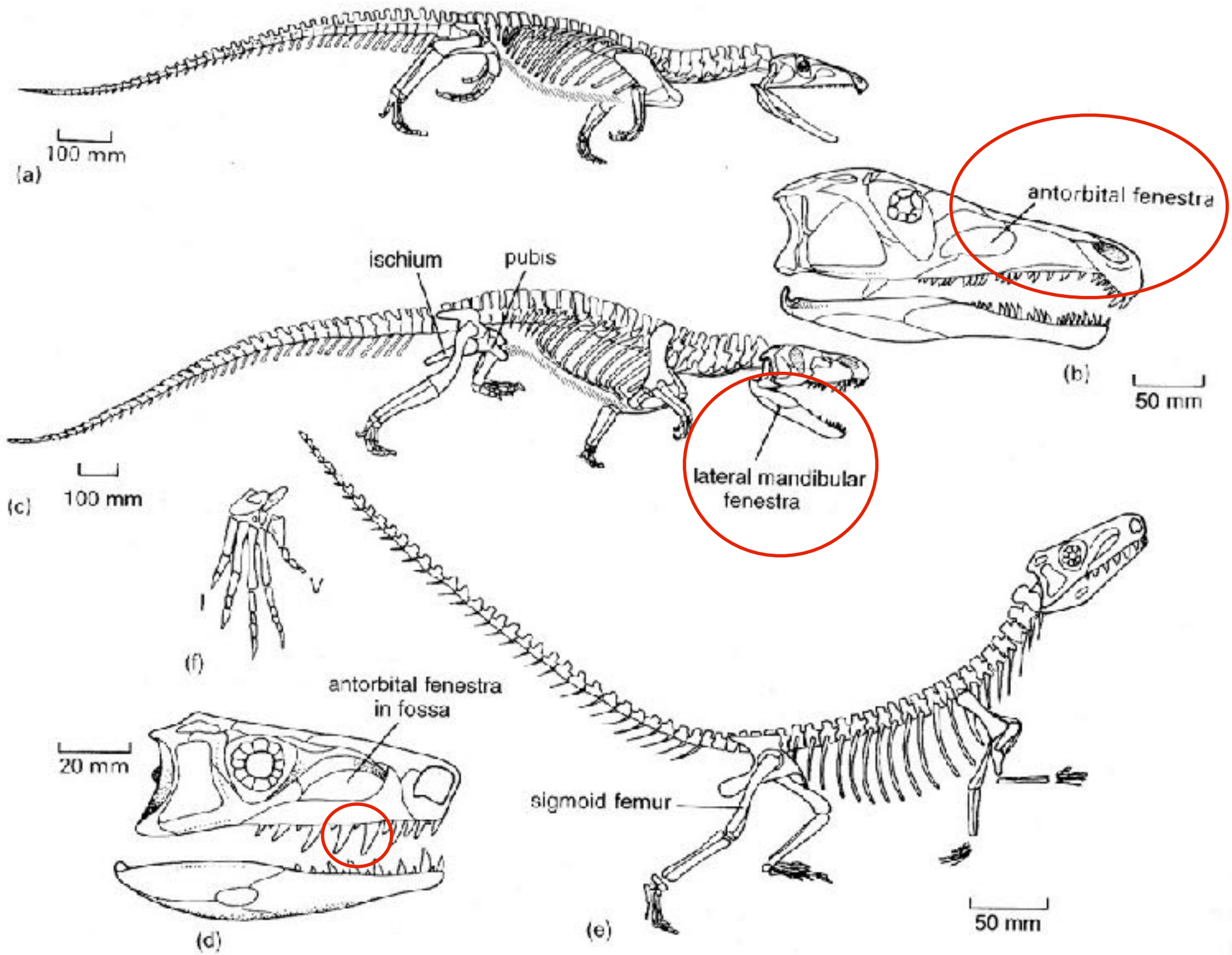


Fig. 6.2 Early Triassic archosaurs: (a, b) the proterosuchid *Proterosuchus*, skeleton in running posture, and skull; (c) the erythrosuchid *Vjushkovia*, skeleton in running posture; (d–f) the agile *Euparkeria*, skull in lateral view, skeleton, and foot. [Figures (a, c) based on Greg Paul, in Parrish 1986; (b) after Cruickshank, 1972; (c–f) after Ewer, 1965.]

Faculatative biped vs. Obligate biped

Euparkeria
Derived, Basal Archosaur
Bony dermal plates down back

Crocodylomorpha

"Rauisuchia"

Ornithosuchidae

Pterosauria

Dinosauria

Ornithodira

Crurotarsi

Basal archosaurs

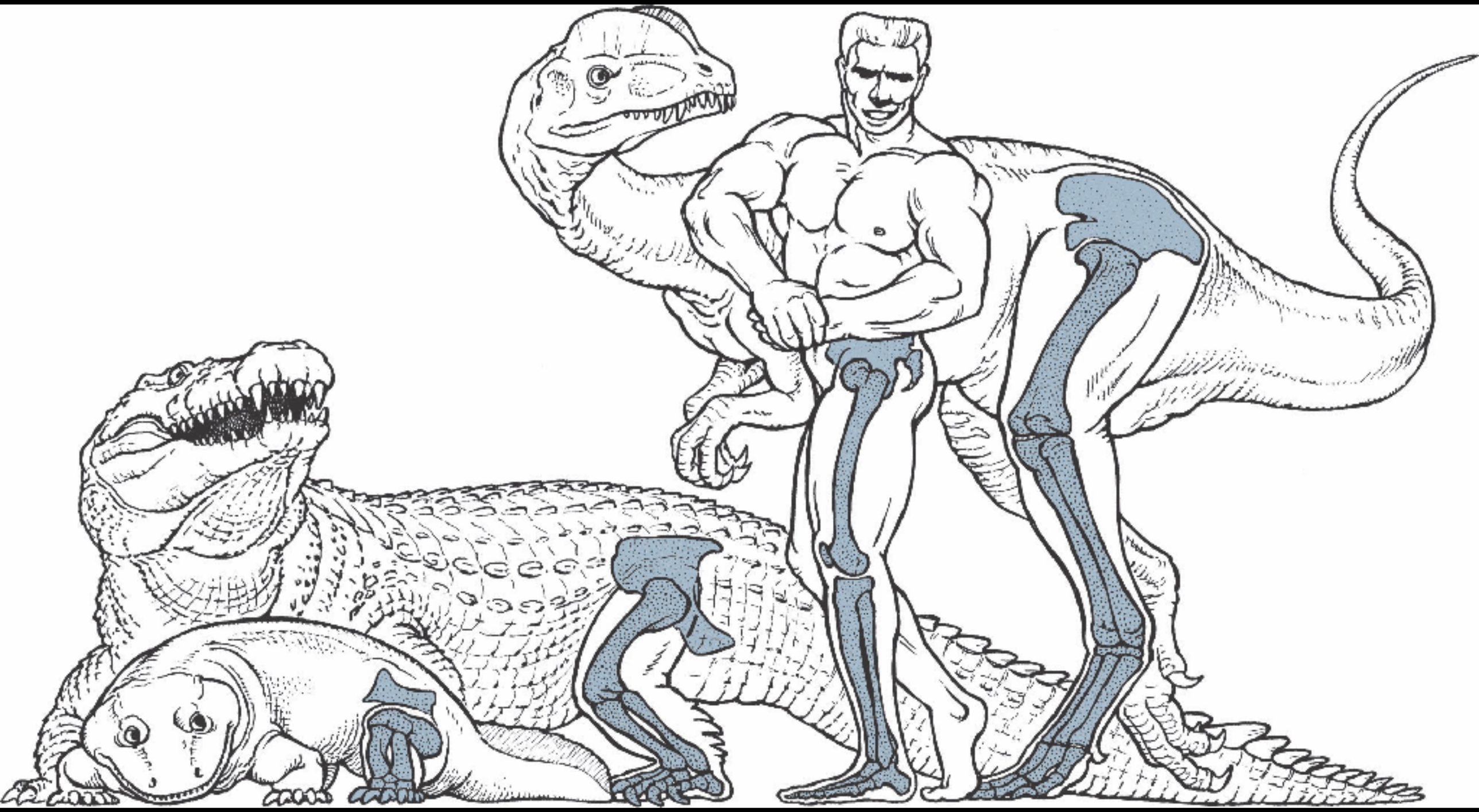
Crown-clade Archosauria

Archosauria

Stances:

sprawling <=> semi-erect <=> erect

aquatic <=> terrestrial

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Locomotion: Pelvic/Hind leg conditions:

Crocodylomorpha

Pillar-Erect

"Rauisuchia"

Ornithosuchidae

Buttress-Erect

Ornithodira

Crurotarsi

Crown-clade Archosauria

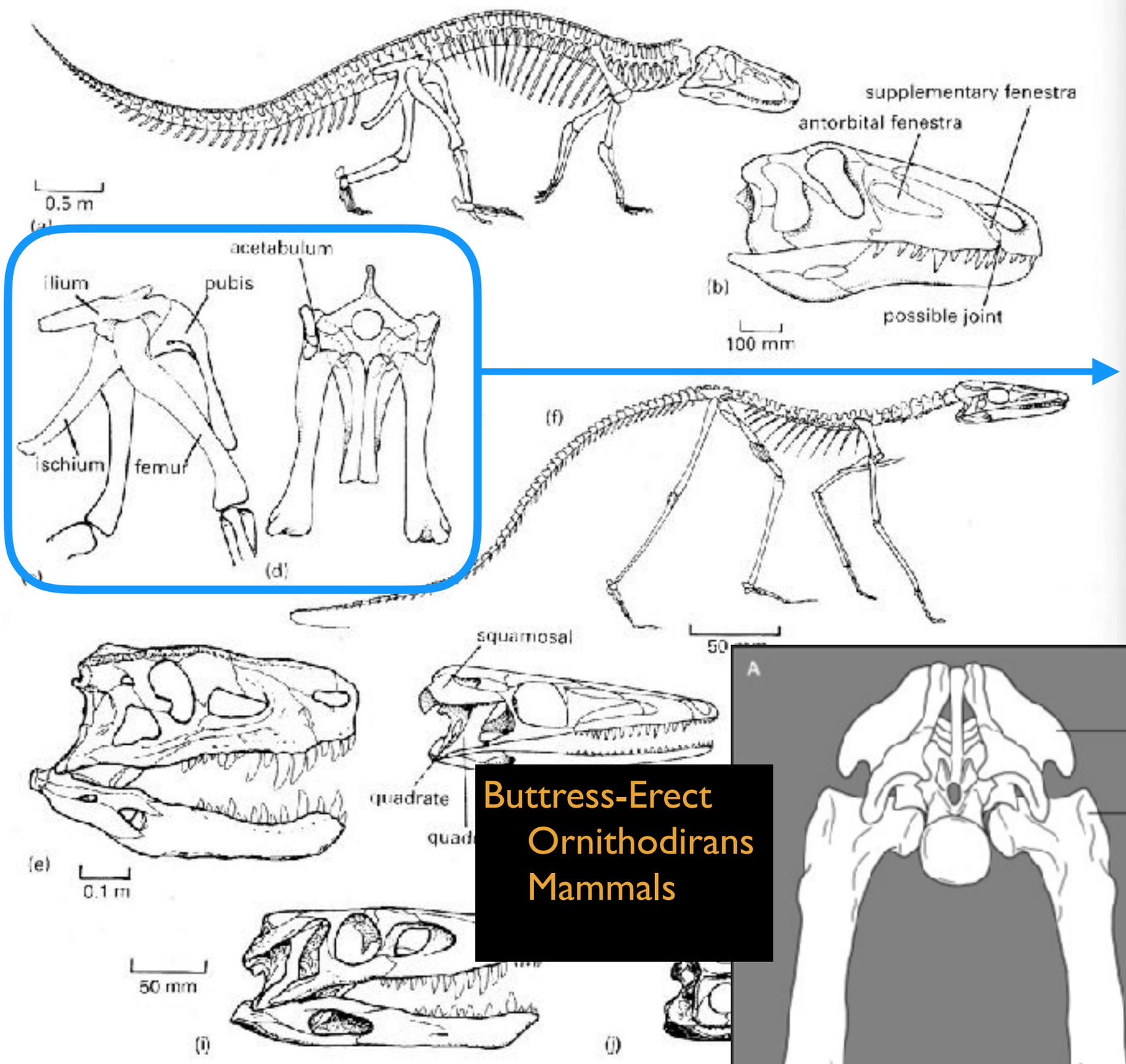
Basal archosaurs

Archosauria

Locomotion (Pelvis)

Rauisuchians
-Pillar-Erect Posture

Buttress-Erect
Ornithodirans
Mammals



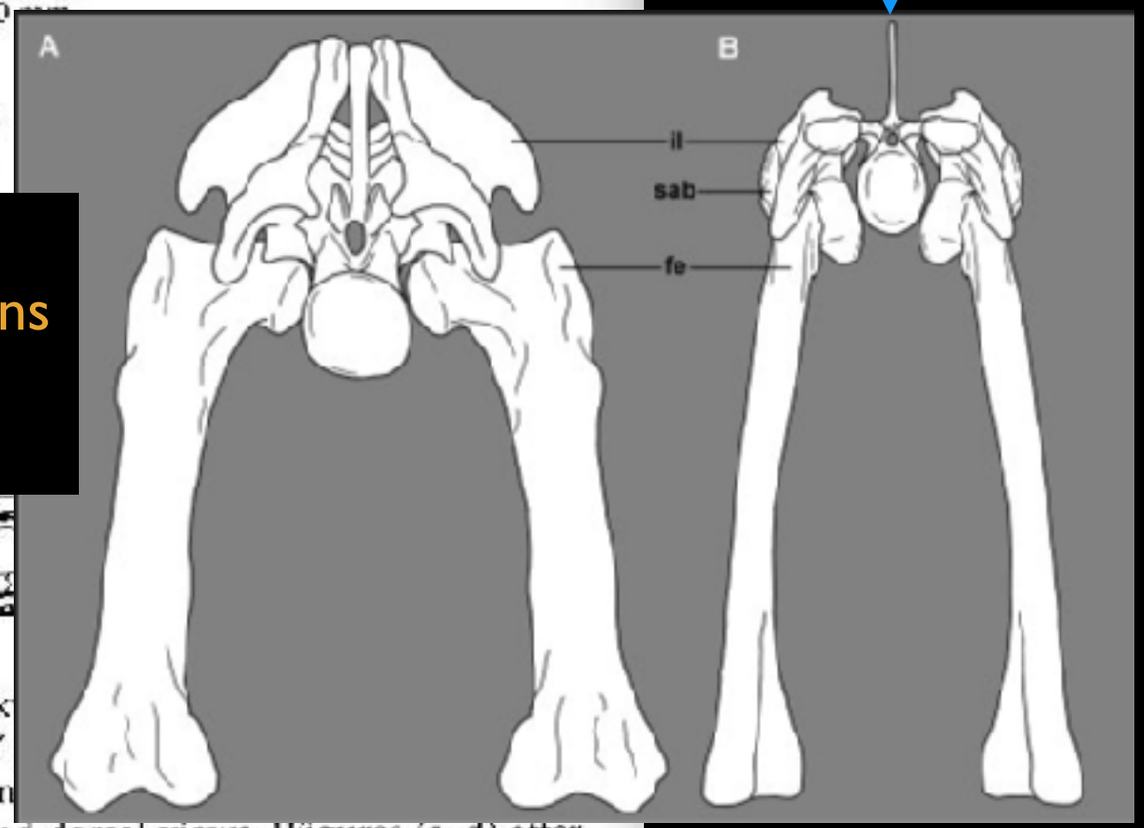
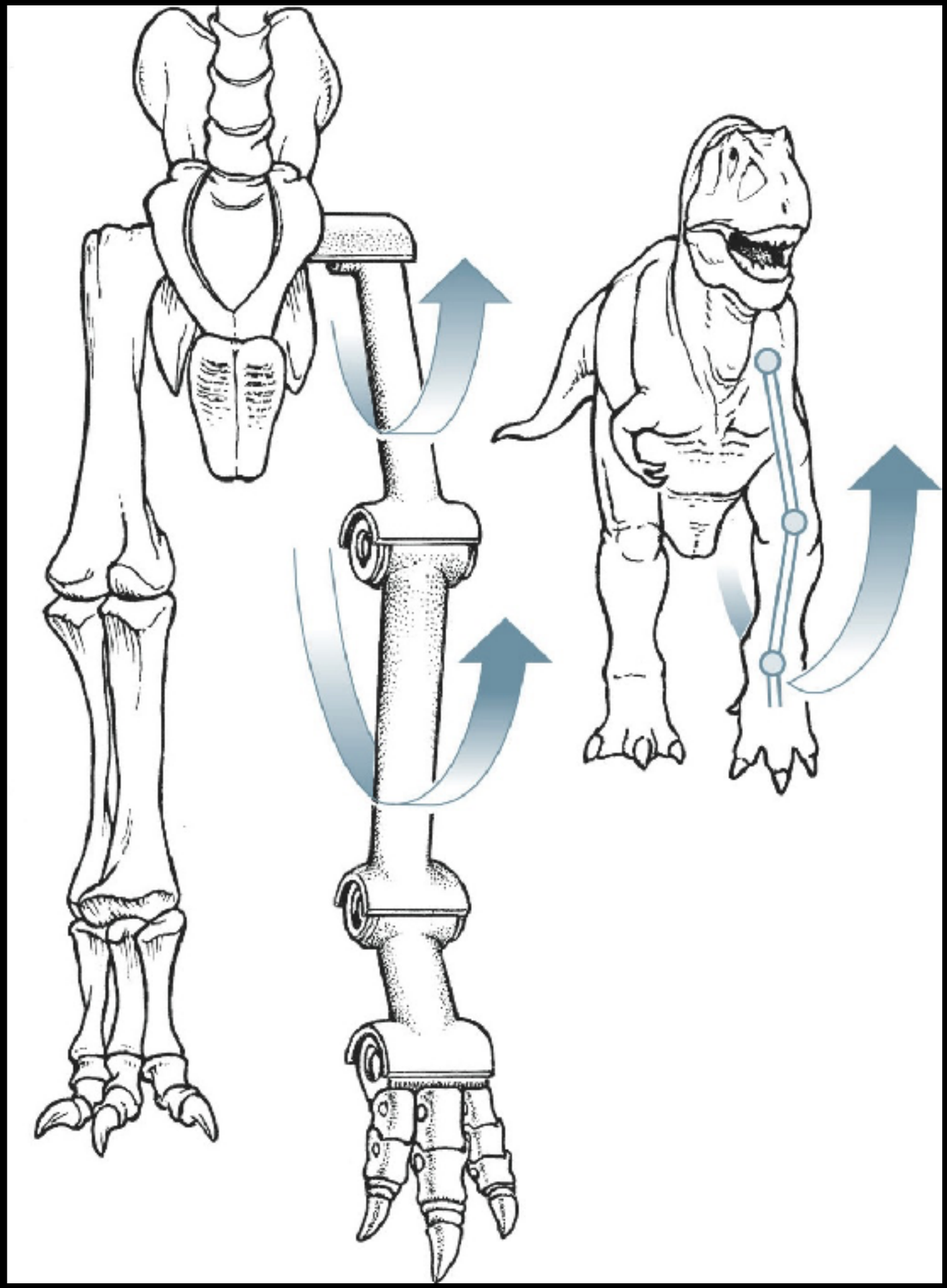


Fig. 6.4 The rauisuchid *Saurosuchus*: (a) skeleton in walking pose; (b) sk
and hind limbs in lateral and anterior views to show the 'pillar erect'
skull in lateral view; (f–h) the saltoposuchid *Terrestrisuchus*, skeleton
anterior view; (i, j) the sphenosuchid *Sphenosuchus*, skull in lateral and dorsal views. [Figures (a–d) after Bonaparte, 1981; (e) modified from Murry and Long, 1995; (f–h), after Crush, 1984; (i, j) modified from Walker, 1990.]



Barrel-like articulation
Constrained ‘twisting’ motion to the plane parallel with its body

Digitigrade
vs.
Plantigrade

Crocodylomorpha
- Late Triassic
- *Terrestrisuchus*
- *Saltoposuchus*
  - BIPEDAL!/TERRESTRIAL!

Terrestrisuchus

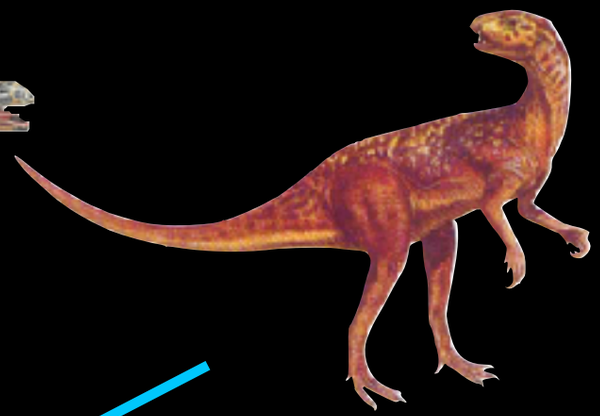
Saltoposuchus

A return to aquatic environments was more recent for crocodylomorphs

Pterosauria
(later)

Saurischia

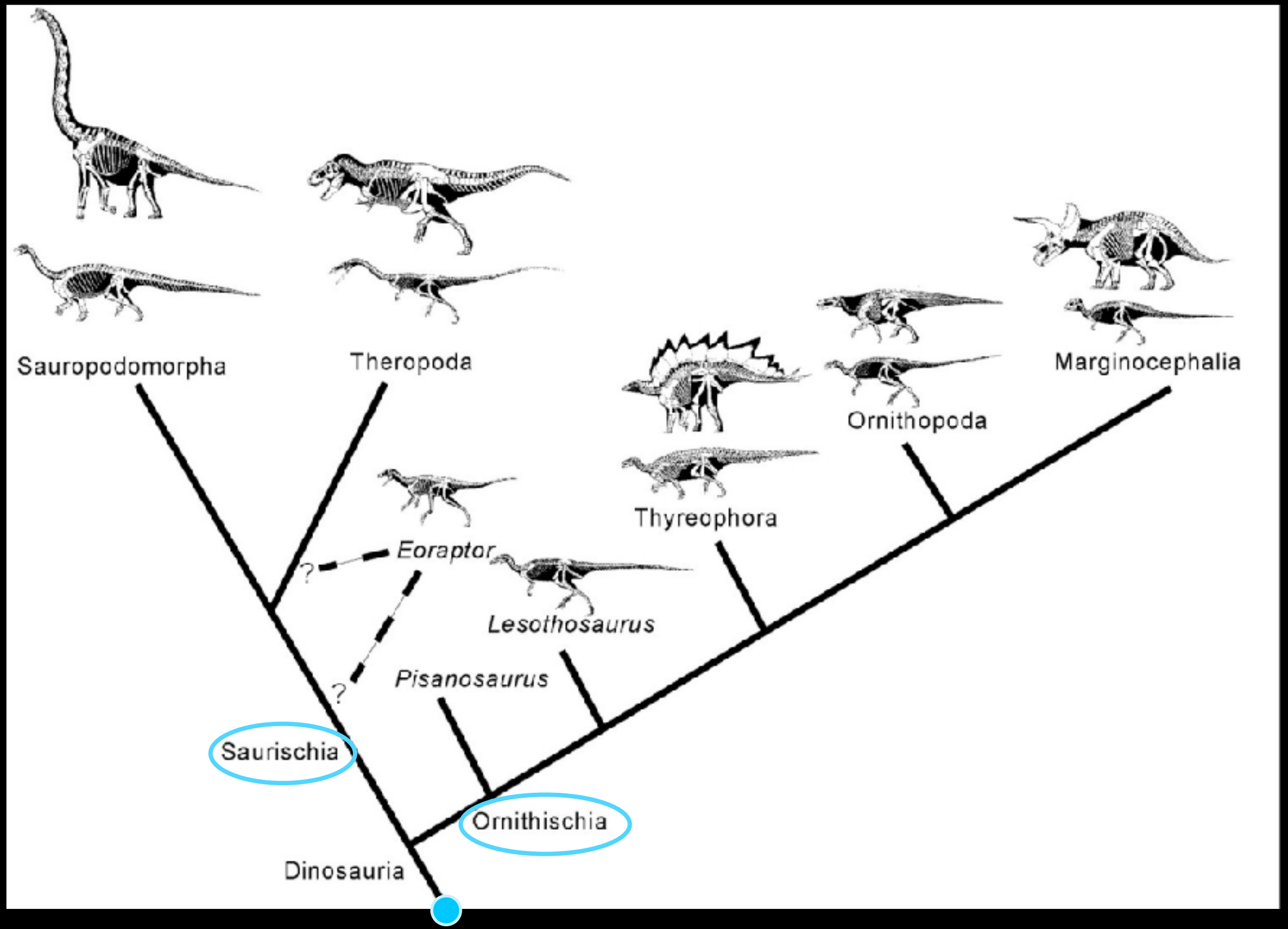
Ornithischia



Dinosauria

Ornithodira

DINOSAURS


Sauropodomorpha
Theropoda
Ornithopoda
Marginocephalia
Thyreophora
Eoraptor
?
?
Lesothosaurus
Pisanosaurus
Saurischia
Ornithischia
Dinosauria

Dinosaur expansion: multiple models

Competitive Replacement Scenario (Gradual)

Opportunistic Scenario (Abrupt)

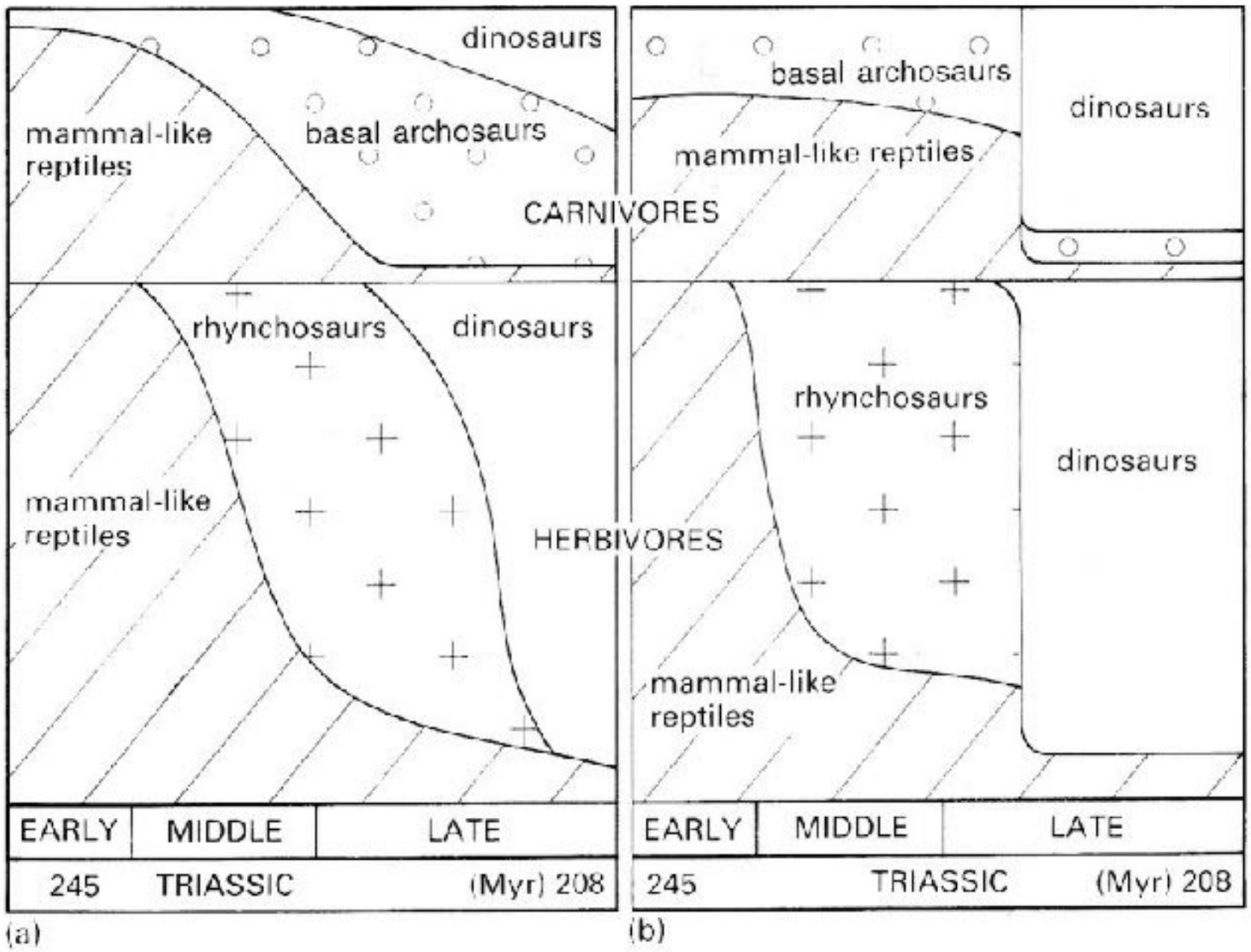
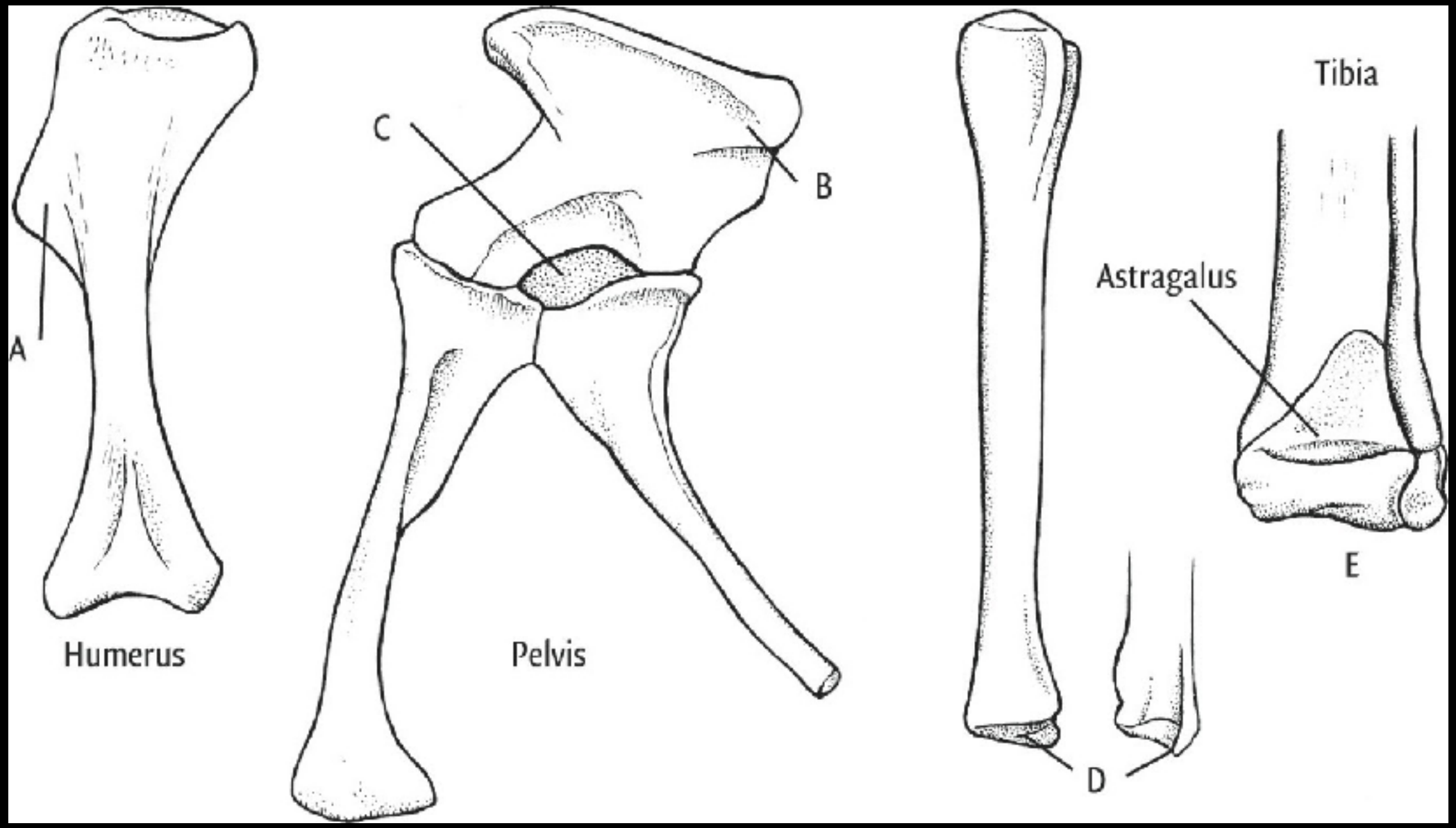


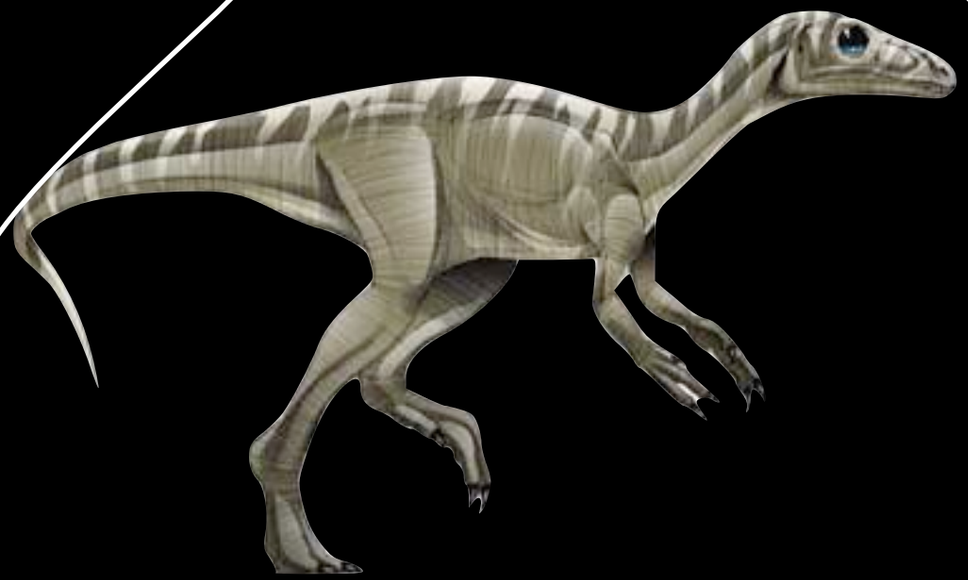
Fig. 6.10 Two models for the replacement of mammal-like reptiles, basal archosaurs, and rhynchosaurs by dinosaurs: (a) a competitive replacement scenario; (b) an opportunistic mass extinction replacement model.



Dinosaur synapomorphies

A) Crest on humerus
B) Shelf on top surface of ilium
C) Perforated acetabulum
D) Tibia w/ expanded end
E) Ascending astragular process on front surface of tibia

Basal Dinosaurs



Eoraptor

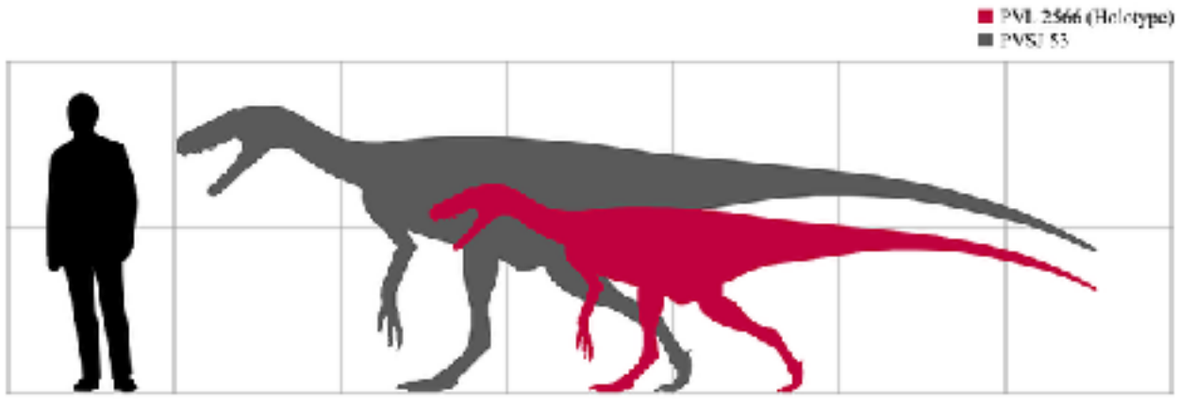
Pisanosaurus

Herrerasaurus

Coelophysis

Saurischia

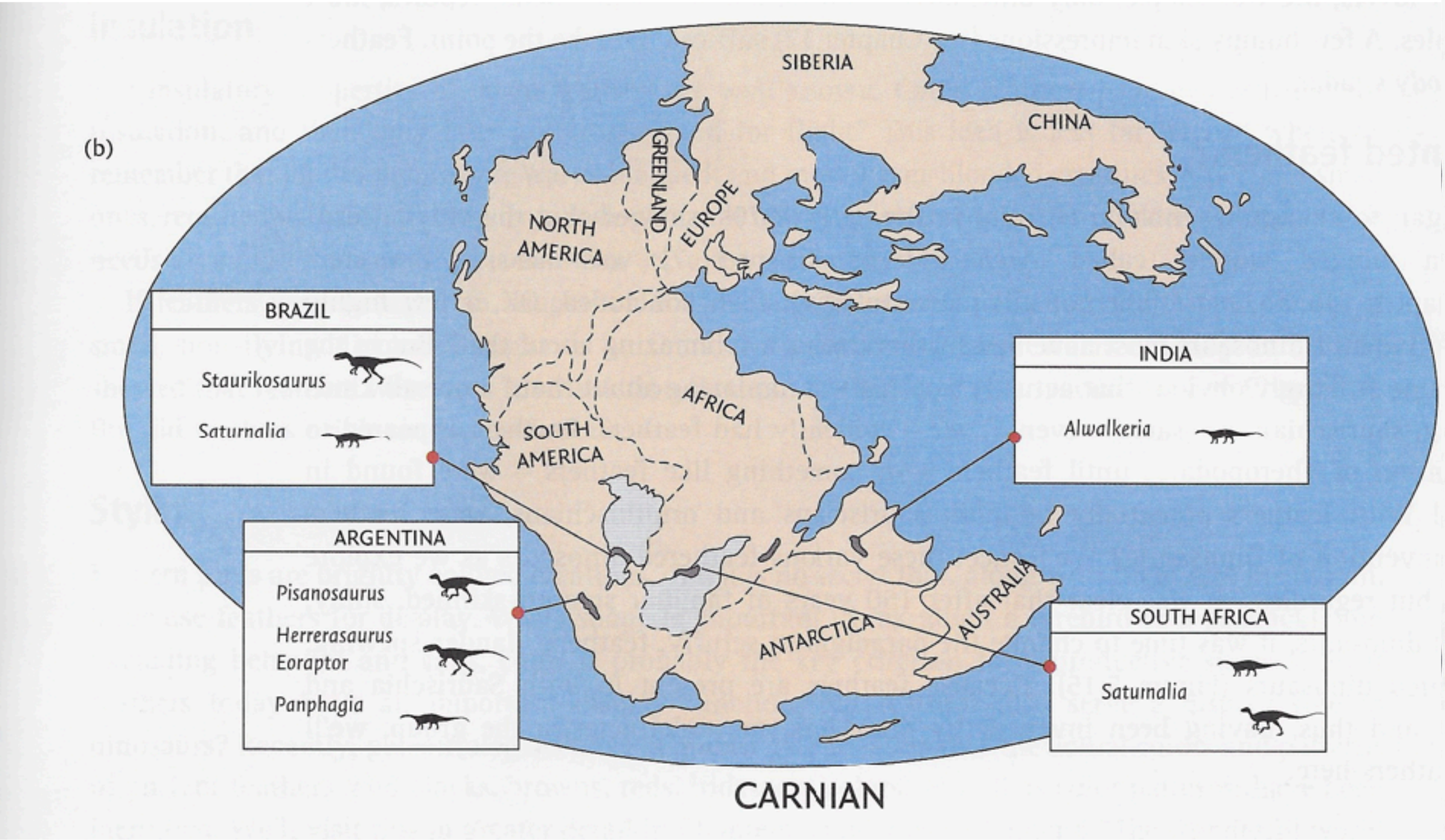
Herrerasaurus

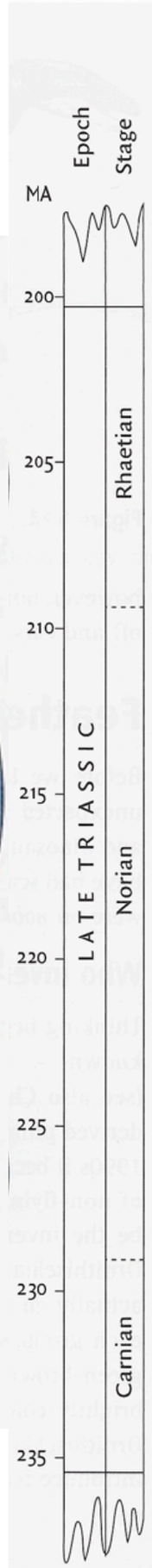


Hunted small-mid sized dinosaurs and synapsids such as *Pisanosaurus*

-gut could dissolve bone

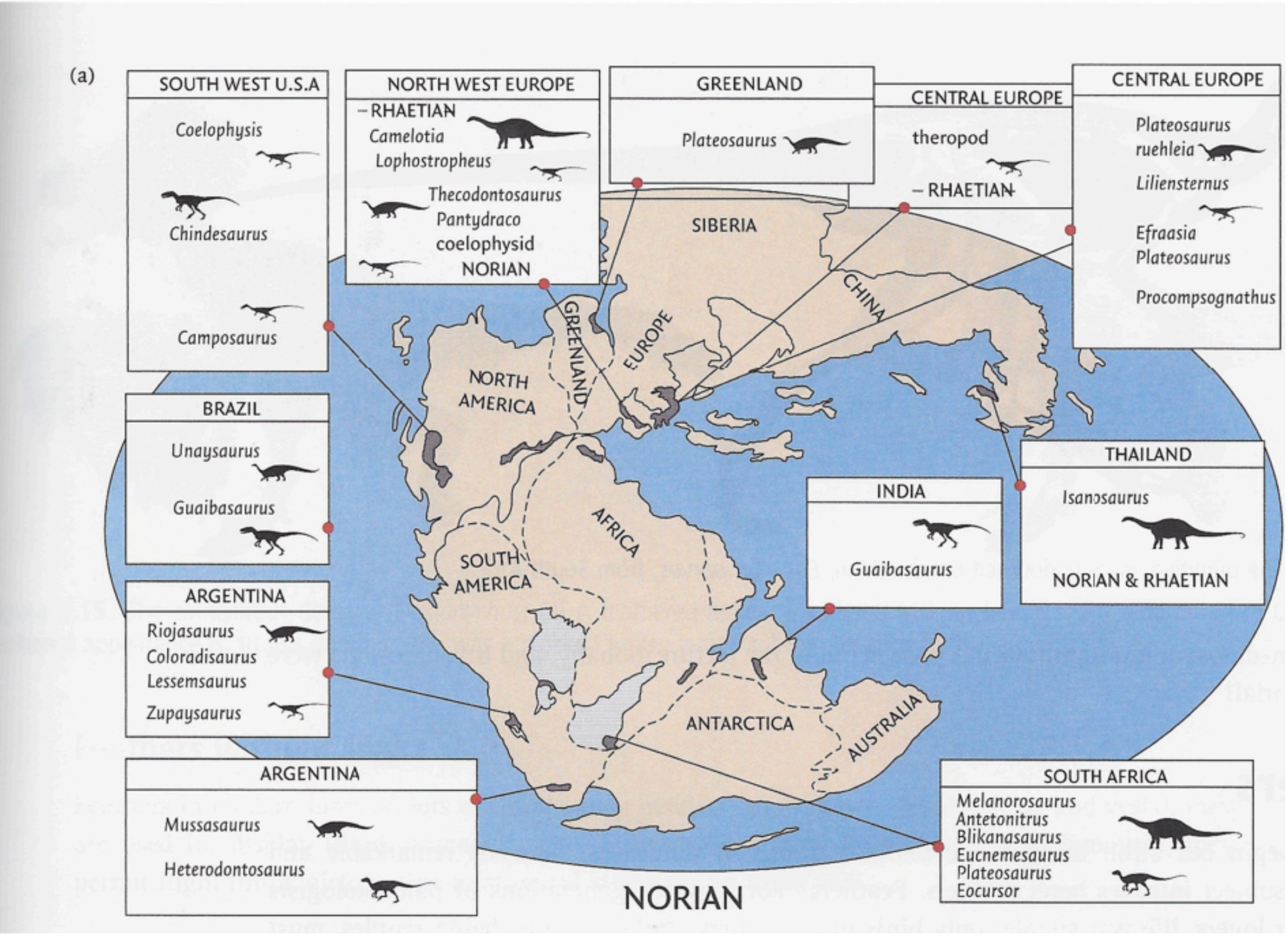
Between 235-230 MA





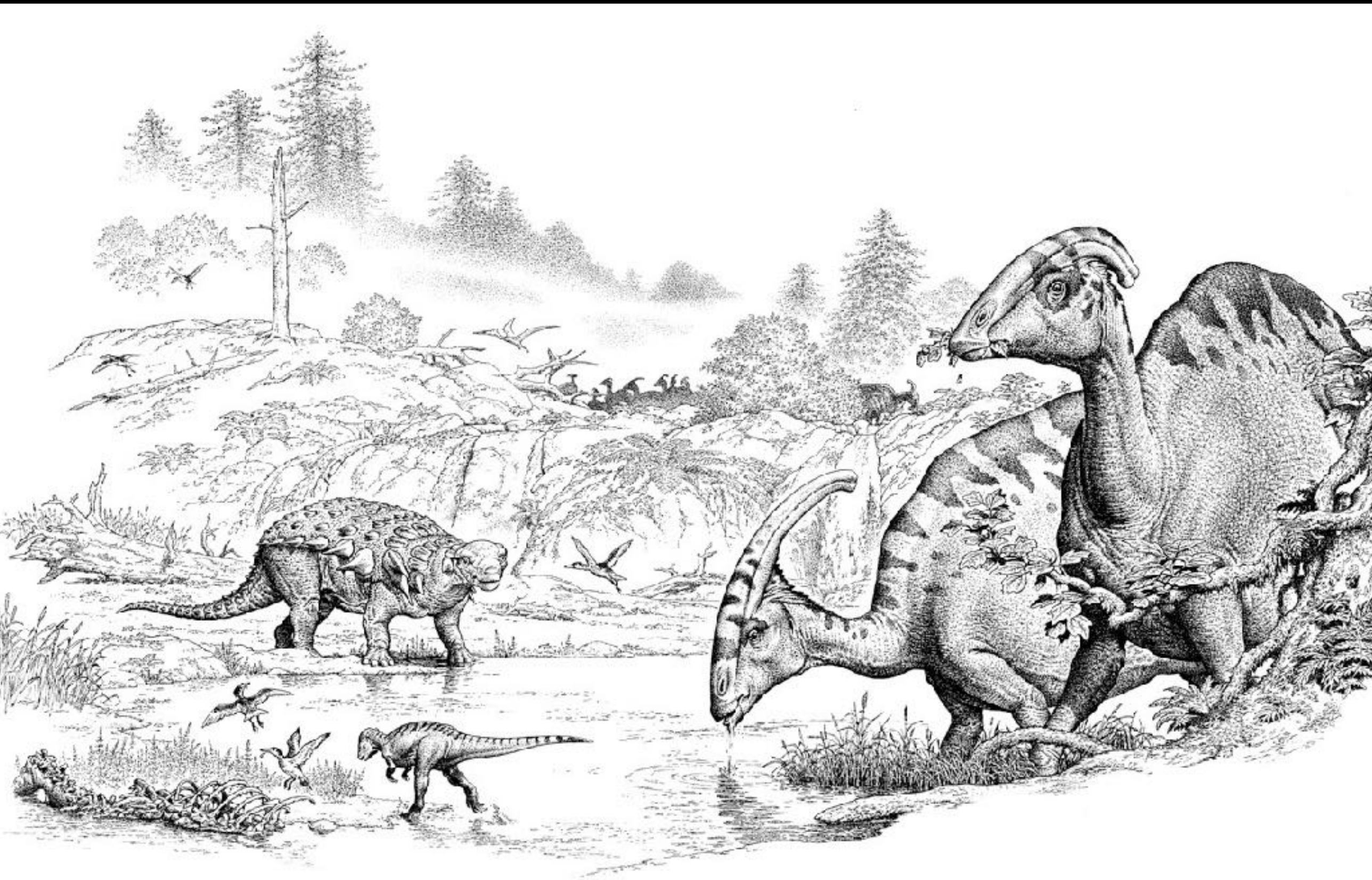
Redrawn from

Between 230-200 MA



Redrawn from

Ornithischians!



Lesothosaurus

Saurischia

Heterodontosauridae

Marginocephalia [Chapter 6]

Ornithopoda [Chapter 7]

Thyreophora [Chapter 5]

4

Cerapoda

3

Genasauria

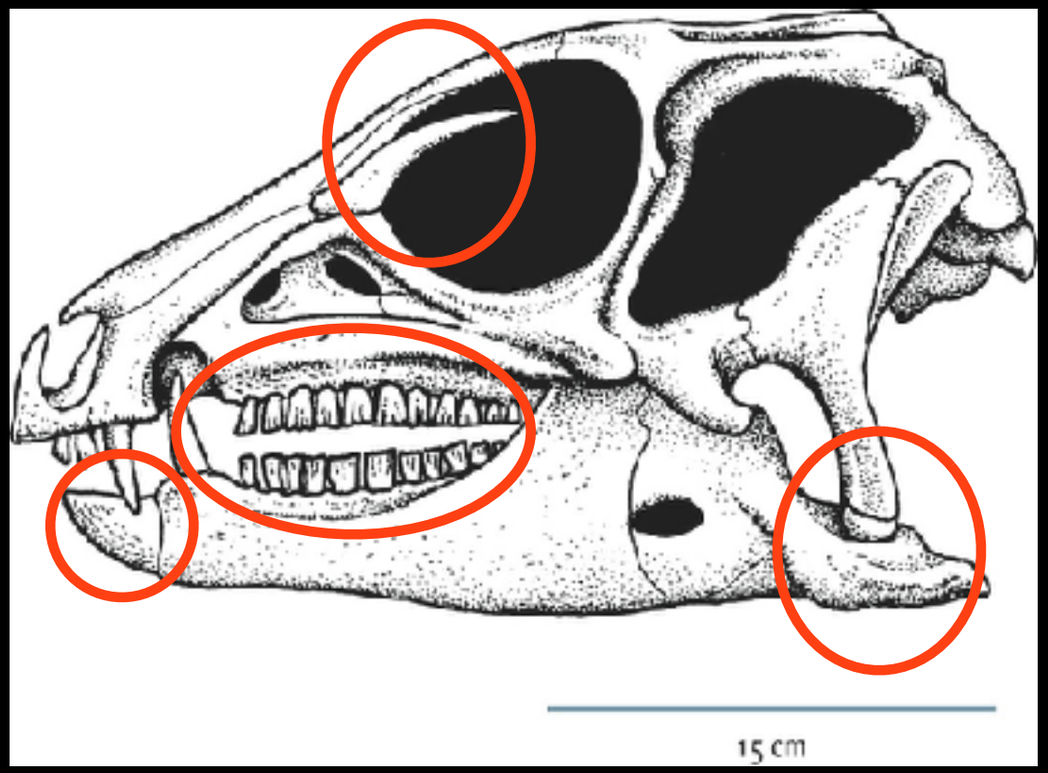
2

Ornithischia

1

Dinosauria

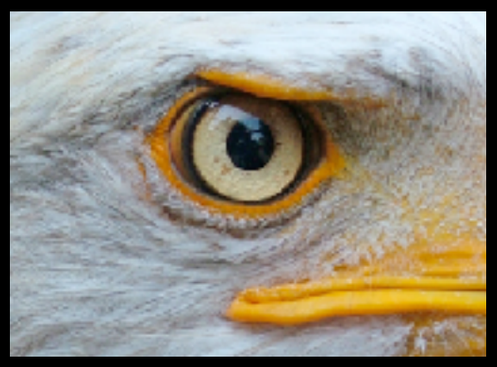
'Cheeky' saurs

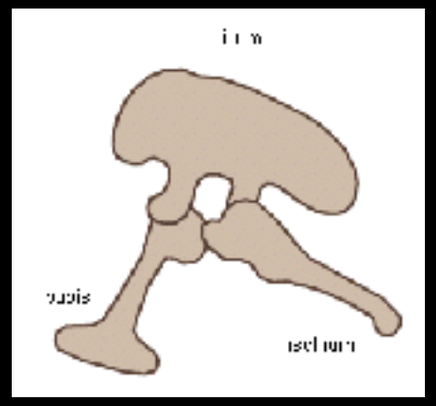


Heterodontosaurus

Shared, derived traits of skull

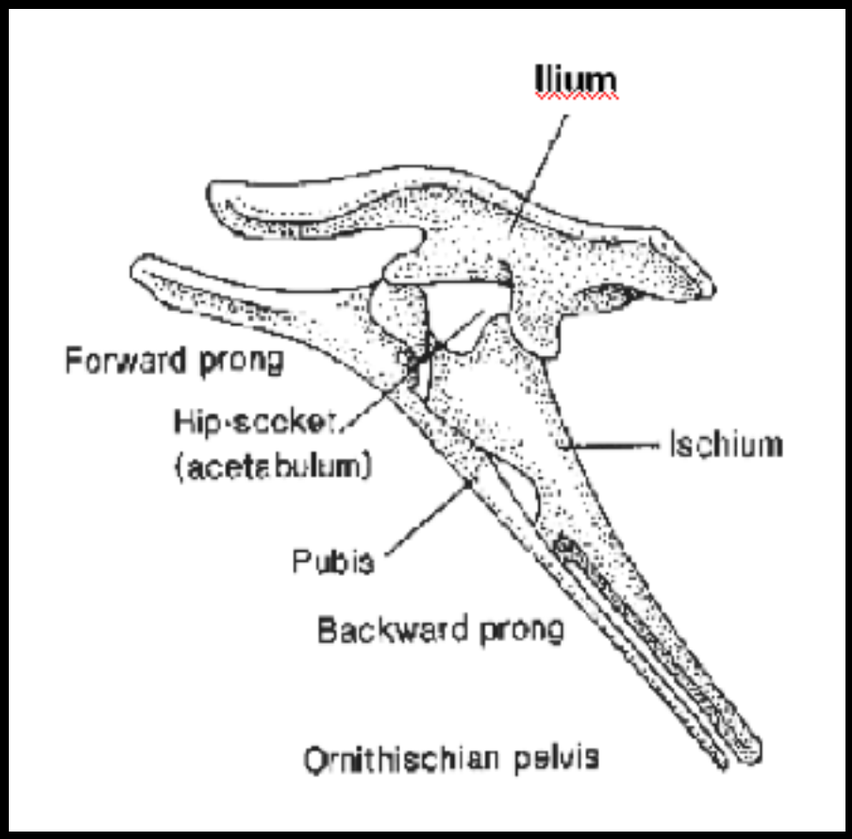
Predentary
Low jaw joint
Palpebral bone: EAGLE EYE!
Deep set cheek teeth





Basal Ornithodiran condition

Head ⟷ Tail



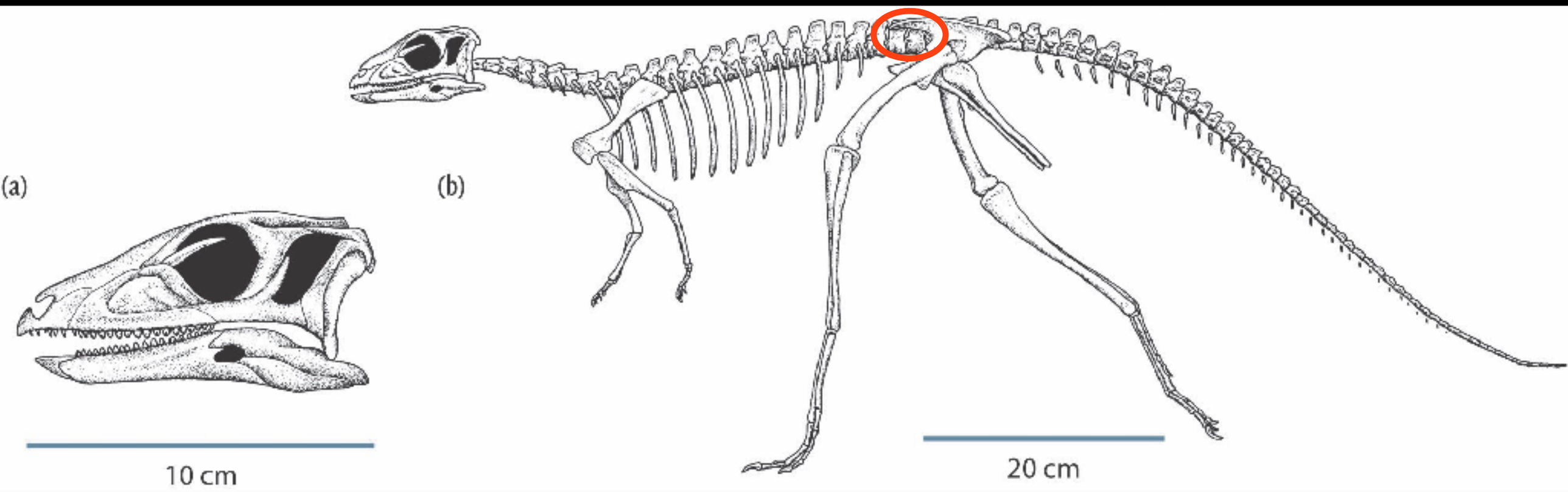
Hip shared, derived, trait

'Opisthopubic pelvis'

Other shared, derived traits

At least 5 sacral vertebrae
Ossified tendons above sacral region
Frontal process on illium

Lesothosaurus



How do mammals chew?

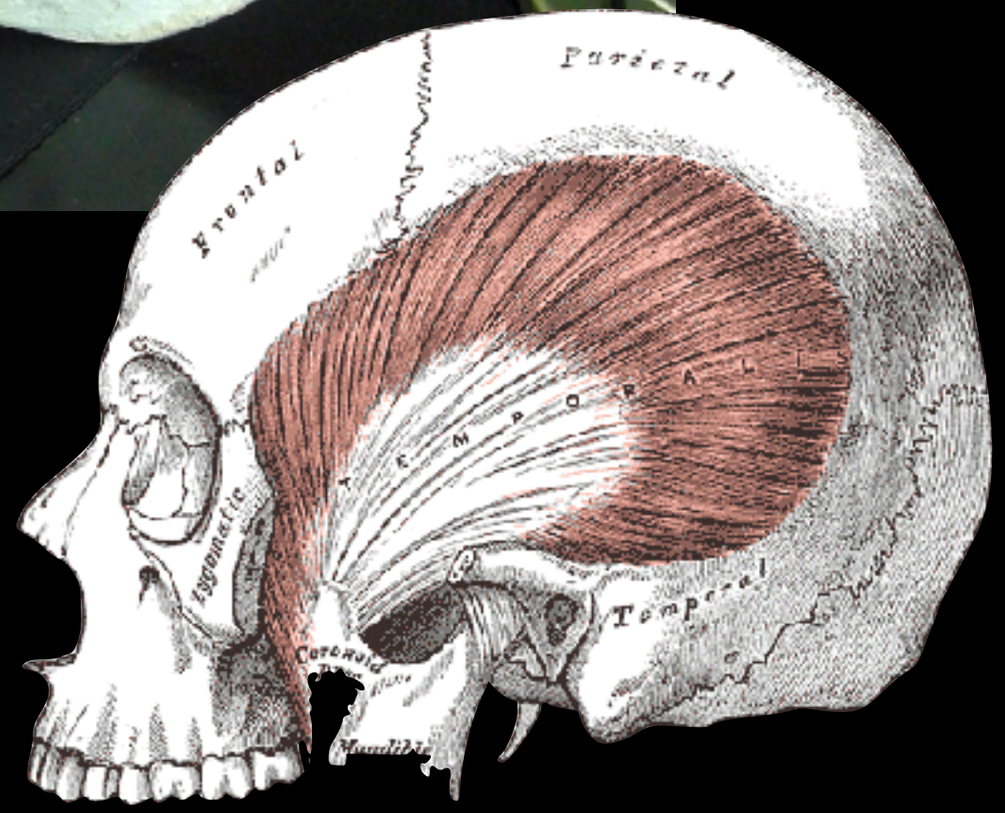
Front: Cropping

Diastem: Manipulation by tongue

Cheek teeth: Grinding (occluding)

Coronoid Process ~ Muscle attachments

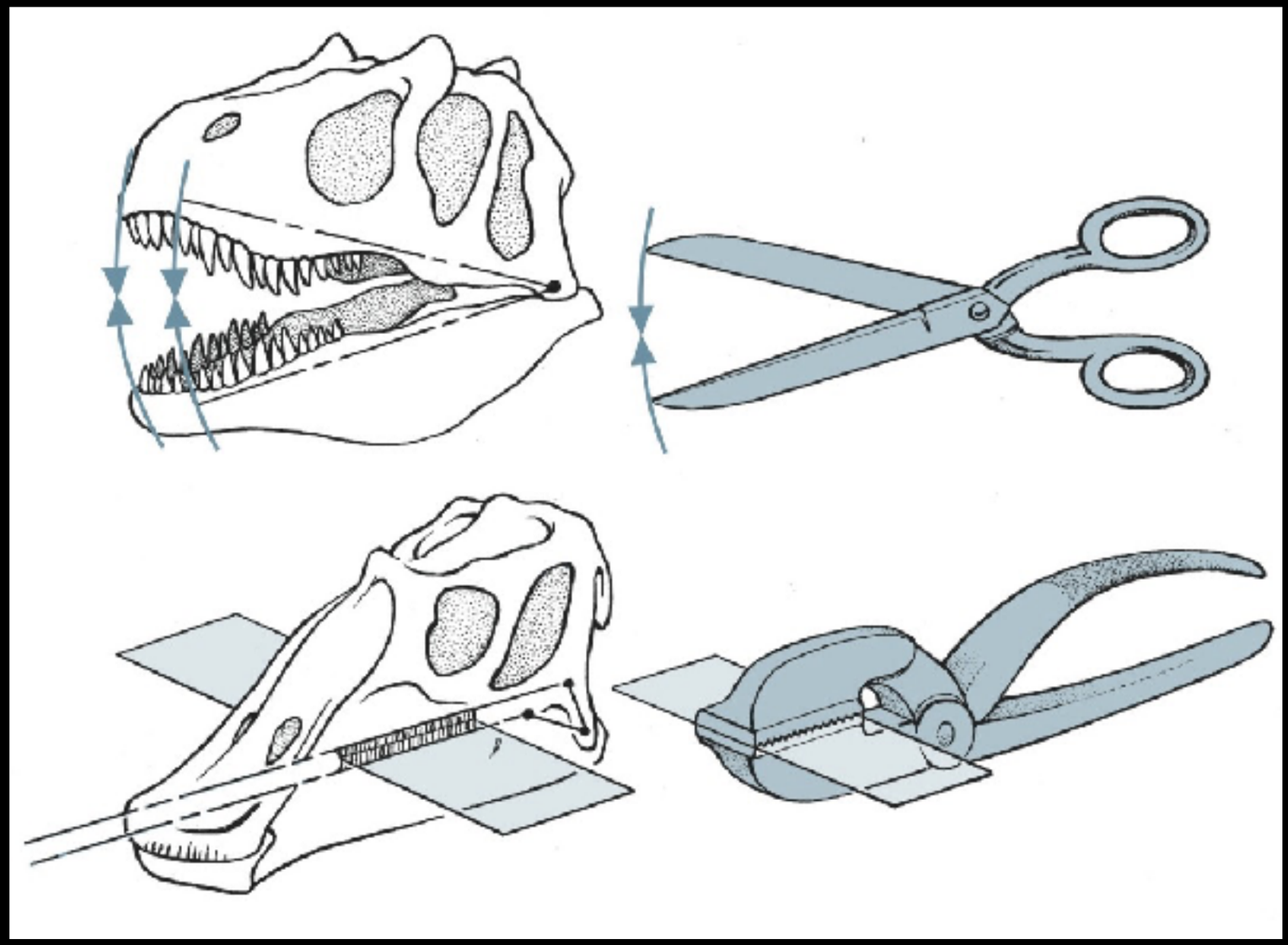
Inset molars for cheeks ~ keep food in mouth



Edmontosaurus
Ornithopod

How did Ornithischians chew? In very similar ways

Front: Cropping: carried out by keratin RAMPHOTHECA
Diastem: Manipulation by tongue
Cheek teeth: Grinding! Dental Batteries
Coronoid Process ~ Different shape, different muscle attachments
Inset molars for cheeks ~ keep food in mouth



Traveling force

Small area, large force

Broadly distributed force

Large area, less force

How did Ornithischians chew?

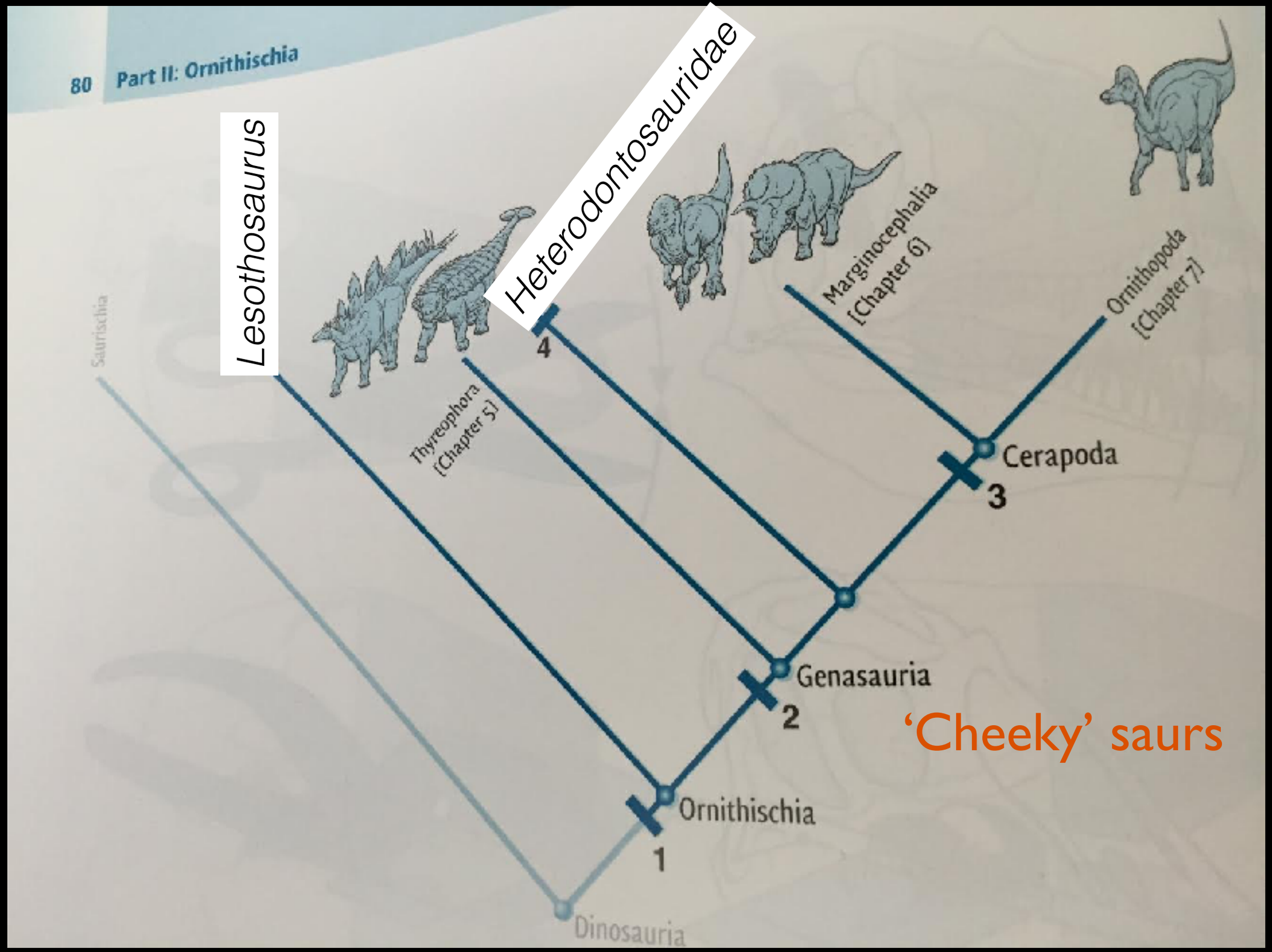
The Angle of the jaw. Scissors vs. Pliers

Basal Ornithischians

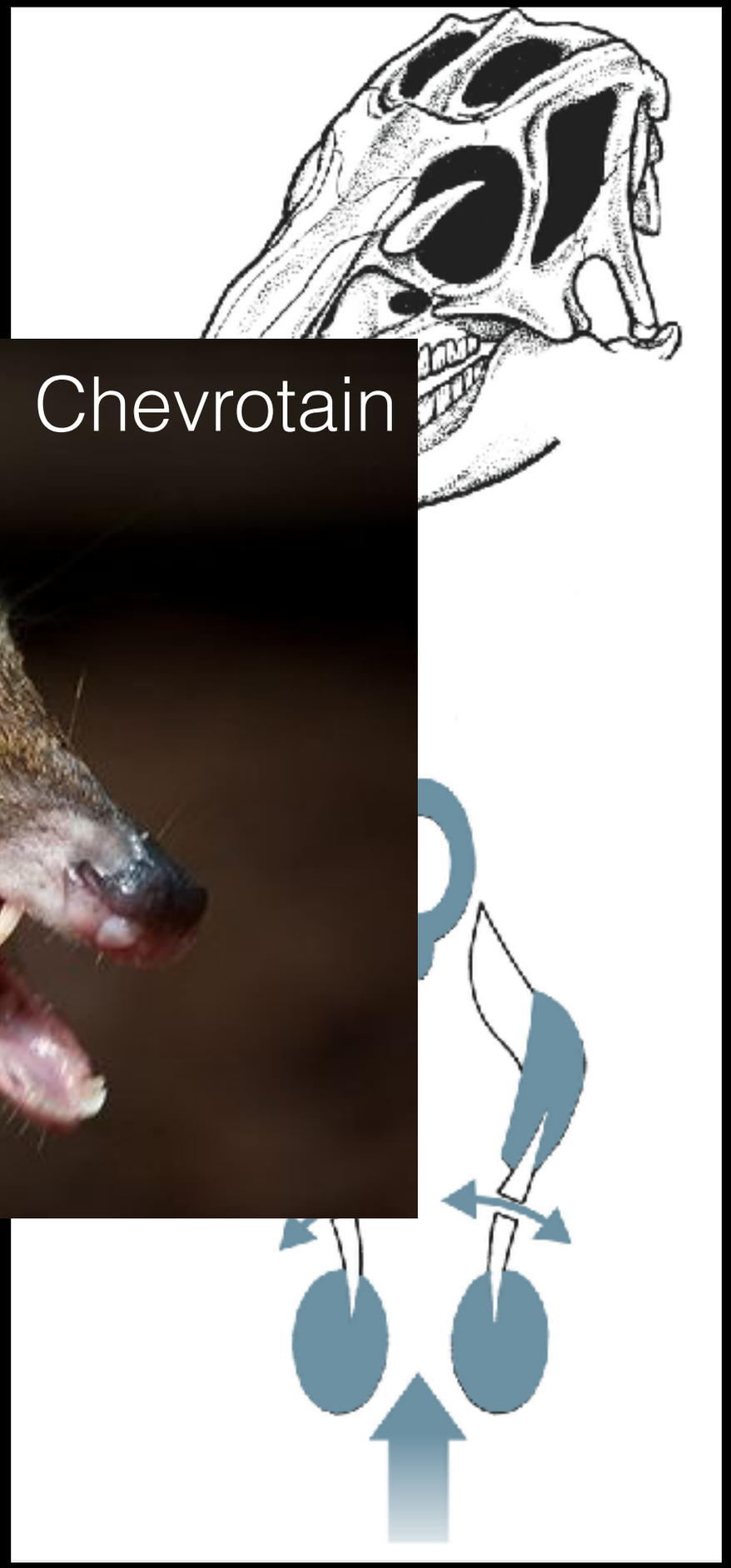
Pisanosaurus

Lesothosaurus

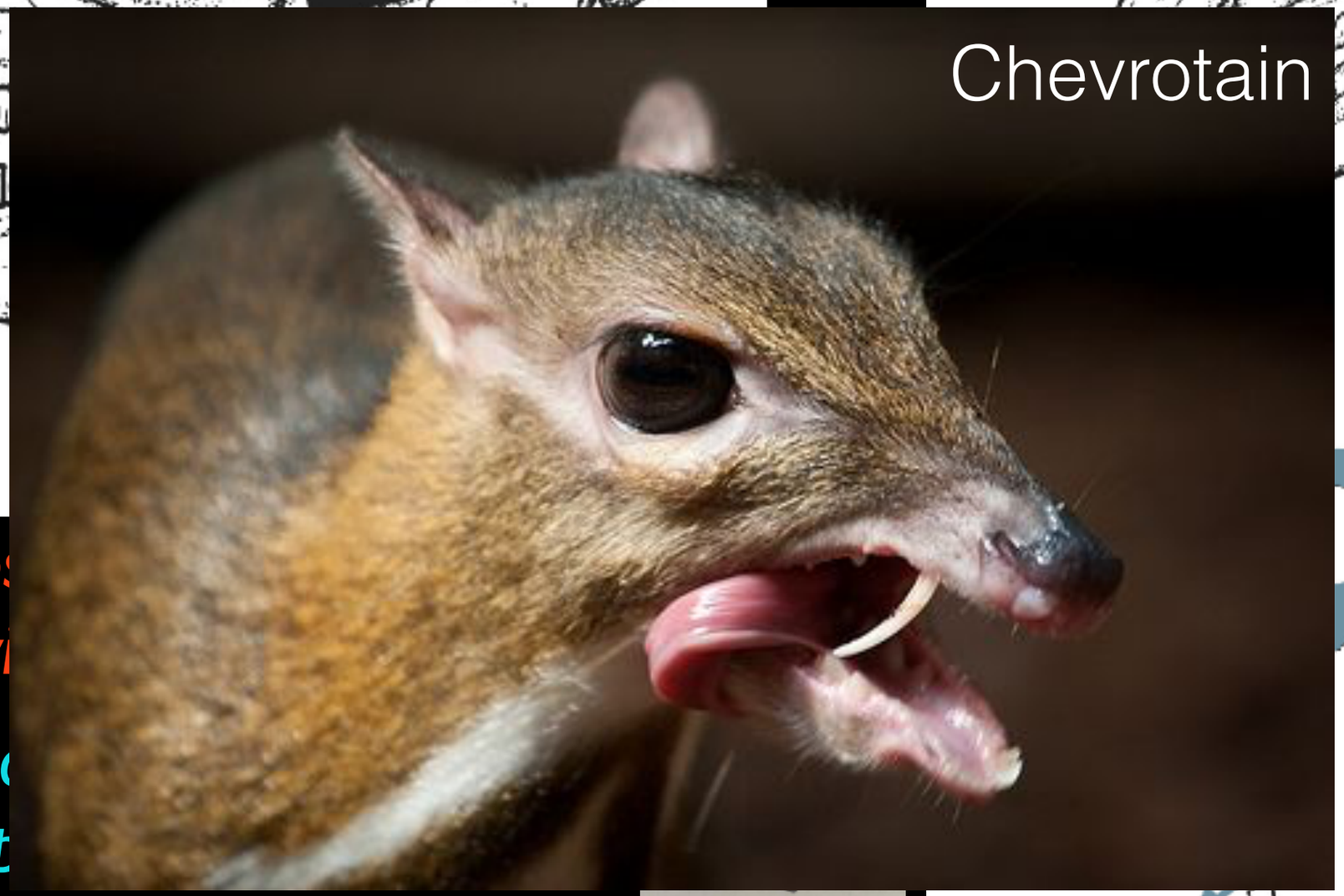
Everything else in Ornithischia
is in Genasauria ⟶ Chewing



'Cheeky' saurs



Chevrotain



Heterodonto
unique chew

Three kinds
Anterior: Snip
Posterior: Chewing
Tusks: Potentially display/courtship