

Office hours (today)
2-3 (rather than 2-4)



Today's Lecture

Thyreophora (continued)

Stegosauria

Ankylosauria

Shared, derived traits (synapomorphies)

General characteristics

Diet

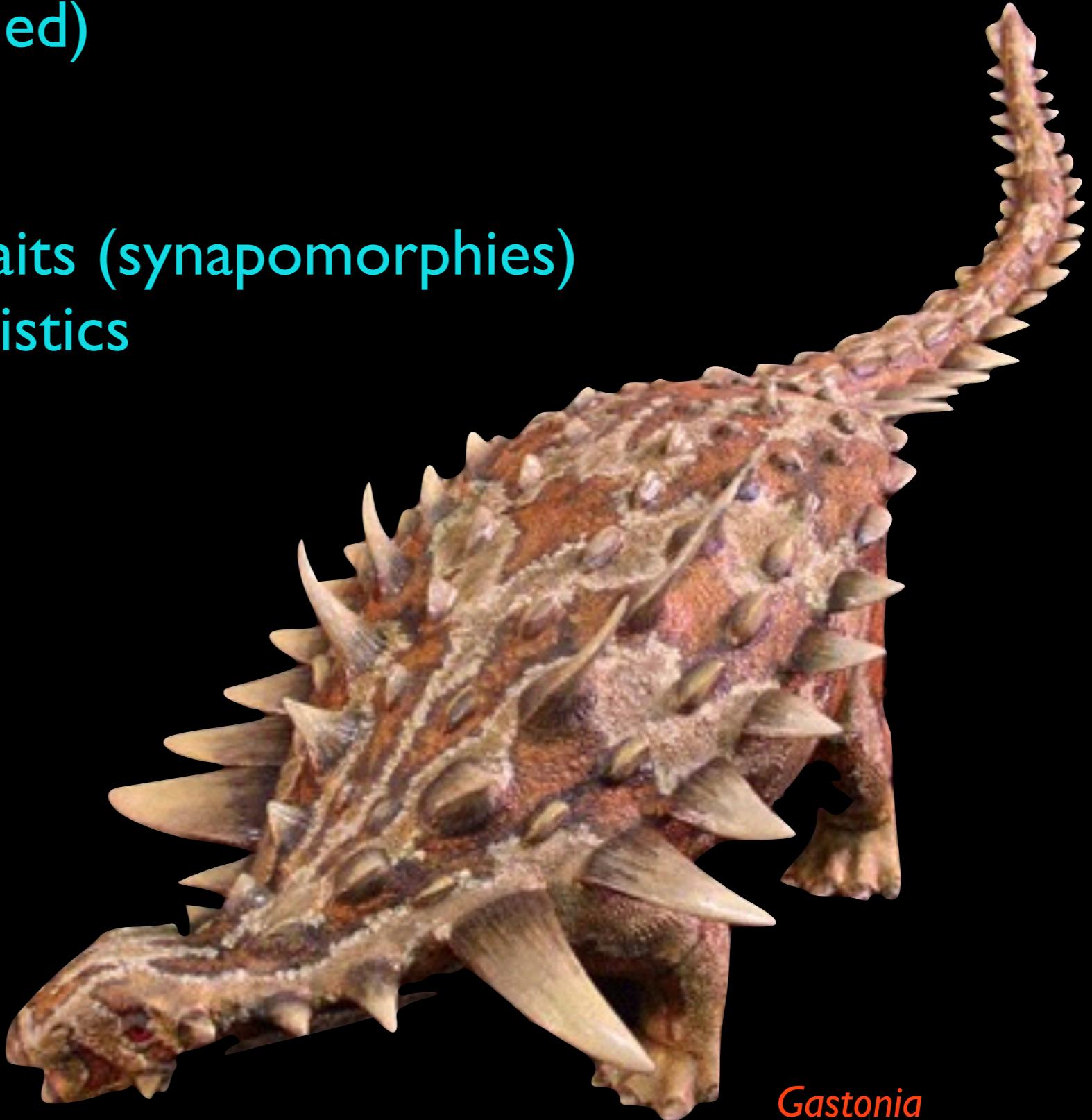
Brains

Locomotion

Armor

Distribution

Taphonomy



Genosauria

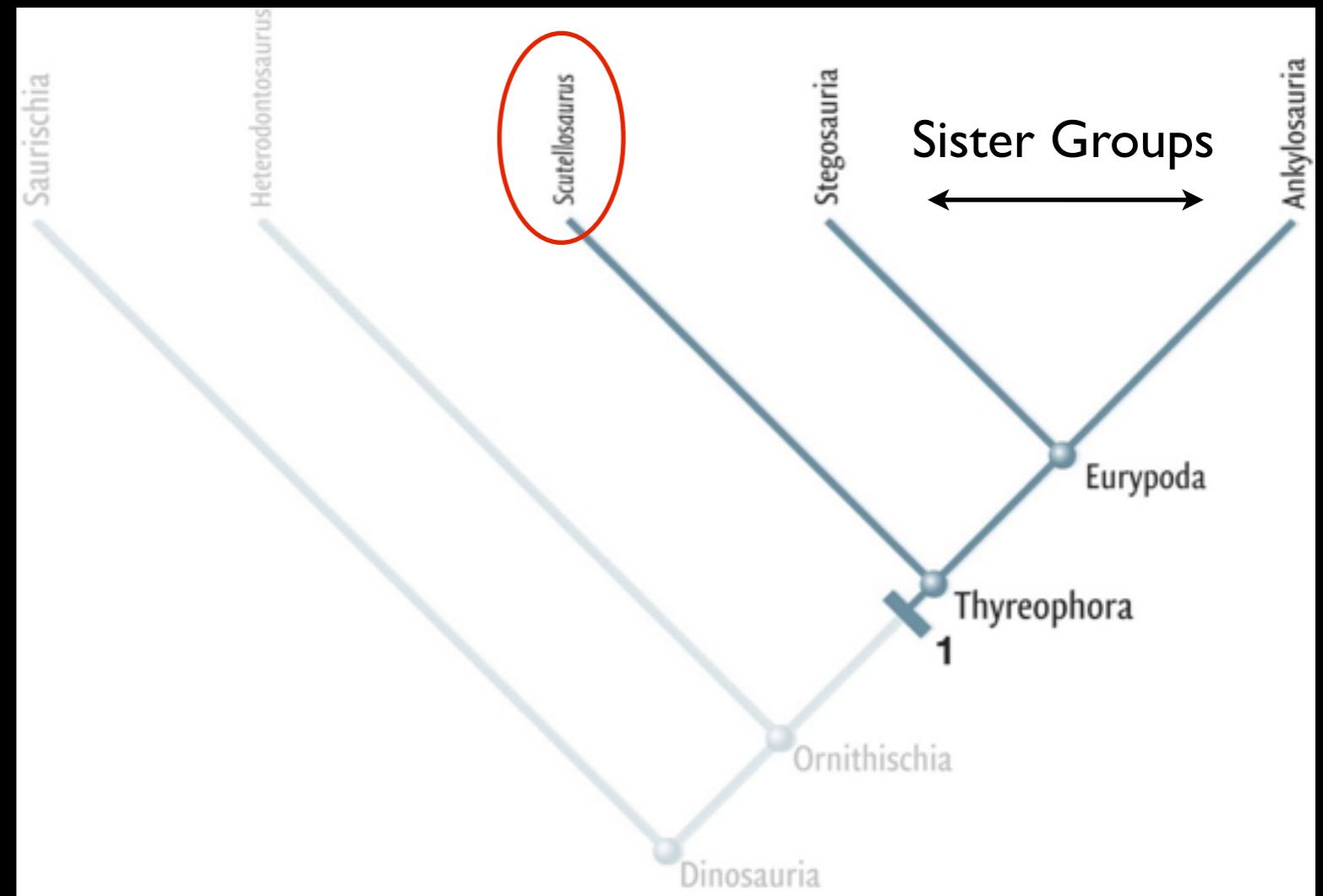
Thyreophora

Stegosaura

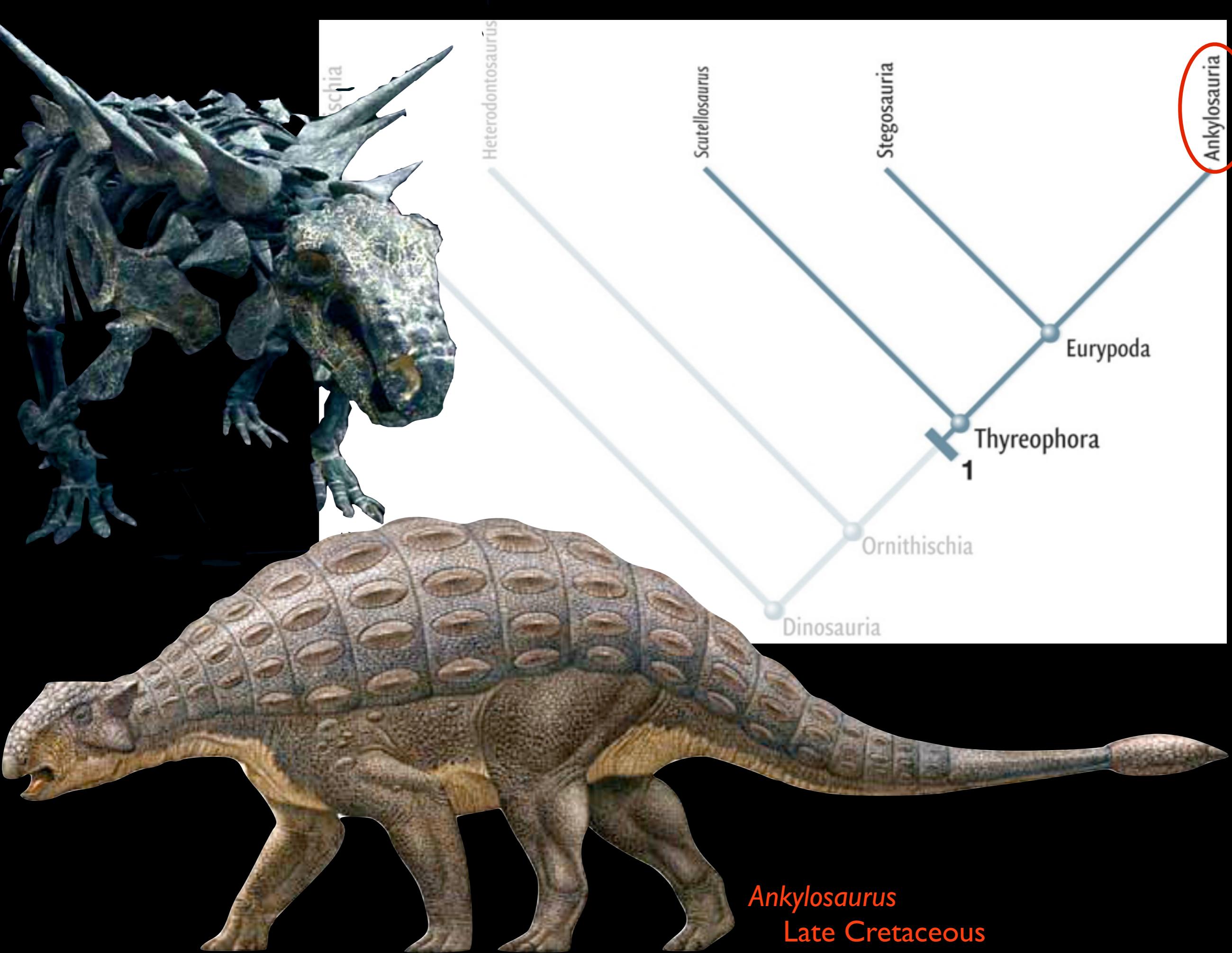
Basal Thyreophorans
bipedal to quadrupedal
osteoderms

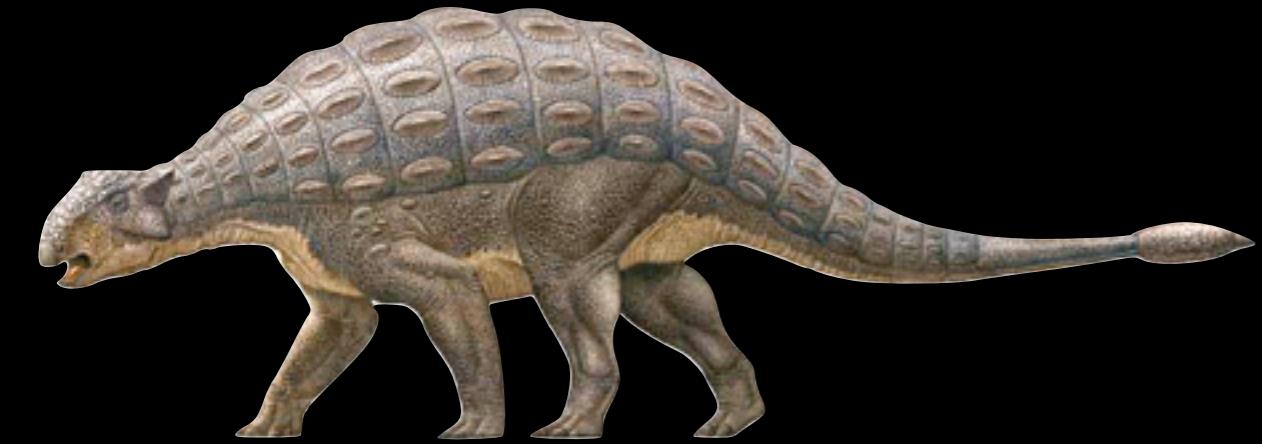


Scutellosaurus
4 ft long
Early Jurassic, North America



Scelidosaurus
13 ft long
Early Jurassic, England





Ankylosauridae

Ankylosaurus
Late Cretaceous



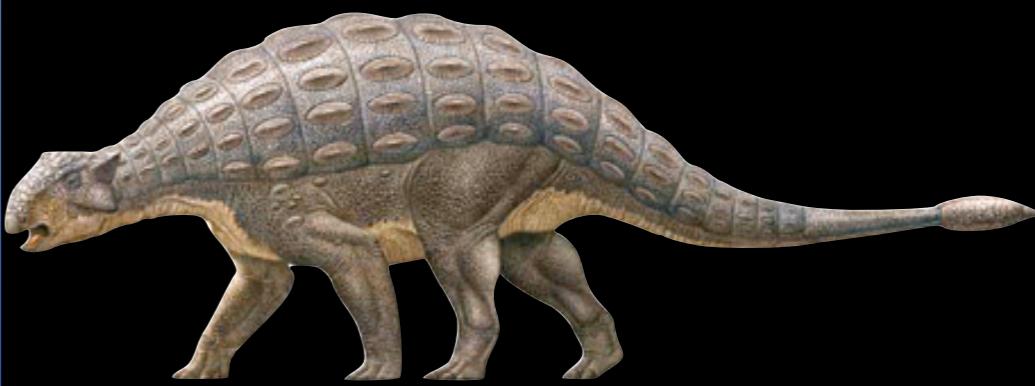
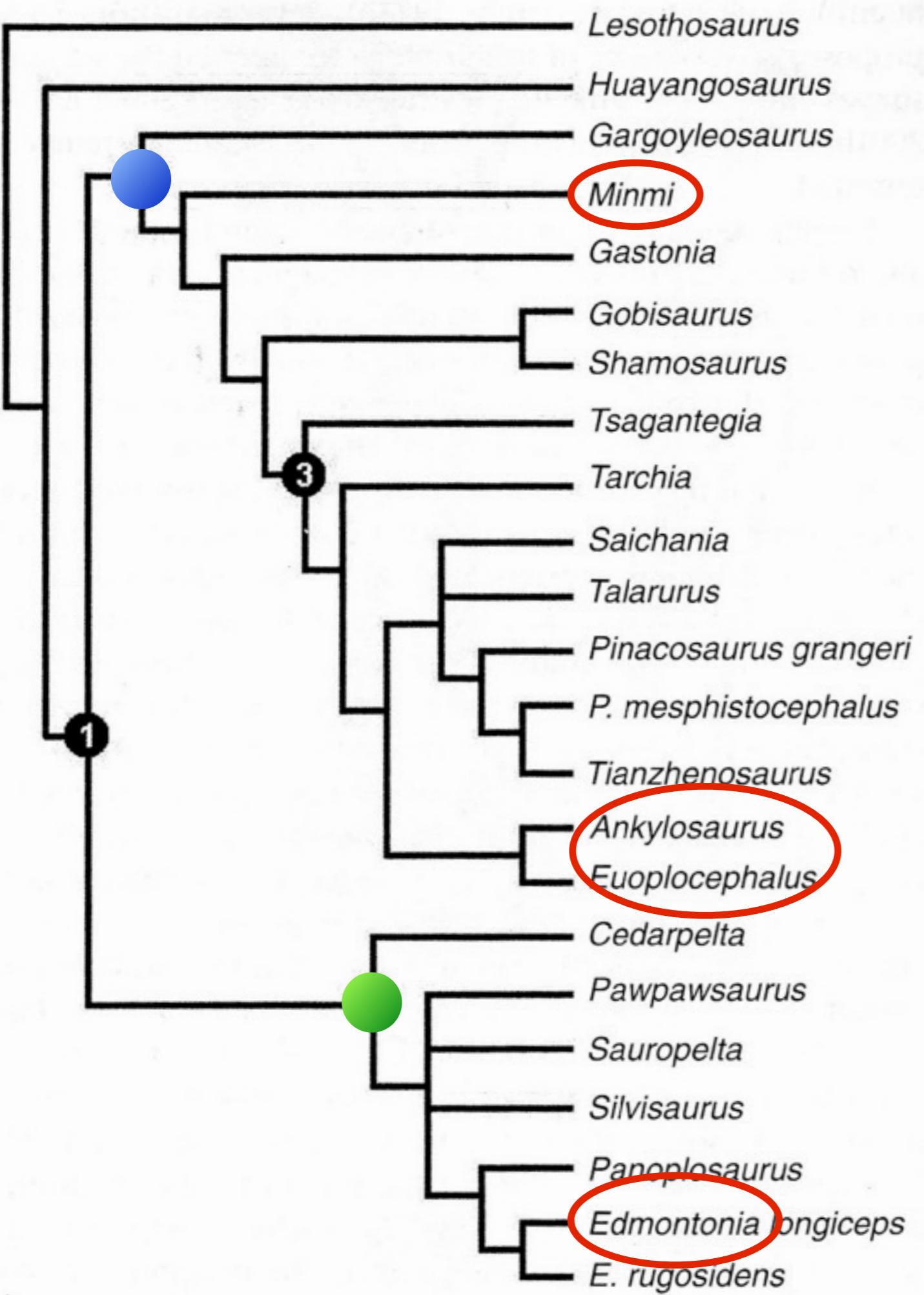
Nodosauridae

Sauroelta
Early Cretaceous

Ankylosauria = GROUP
Ankylosaurs = GROUP
Ankylosauridae
Ankylosaurids

Ankylosauria

Loss fenestra
Armour fused to lower jaw
Broad pelvis
Wide gut
Dorsal osteoderms



Ankylosauridae



Nodosauridae



● *Minmi*

Basal Ankylosauria (*Minmi*)

Southern continents (Australia)

Ankylosaur/Nodosaur traits

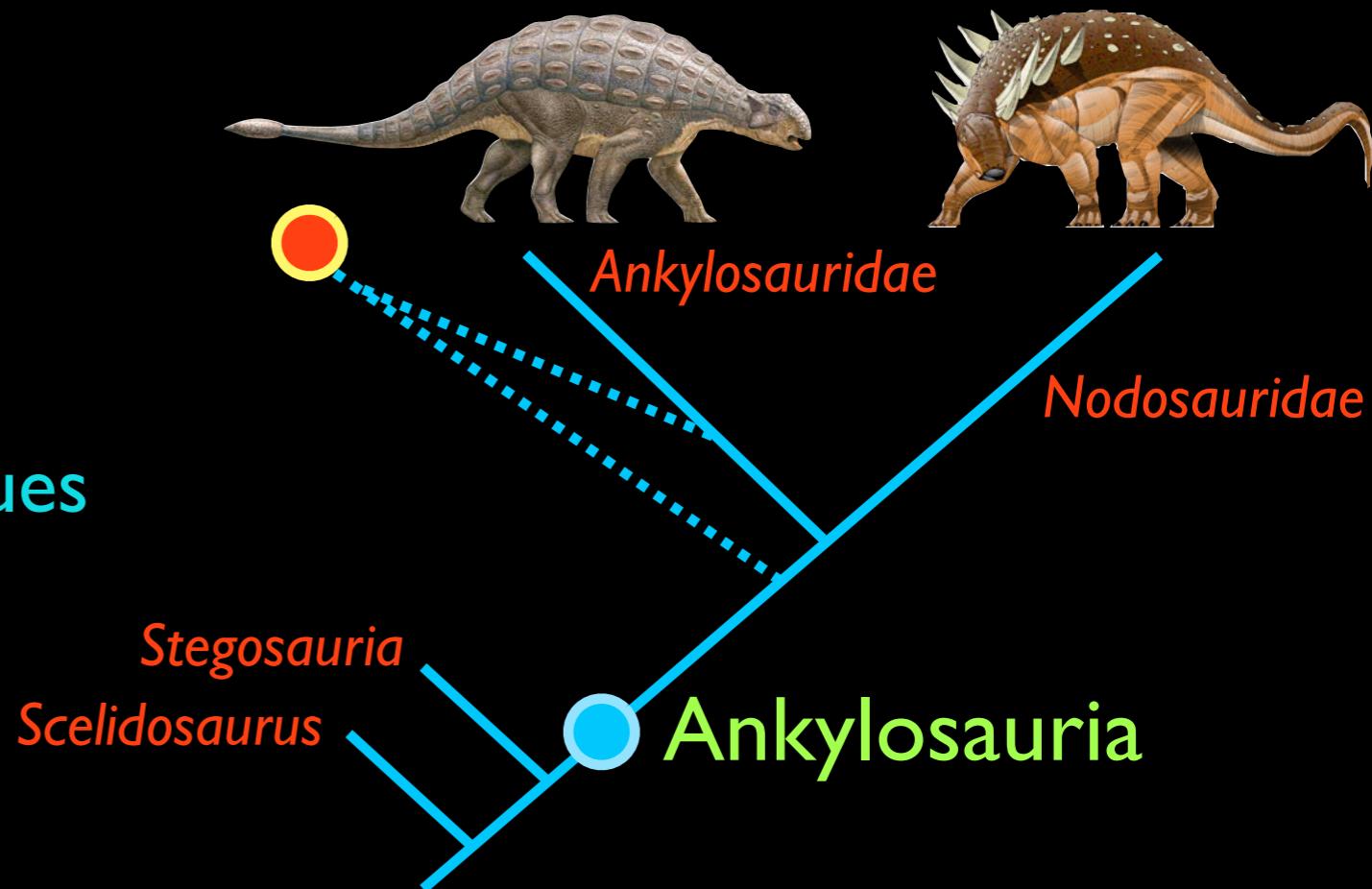
Direct evidence of diet

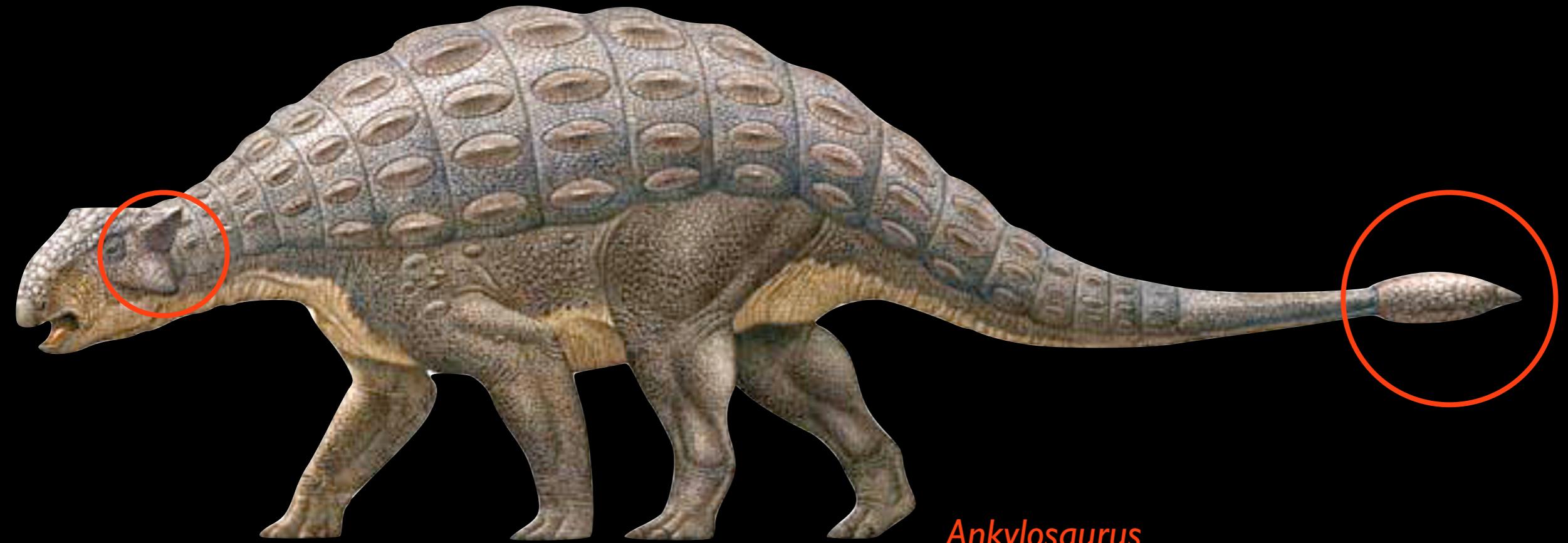
fragments of plant vascular tissues

seeds

leaves

Spike-like scutes on hips





Ankylosaurus
Late Cretaceous

Ankylosauridae

Shared, derived characteristics

Well armoured, but fewer spines

Tail CLUB

Shorter, knobbier skull than Nodosaurs

Squamosal horns

In some species: asymmetrically arranged scutes (*variable*)



Ankylosauridae

Other derived traits:

Dorsal crossbow

Frightened complexion

Pink Eveningwear

Mantis-Human rider



Sauroelta
Early Cretaceous

Nodosauridae

Shared, derived characteristics

Spines are emphasized

No tail club

Longer, thinner skull than Ankylosaurs

No squamosal horns

Symmetrically arranged scutes

Acromial process for heavily muscled foreleg



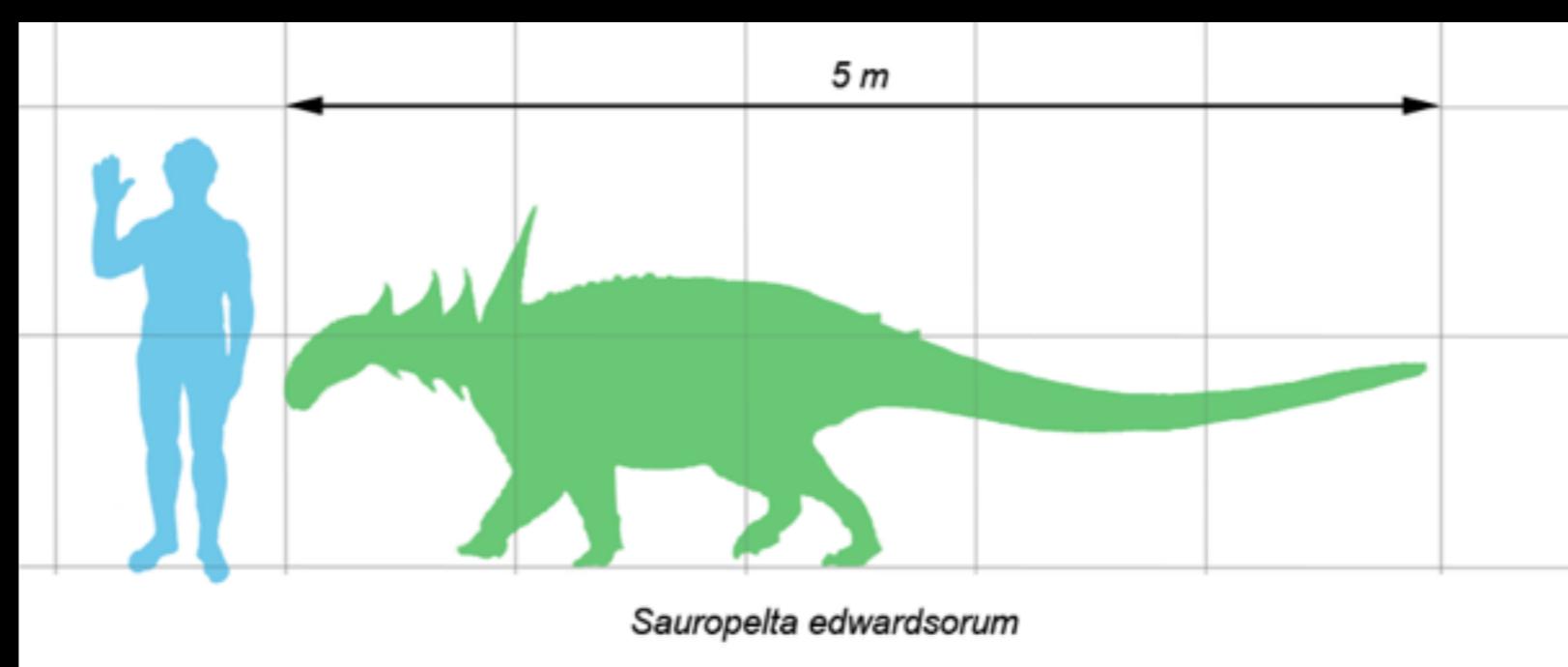
Nodosauridae

Other derived traits:

Piloted, rocket propelled manta ray

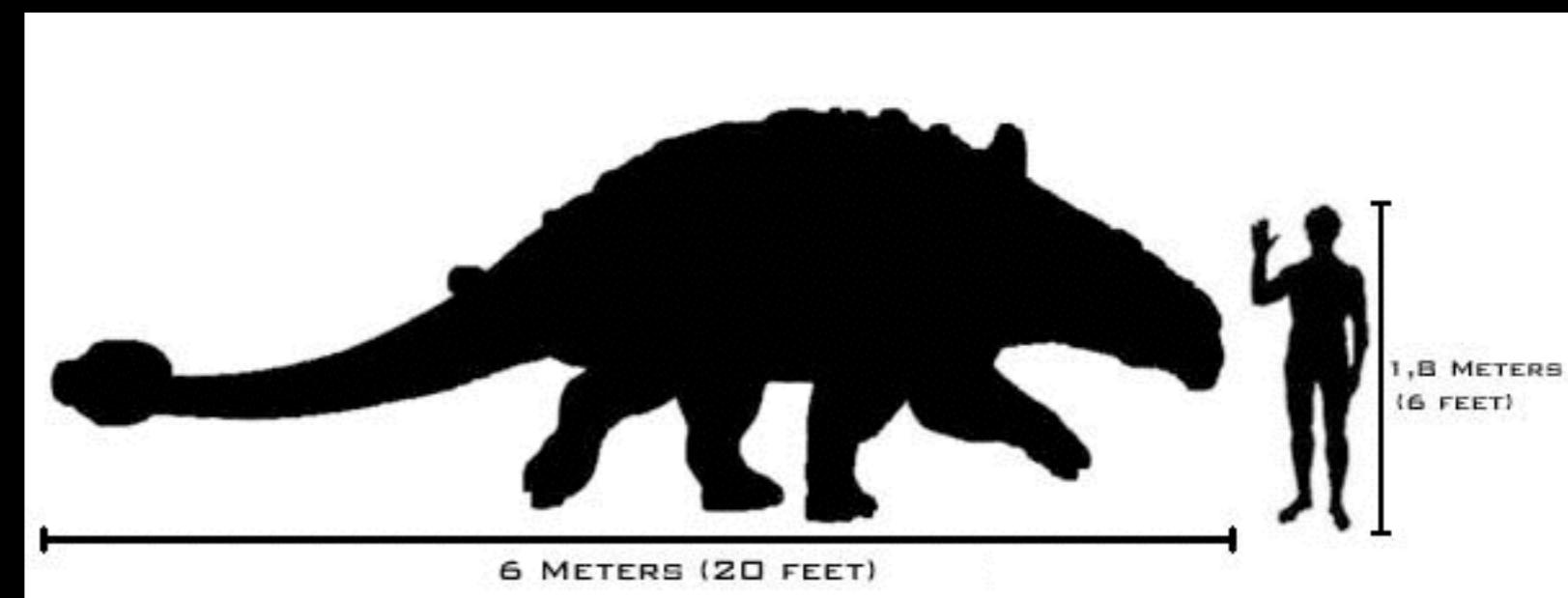
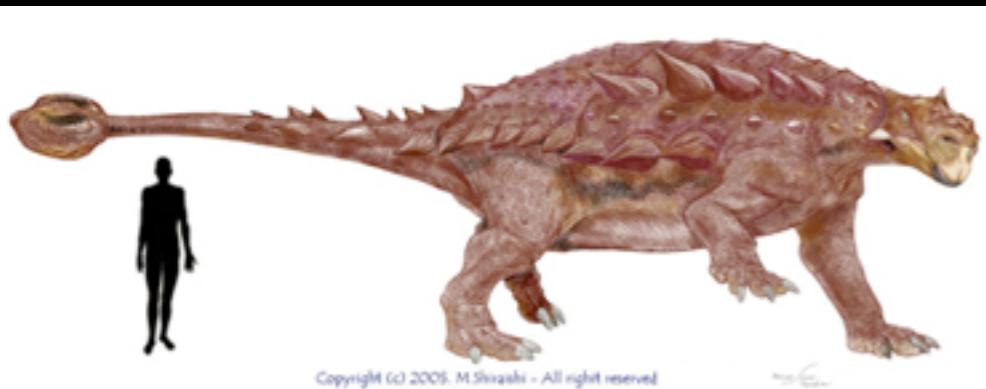
Size

Sauropelta
Nodosaurid
Early Cretaceous



Ankylosaurus... 6-9 meters

Ankylosaurid
Late Cretaceous

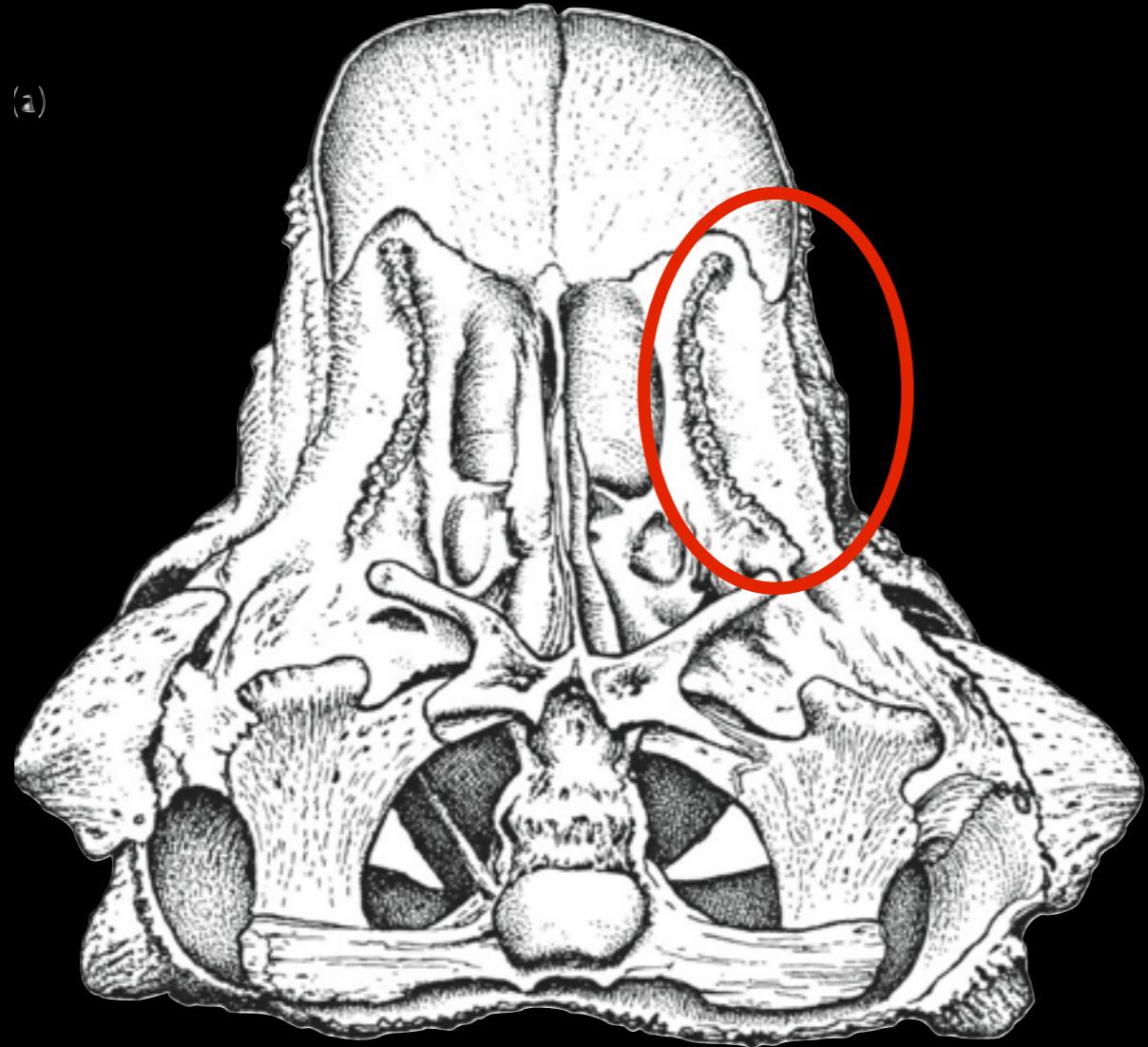


Euoplocephalus
Ankylosaurid
Late Cretaceous



Edmontonia
Nodosaurid
Late Cretaceous

(a)



Euoplocephalus
Ankylosaurid
Late Cretaceous

Ankylosauria: Genosaurs i.e. they'd better have CHEEKS.
Premaxillae (cropping) ~ attachment of beak (ramphotheca),
Diastem, cheek teeth
Cheeks are very emphasized in Ankylosauria
Deep, inset, cheek teeth

Diet



'White' Rhino

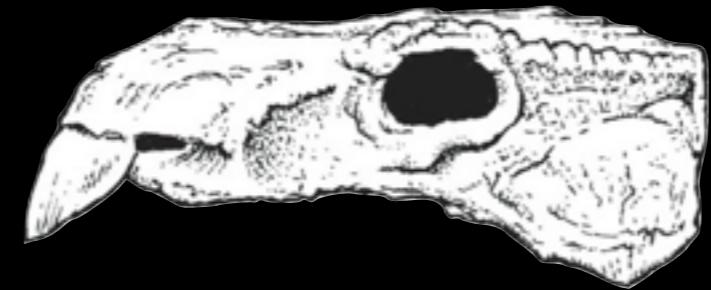
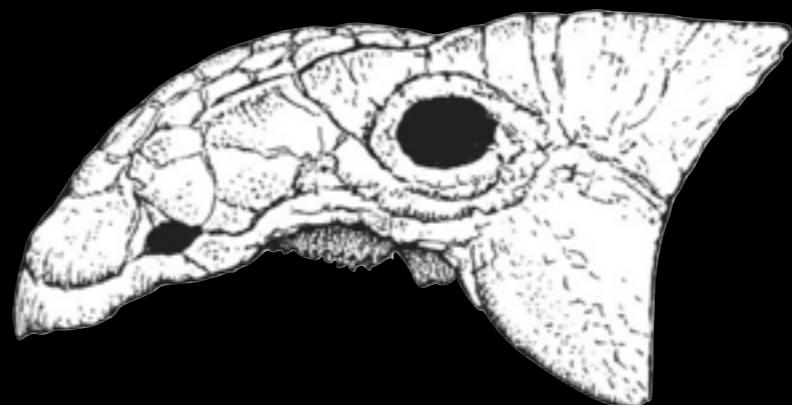
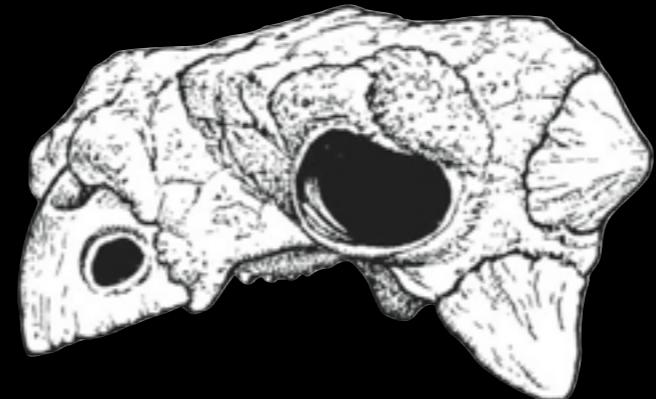
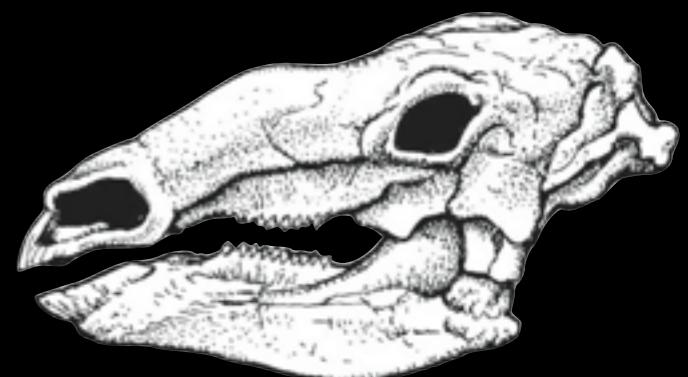
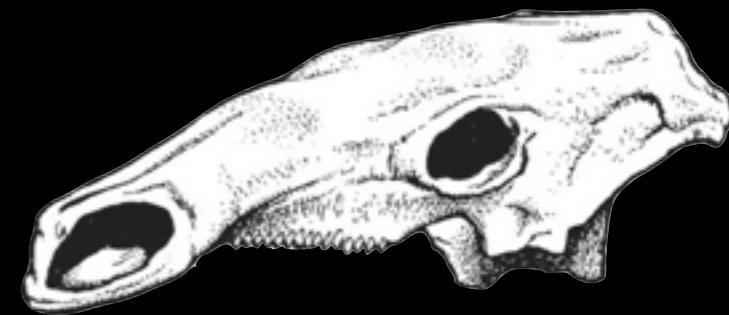
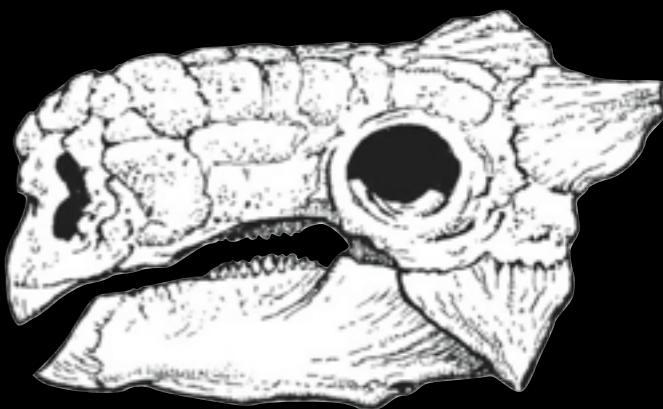


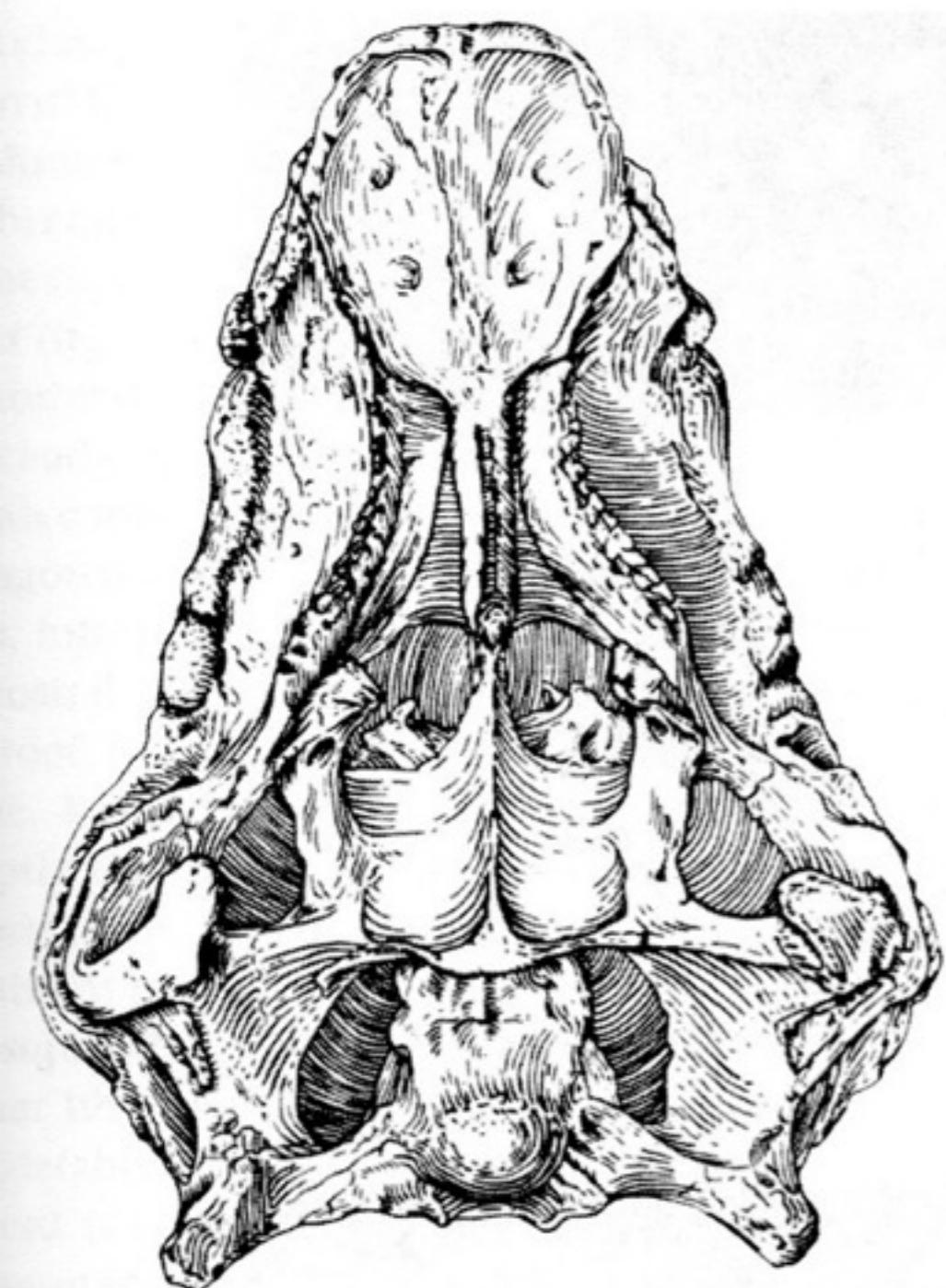
'Black' Rhino

Generalist-feeders

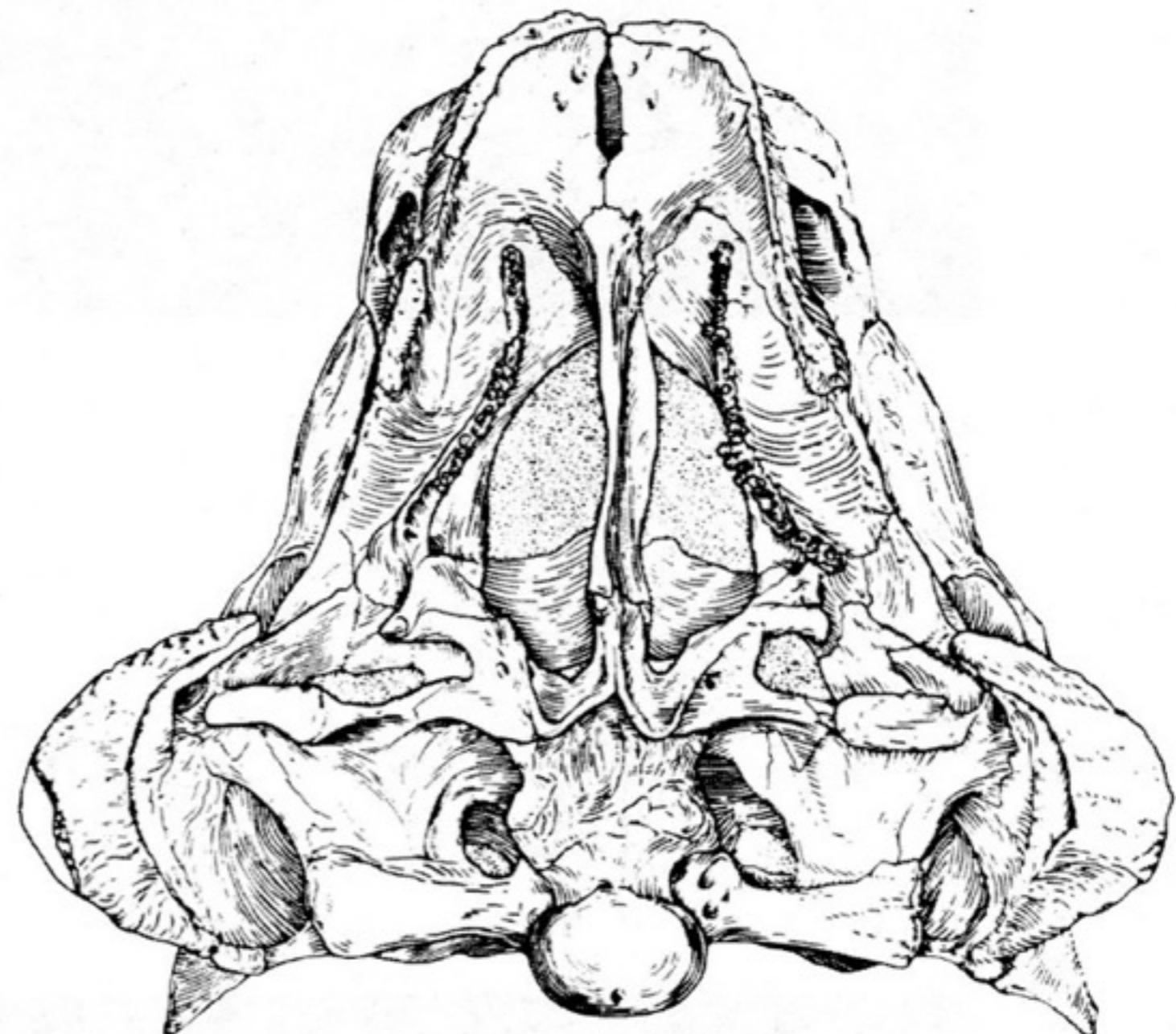
Ankylosaurids

Selective-feeders





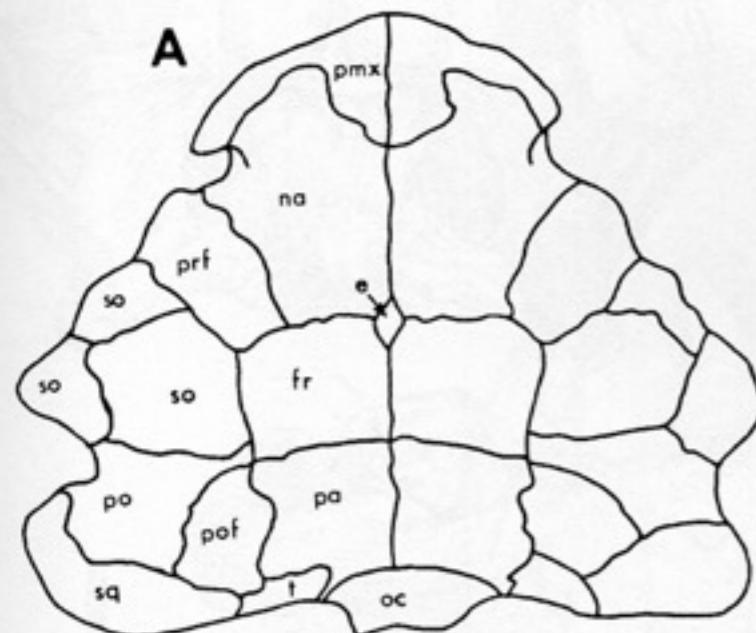
A



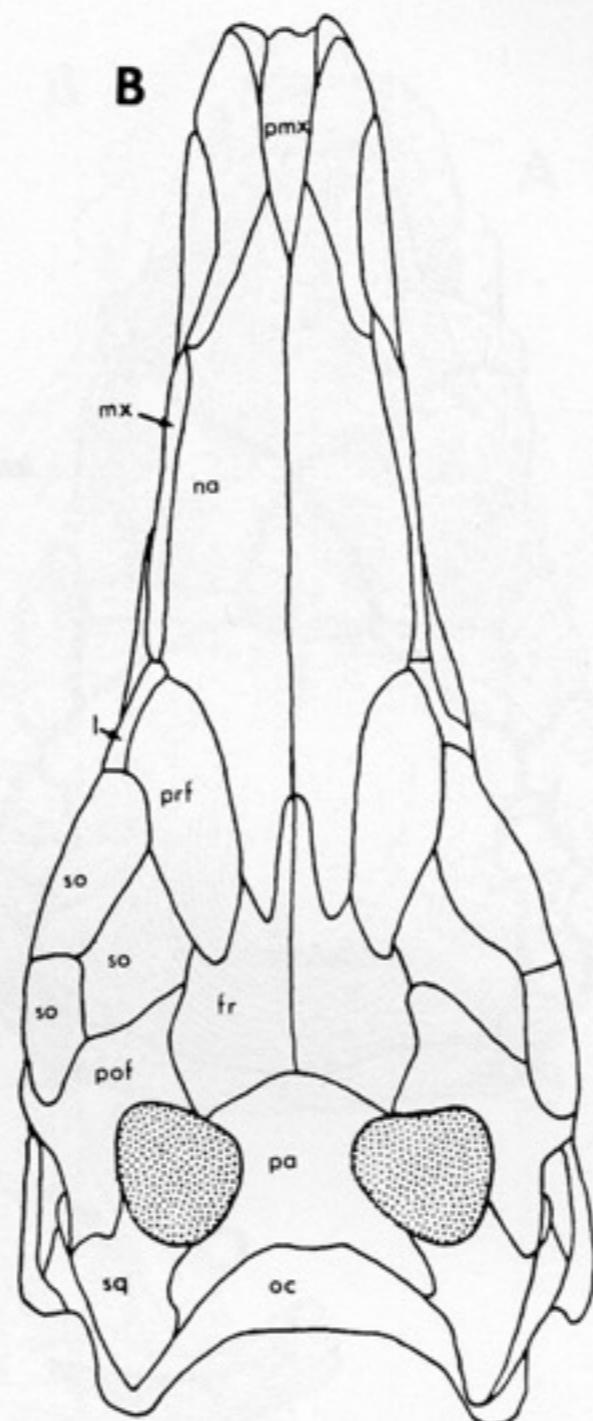
B



Diet



Ankylosaurus



Stegosaurus

5 fenestrae in basal Dinosaurs
Nares
Antorbital
Orbit
Upper Temporal
Lower Temporal

2-3 in Ankylosaurs (note: variable)
Nares
Orbit
(sometimes) lower temporal



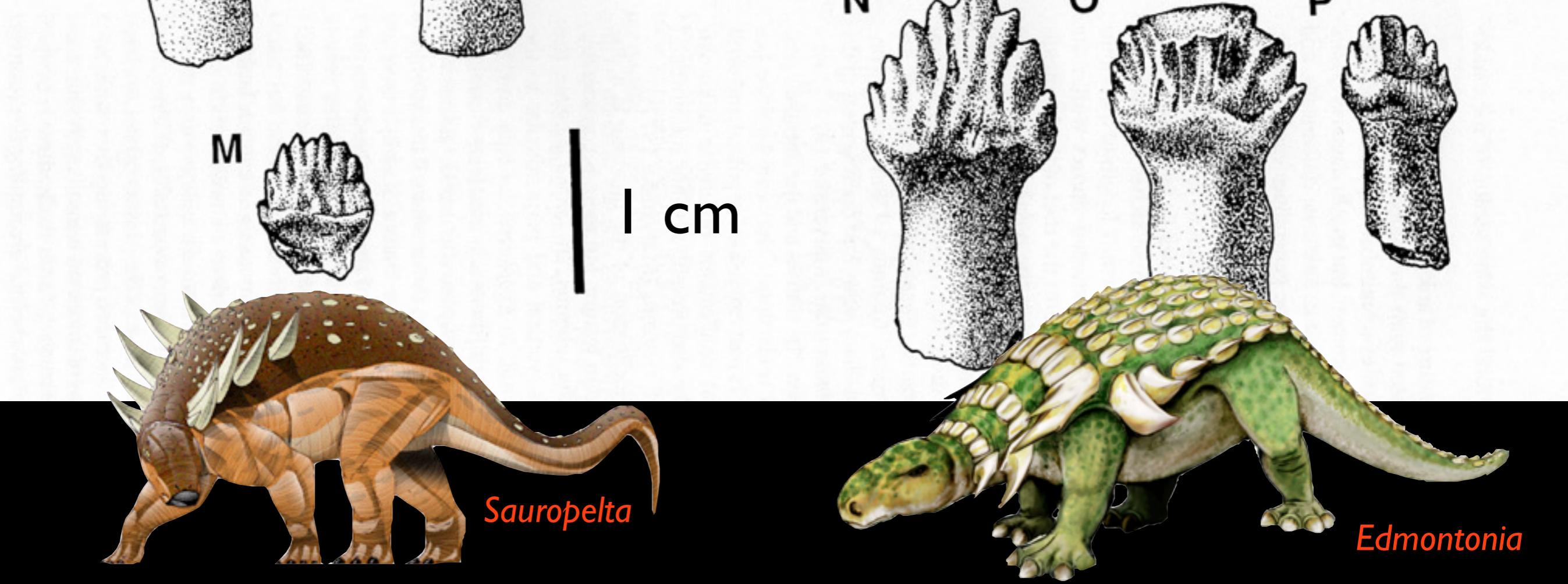
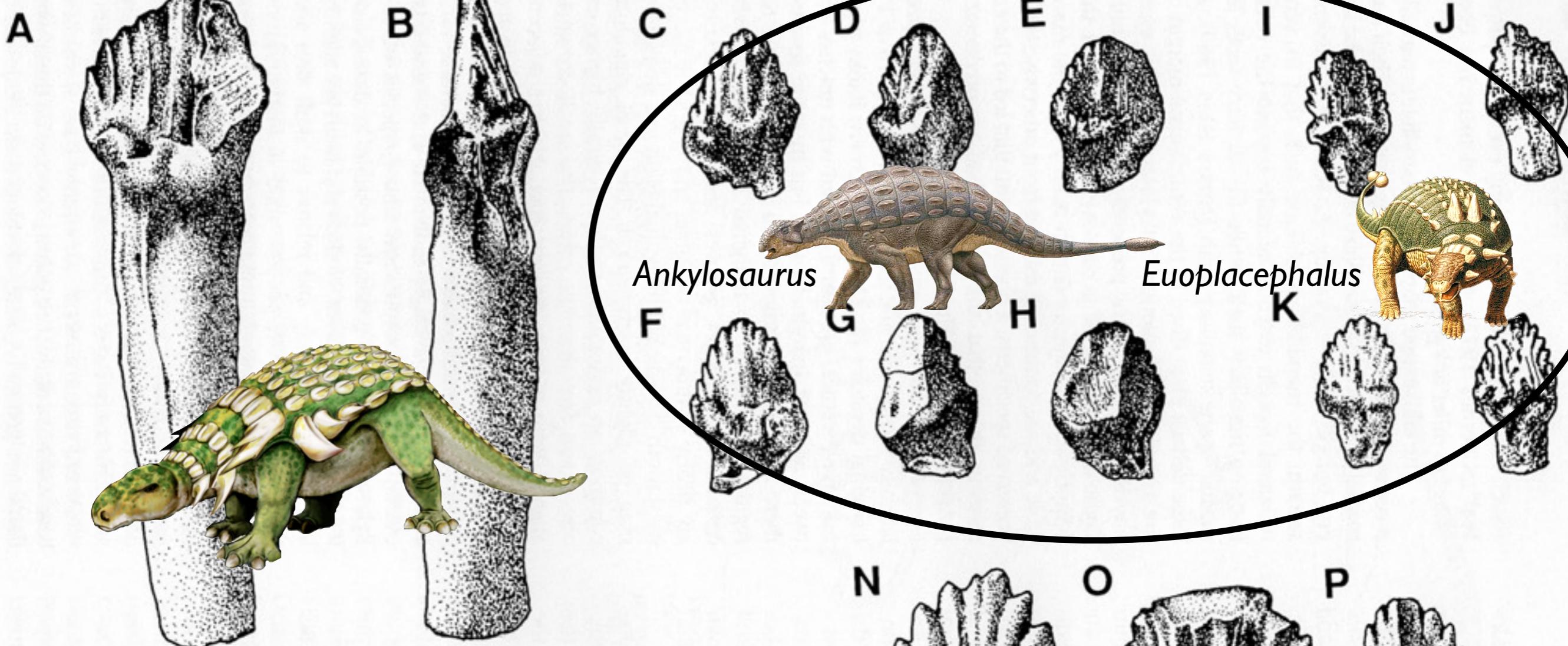
Tarchia

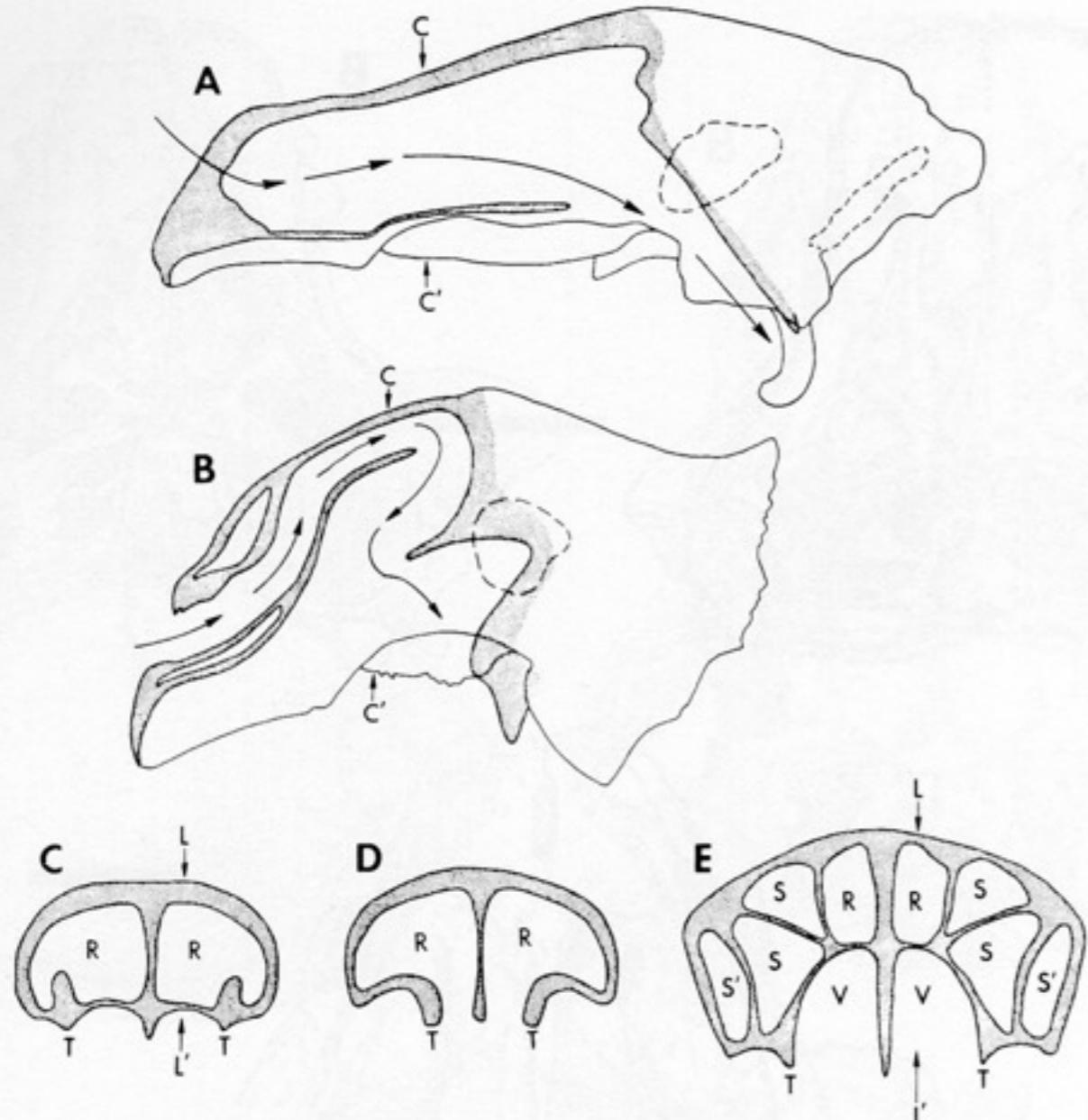
Diet



Euplocephalus
Ankylosaurid
Late Cretaceous

Tooth Morphology
Hand-shaped
Small overall
Smaller in Ankylosaurids
Early Ankylosaurs have conical
teeth on their premaxillae





Edmontonia

Euoplocephalus

Complex secondary palate

Theories:

Resonating chamber

Smell

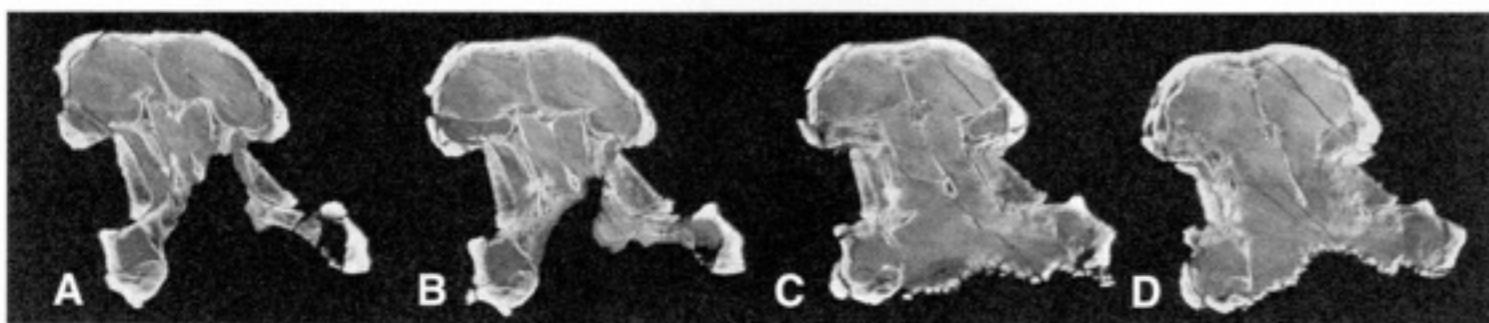
Moisten dry air

Structural brace for complex jaw movements

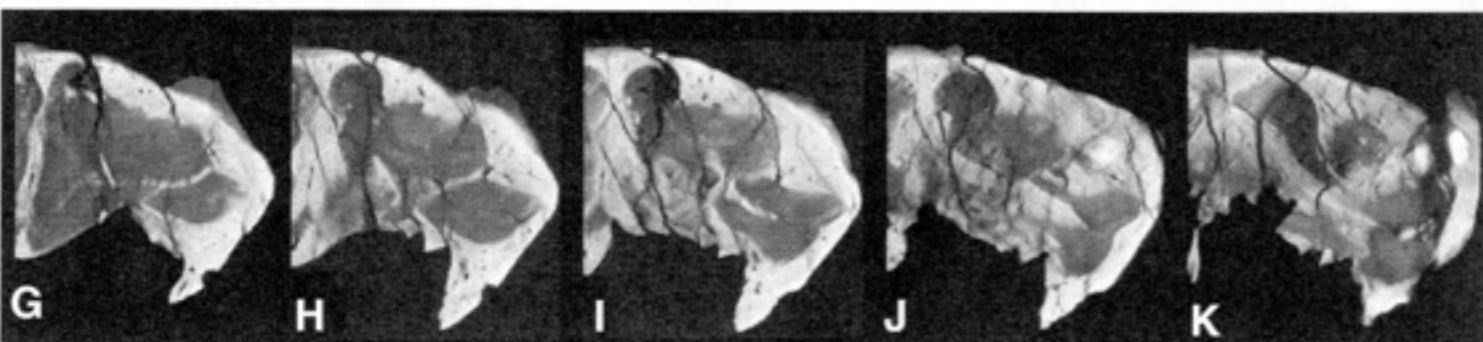
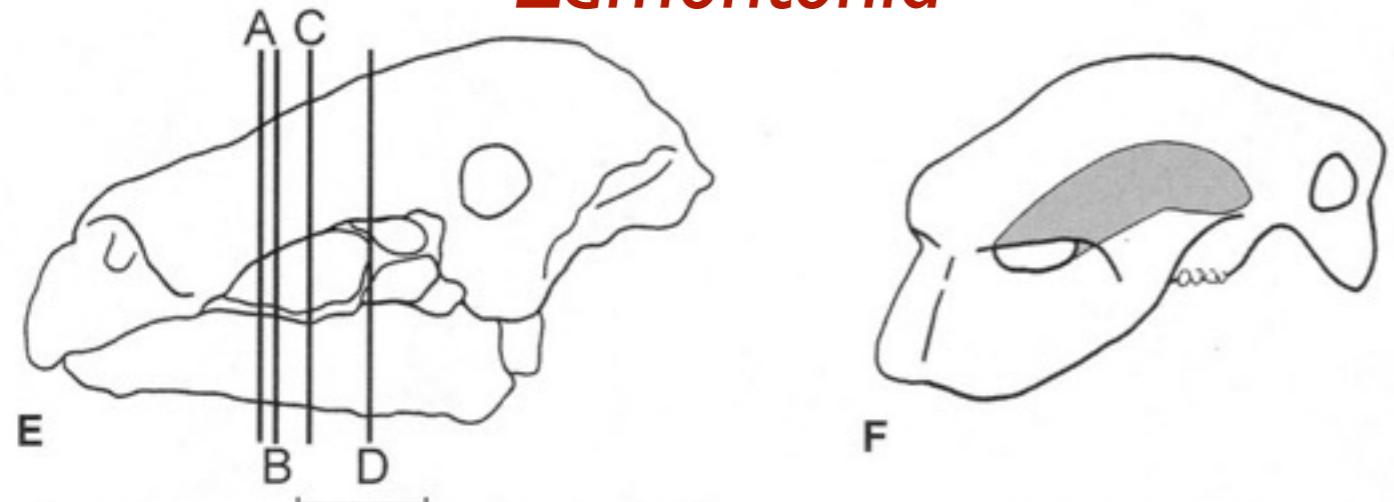
Evidence:

Teeth: microscopic wear

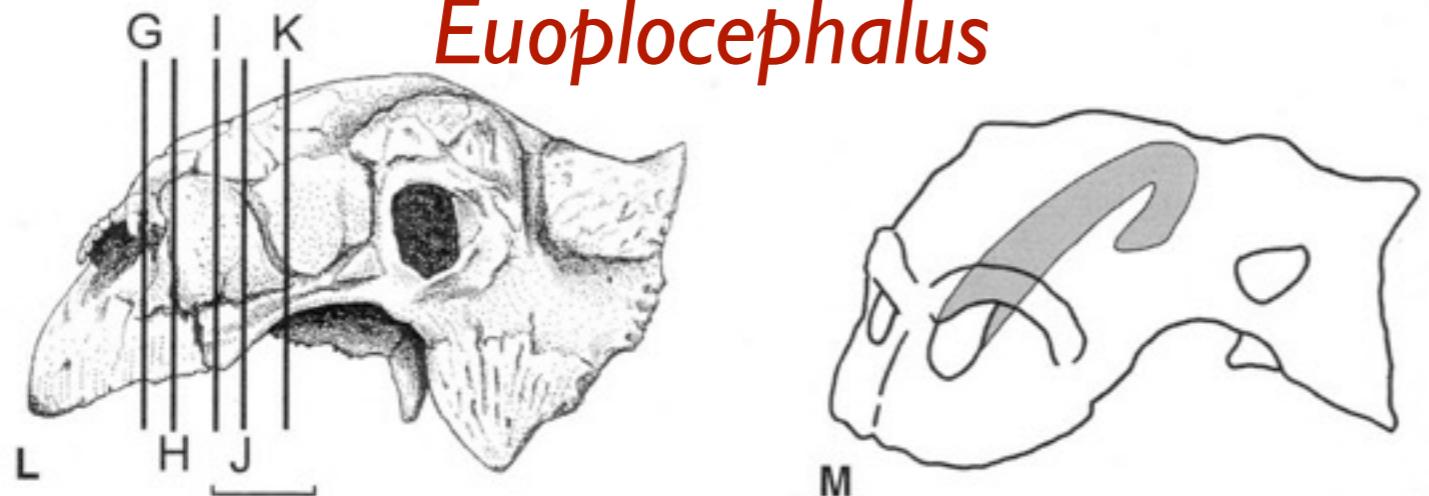
*patterns: suggest pivoting
of lower jaw*



Edmontonia



Euoplocephalus





How to be an Herbivore: 101



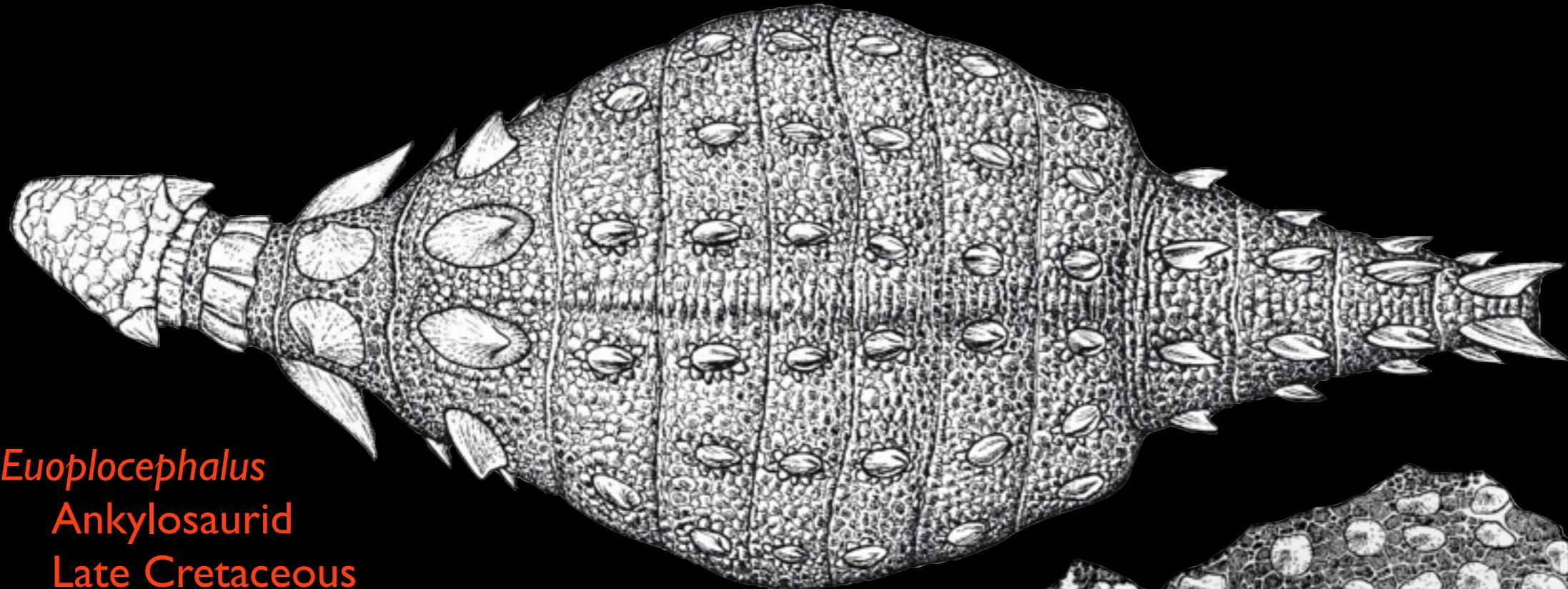
Small & Picky



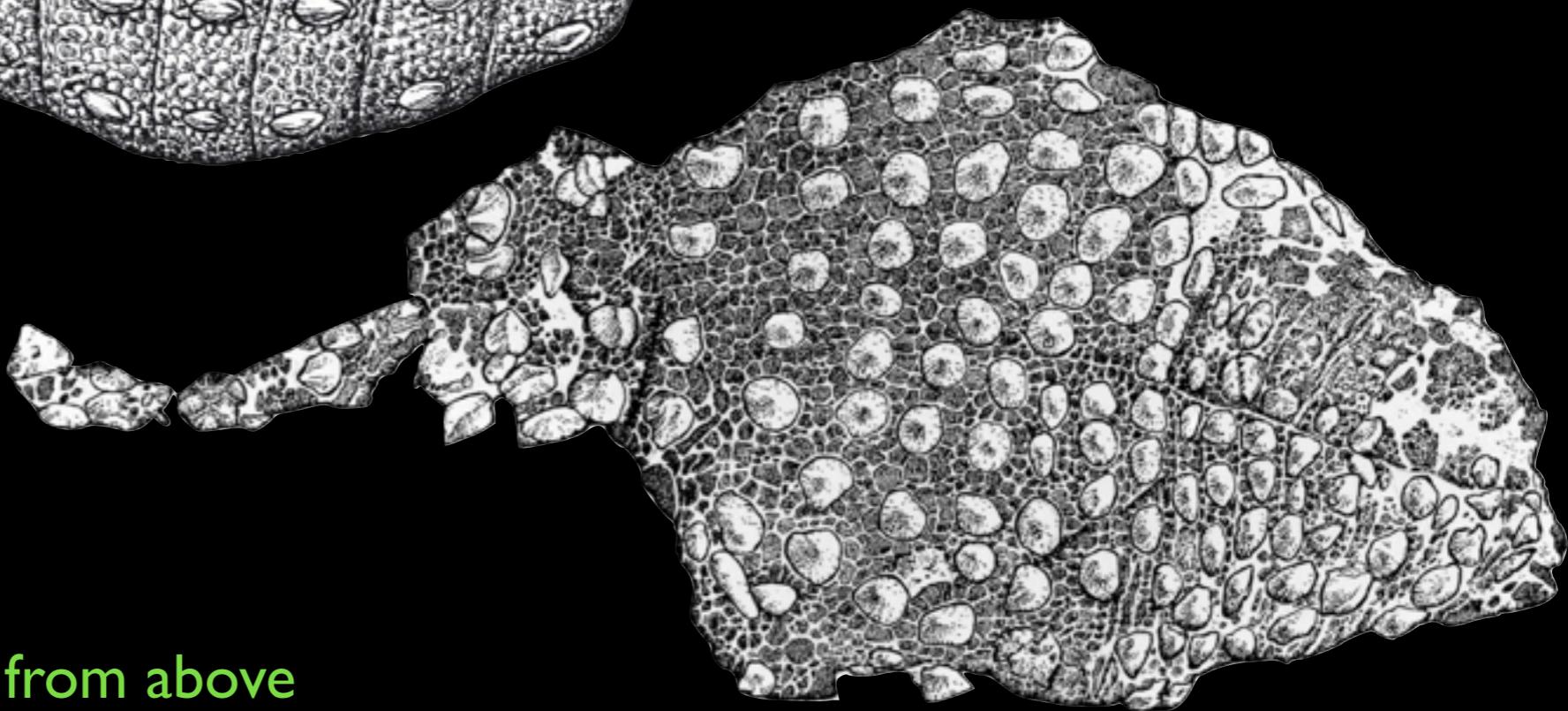
Big & Indiscriminate



Zebra => Wildebeest => Thompson's Gazelle



Euoplocephalus
Ankylosaurid
Late Cretaceous



Sauropelta
Nodosaurid
Early Cretaceous

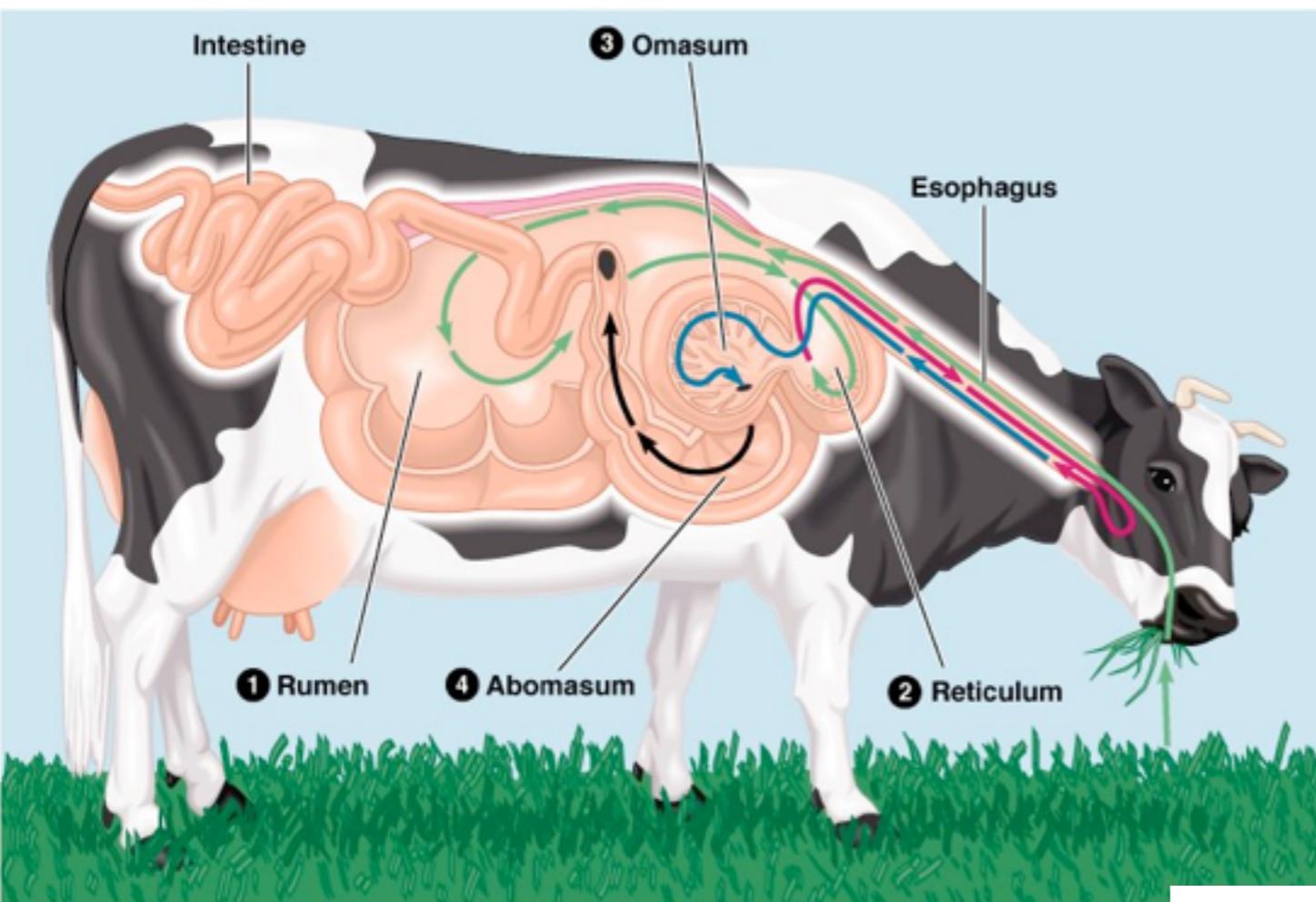
G U T S

Wide hindquarters viewed from above

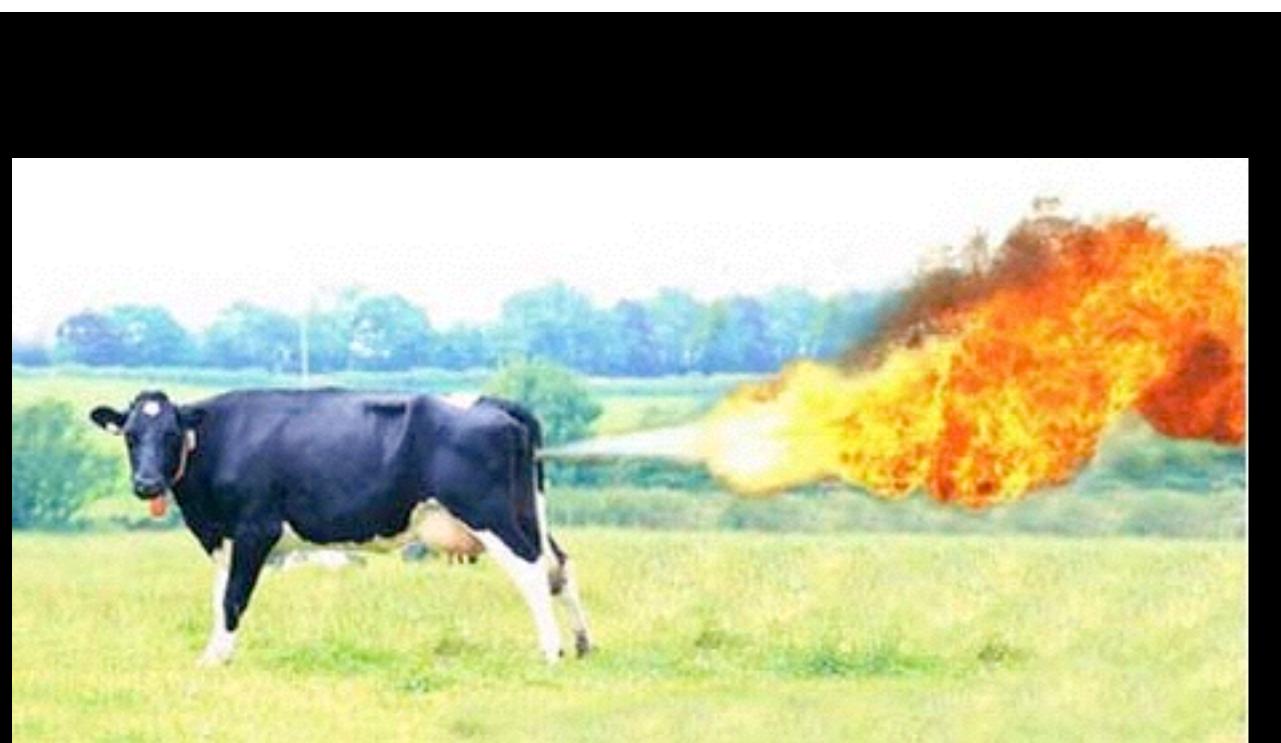
Suggests Rear-Fermentation

No Gastroliths (like Stegosaurids)

~except Panoplosaurus



©1999 Addison Wesley Longman, Inc.

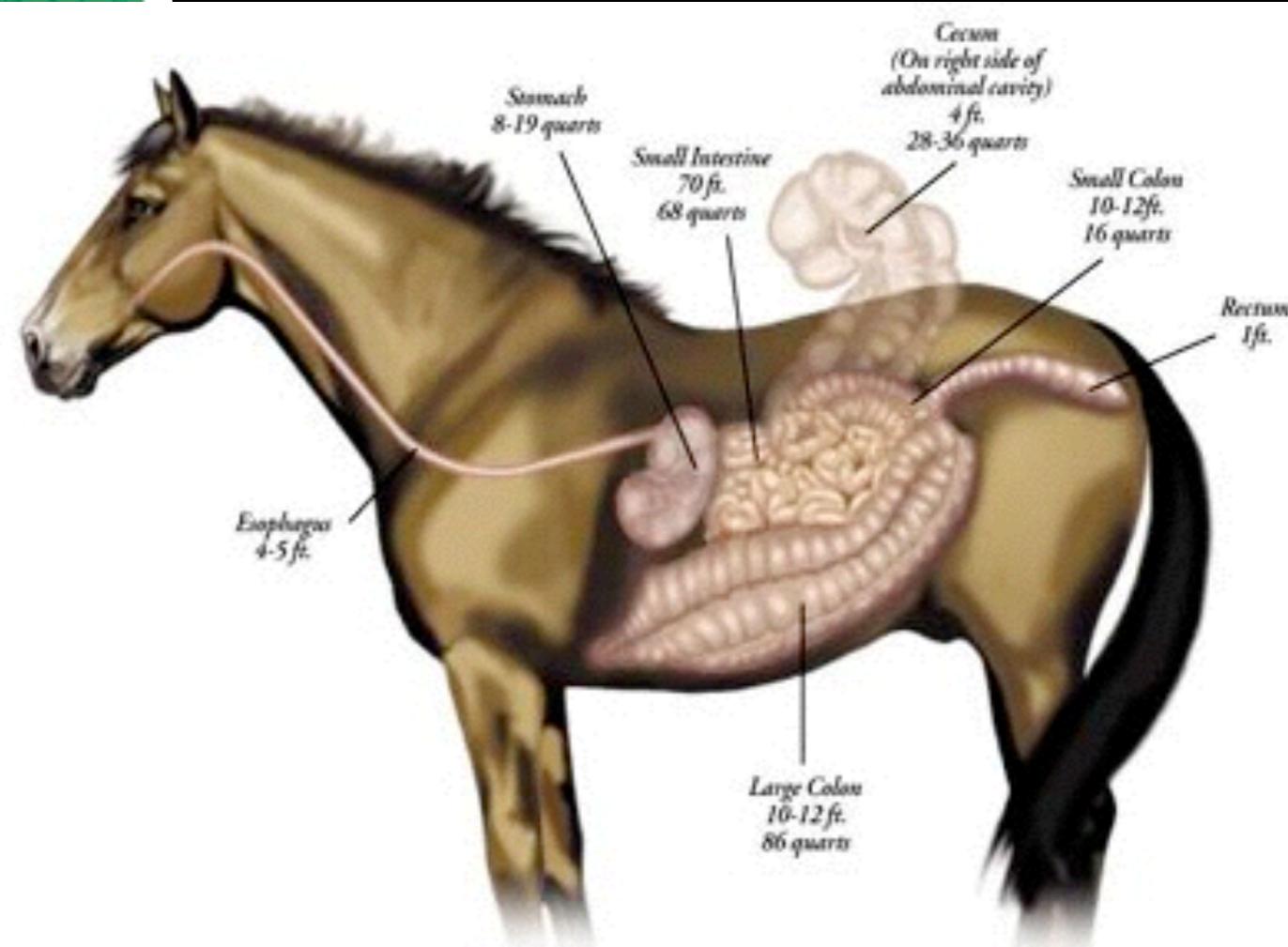


GUTS

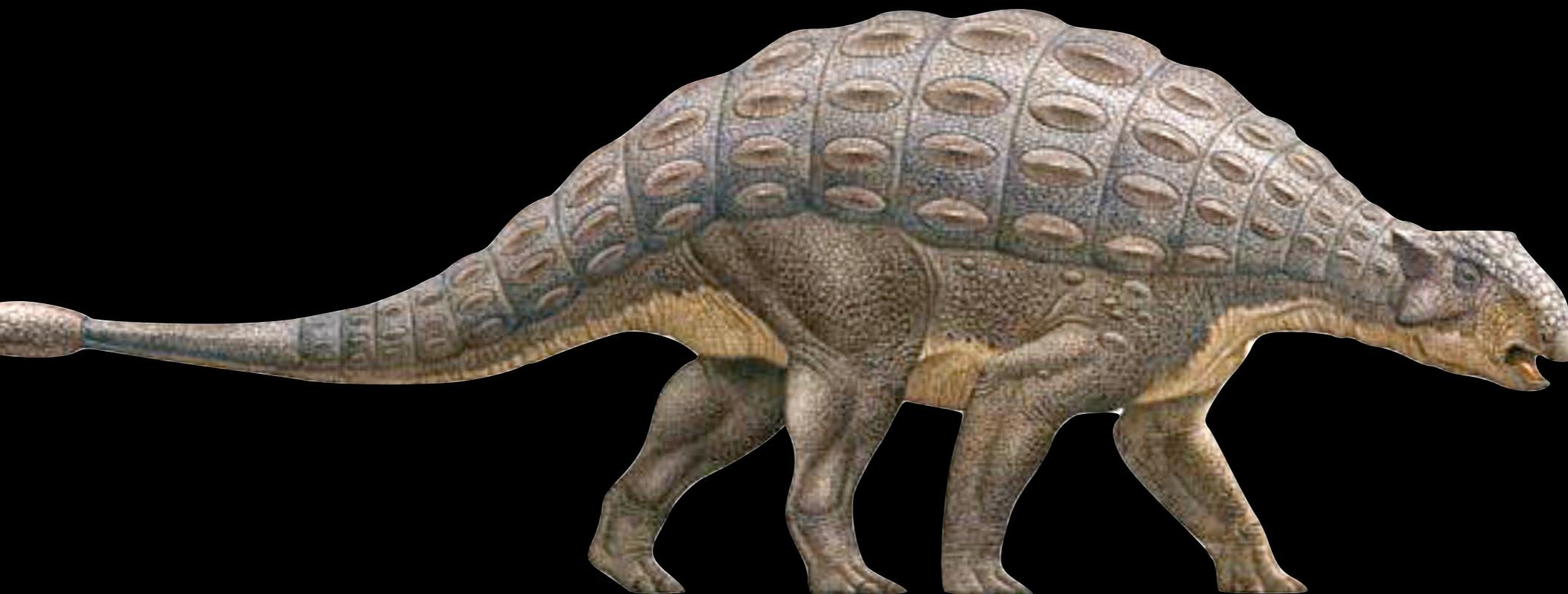
Fore-Gut Fermenters (cows)
Ruminants

Hind-Gut Fermenters (horses)

Caeco-colic Fermenters (us)



Diet



Enlarged Hyoid... => Long tongue



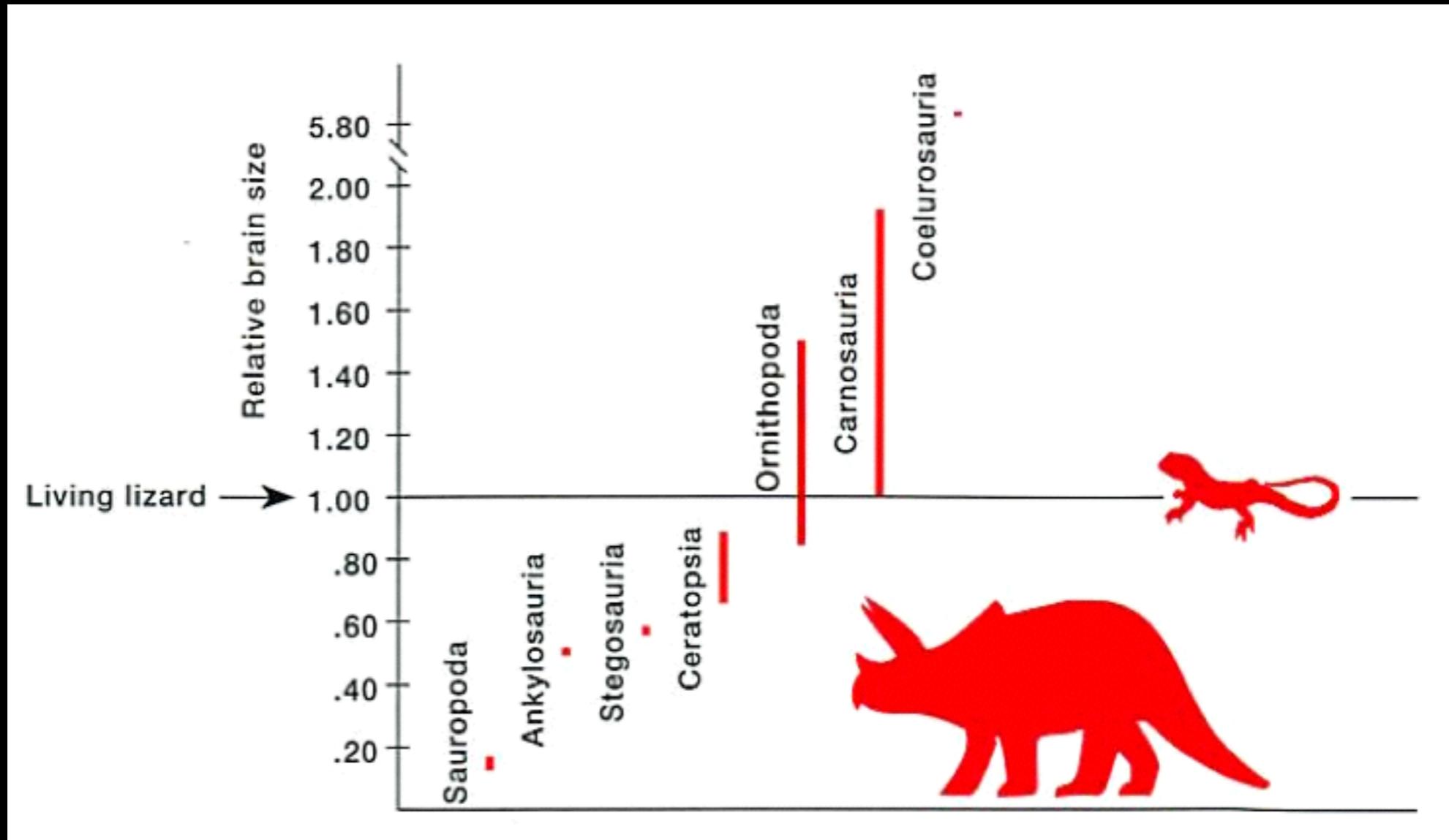
Brain

OHIO
UNIVERSITY
www.ohio.edu/WitmerLab



<http://www.youtube.com/watch?v=Yn2vlmsZwjA>

Brains

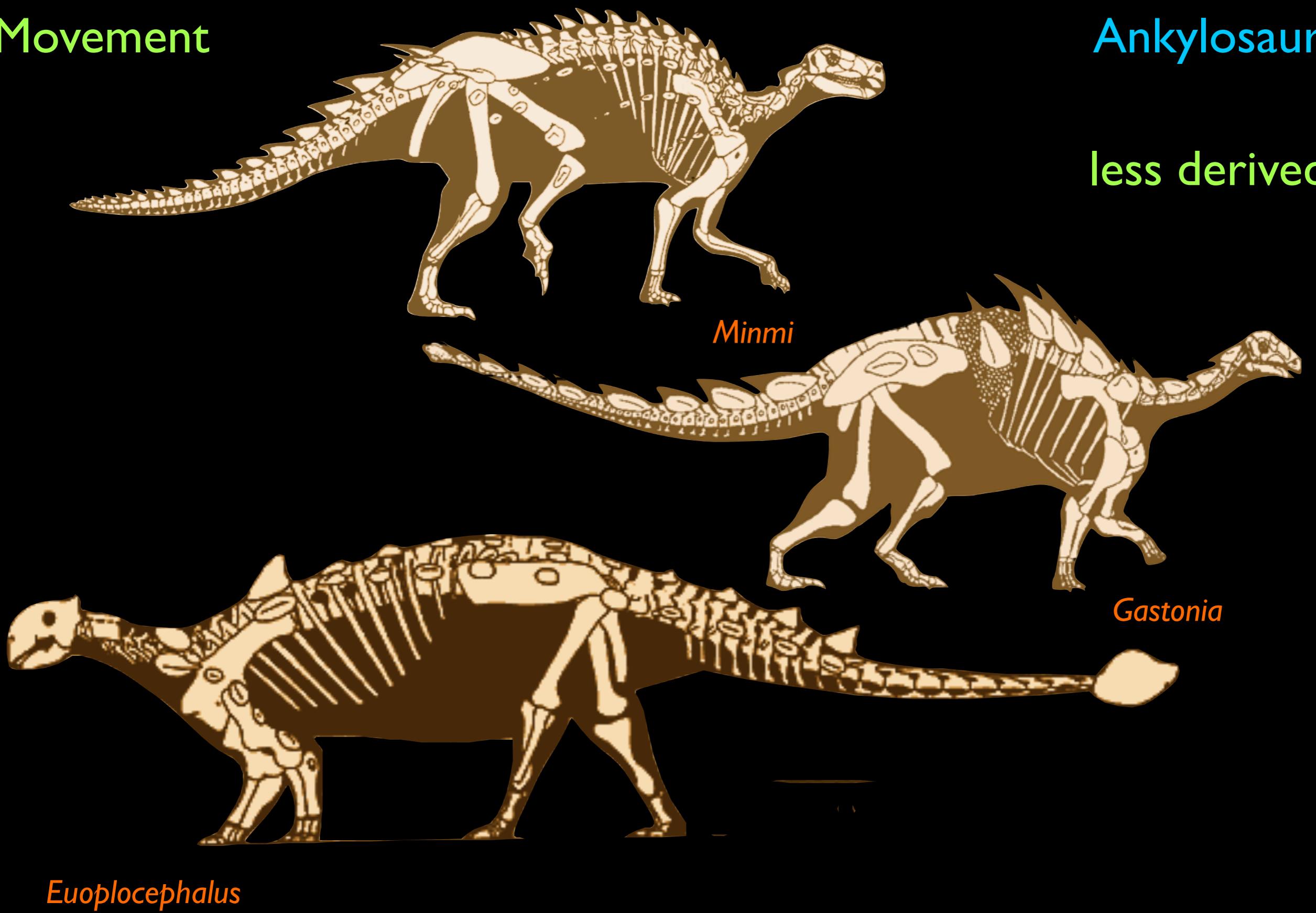


Movement



Movement

Ankylosaurids



less derived

Gastonia

Euoplocephalus

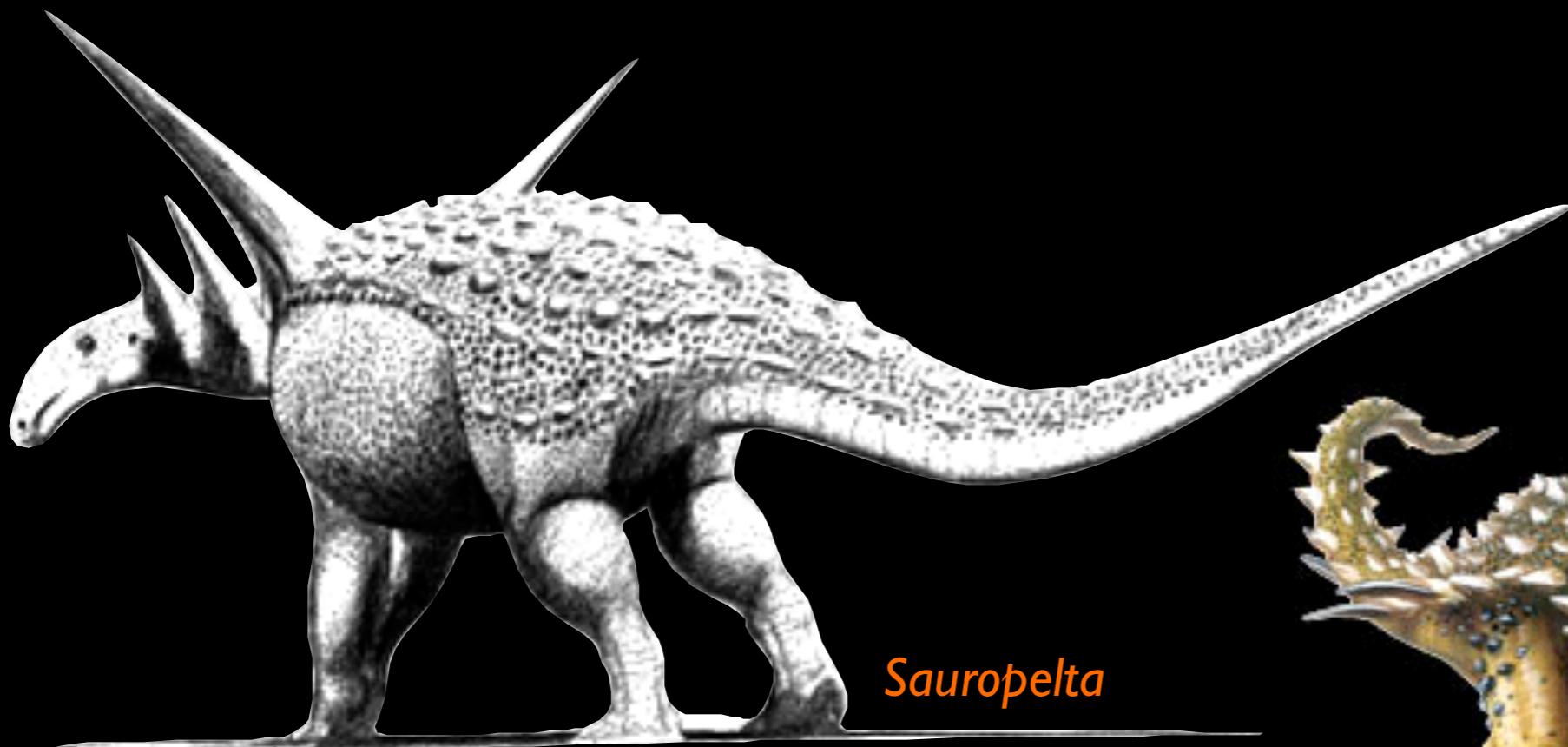
more derived

Nodosaur's

less derived



Pawpawsaurus



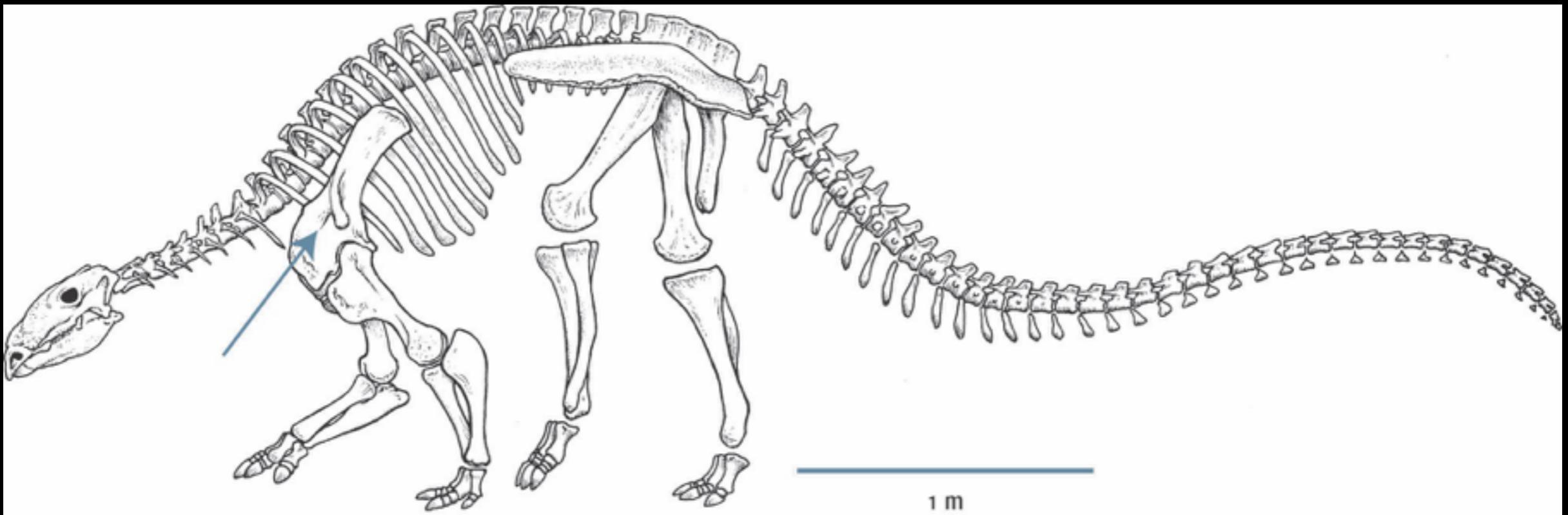
Sauroelta

more derived



Edmontonia

Nodosauridae



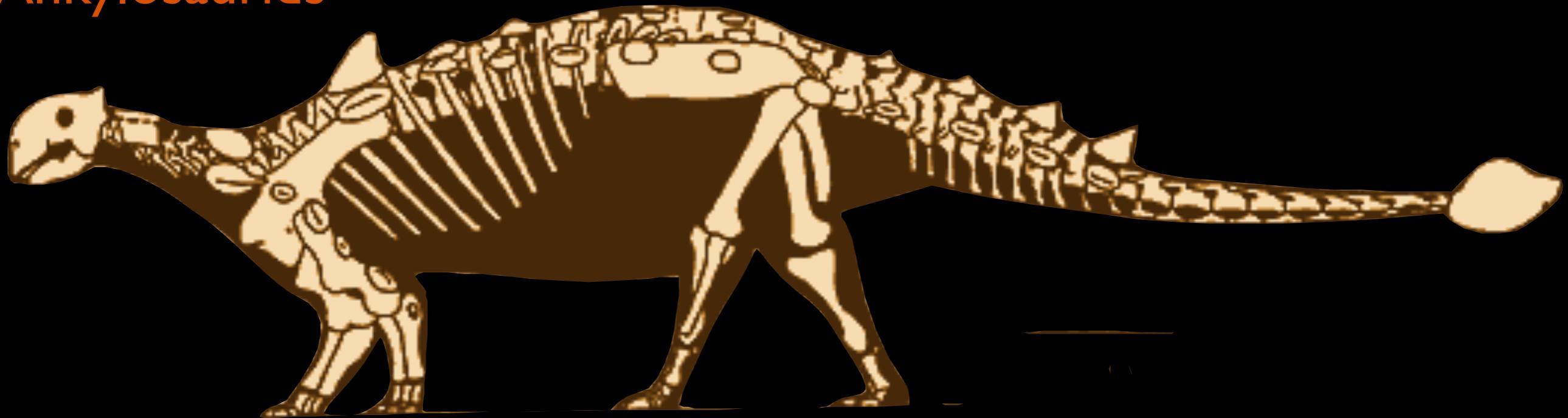
Projection of scapula (shoulder blade) - acromial process

Correlates with a well-muscled shoulder

Shared, derived, character (synapomorphy) of Nodosauridae

Limbs: pillar-like (compare to Rauisuchians ~ pillar erect)

Ankylosaurids



Euoplocephalus

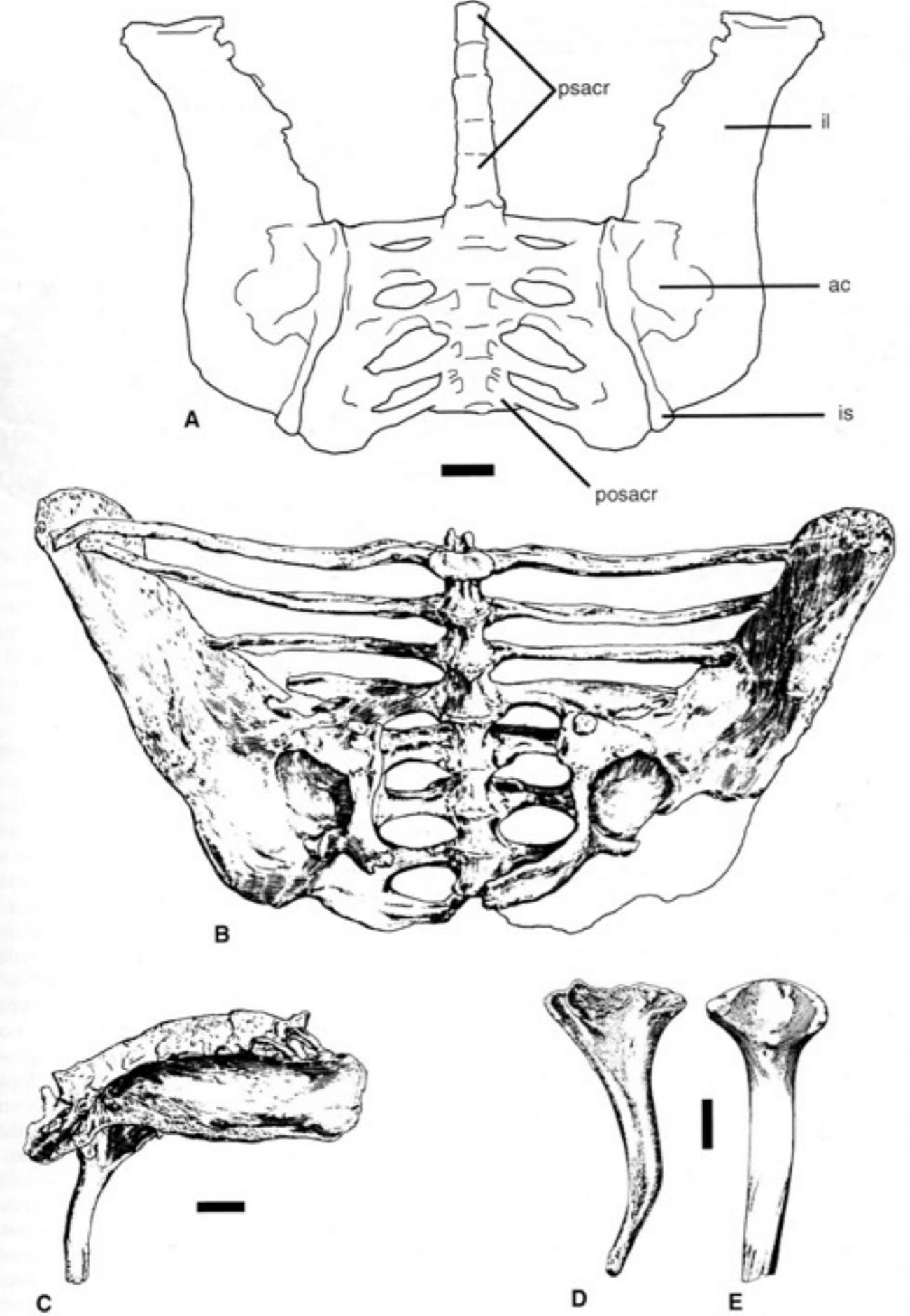
Upper arm crest especially well-developed
Indicated high power strokes with forearms

Why?

Positioning for tail swings ala Stegosaurids?

Digging?

'Running'?



'Power-Pelvis'

FIGURE 12.15. Ankylosaur synsacrum and pelvis: A, synsacrum and pelvis of *Struthiosaurus languedocensis*, ventral view; B, C, synsacrum and pelvis of *Euoplocephalus tutus*, ventral and right lateral views; D, ischium of *Edmontonia rugosidens*, lateral view; E, ischium of *Ankylosaurus magniventris*, lateral view. Scale = 10 cm. (A modified from Garcia and Pereda-Suberbiola 2003 by T. Fedak; B, C after Coombs 1978b, 1979; D after Gilmore 1930.)



A

Scelidosaurus



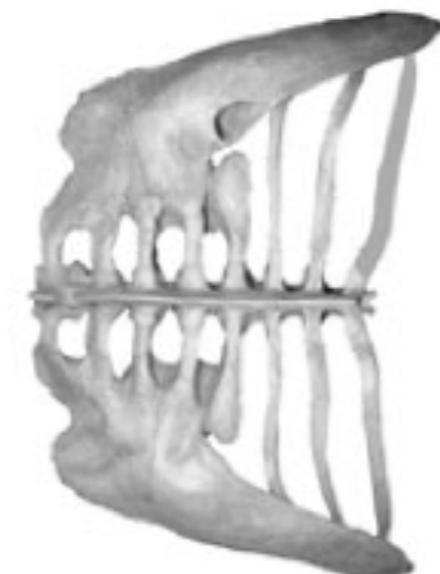
B

Thescelosaurus



C

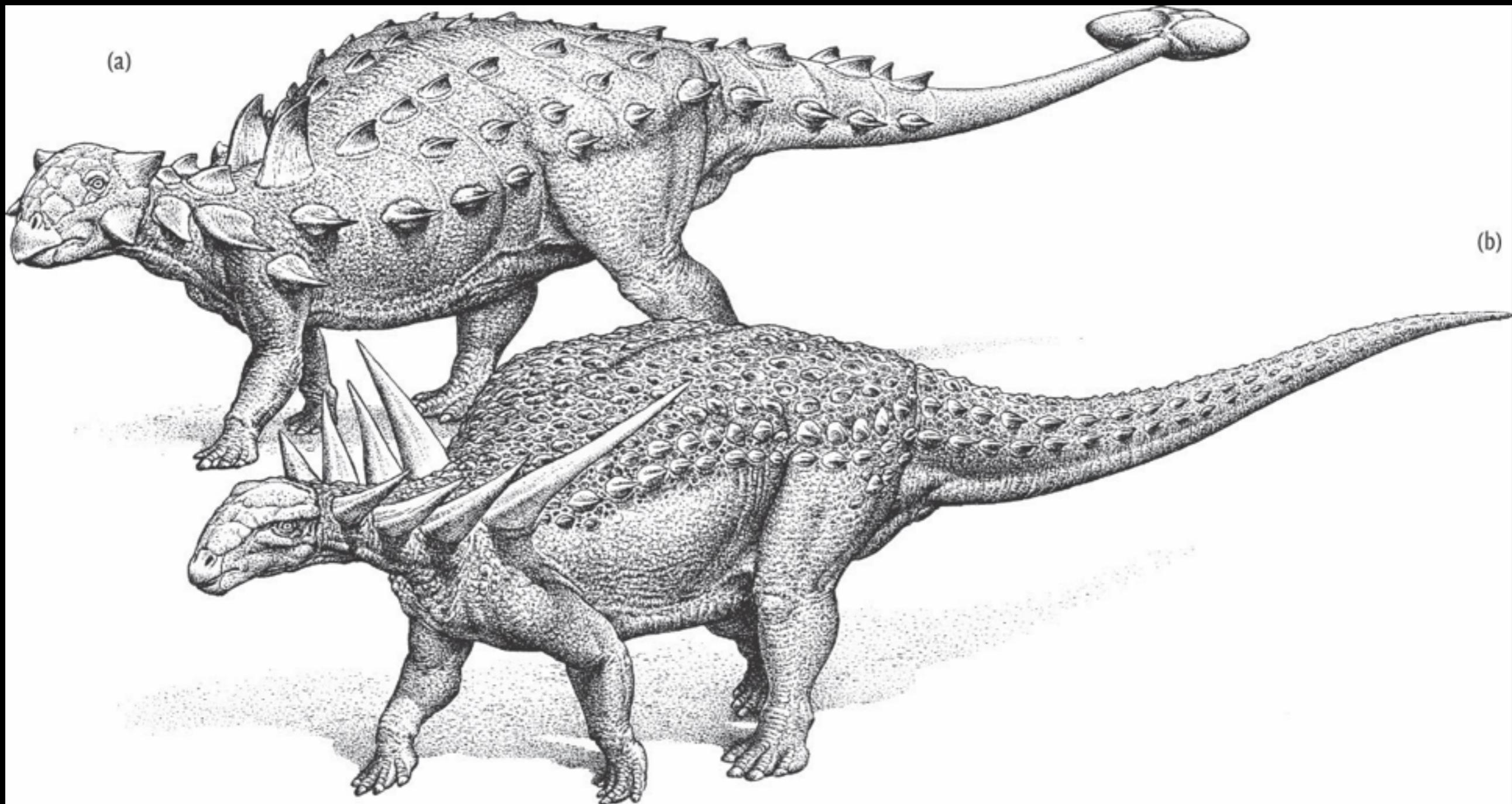
Stegosaurus



D

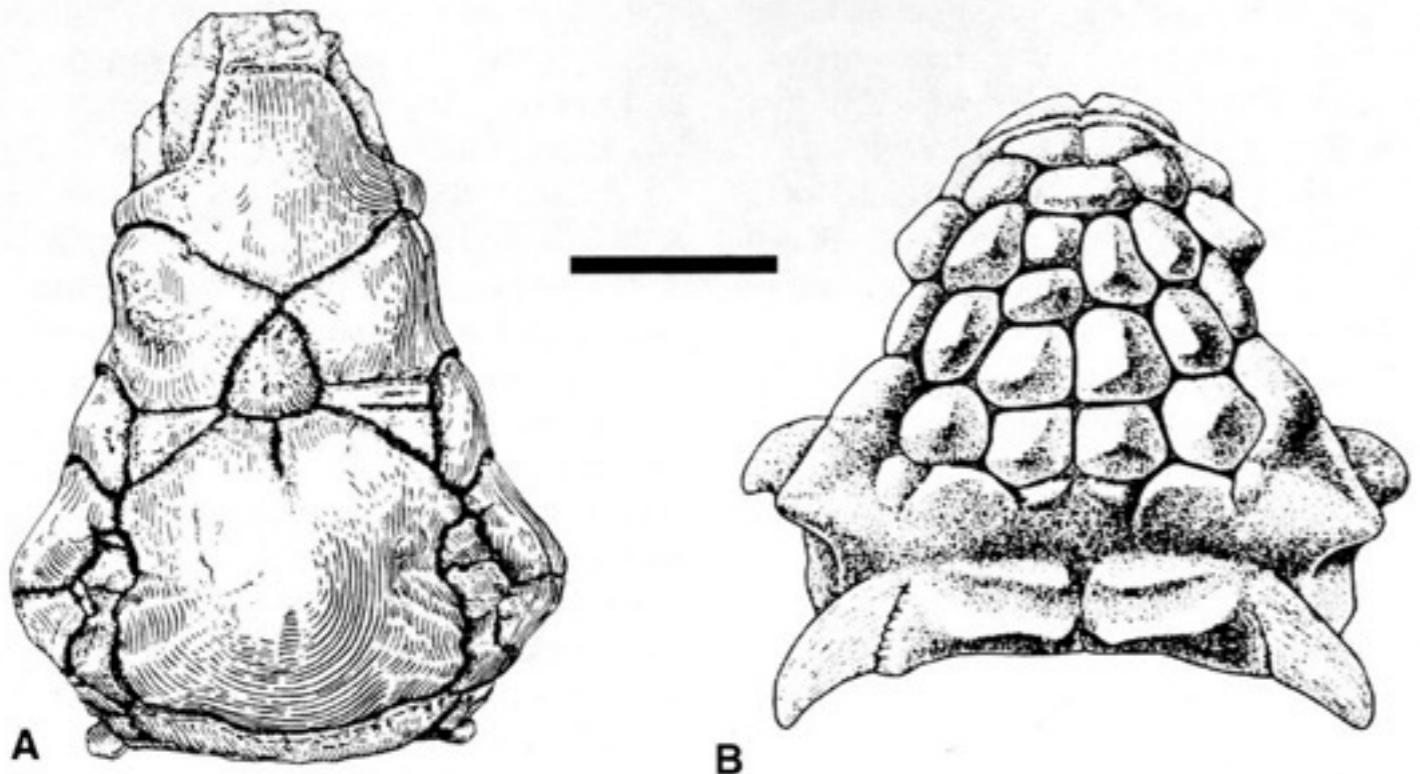
Ankylosaurus

(a)



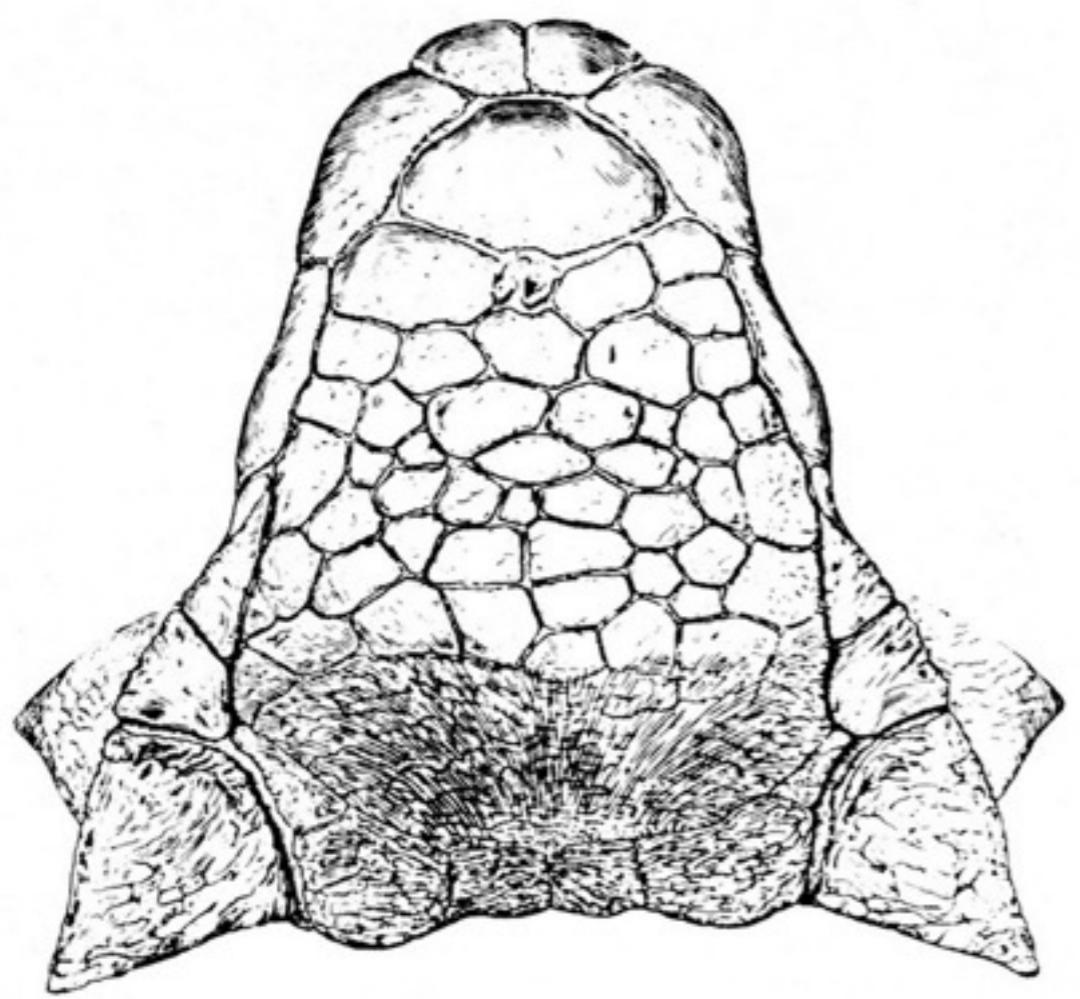
(b)

Cranial Accessories



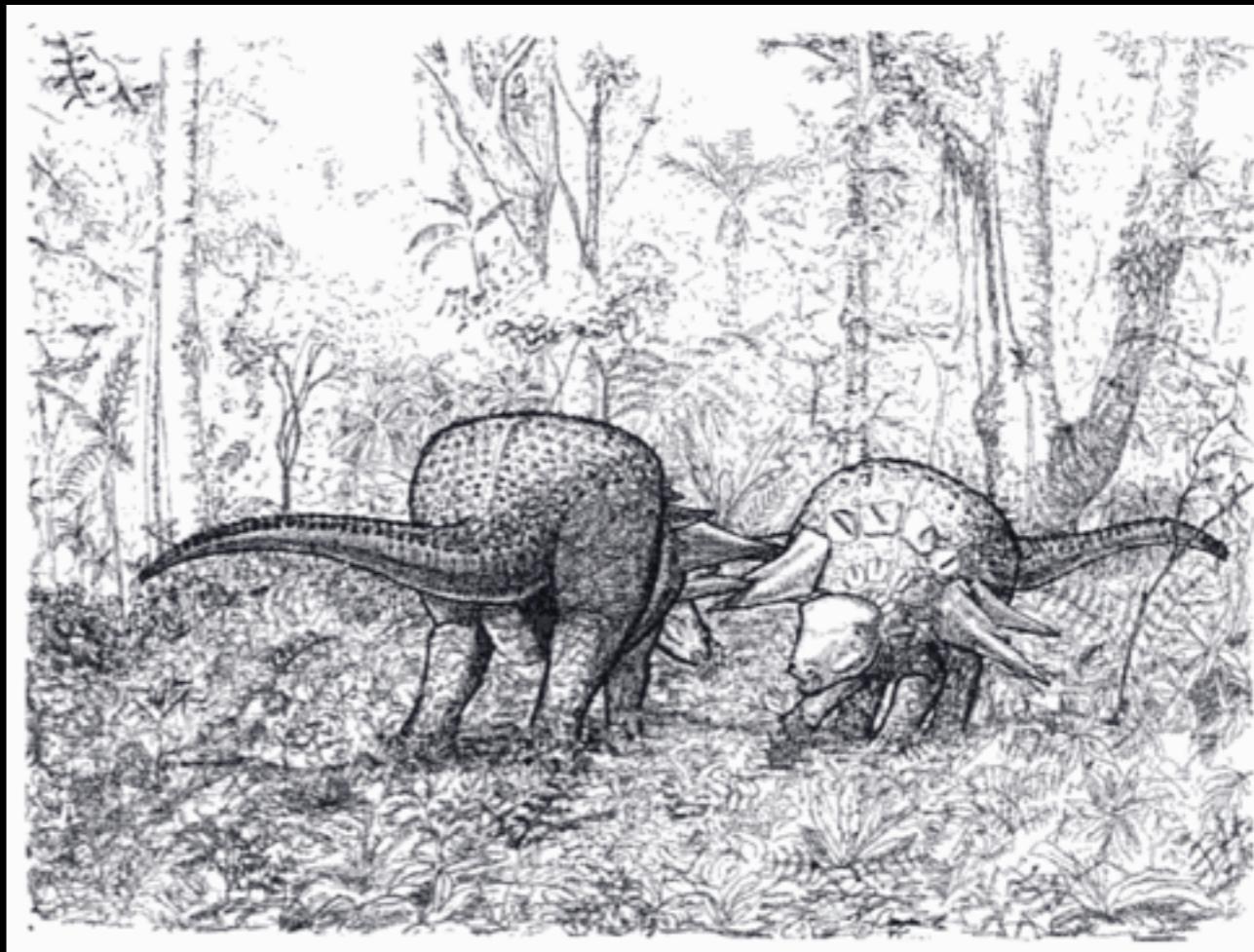
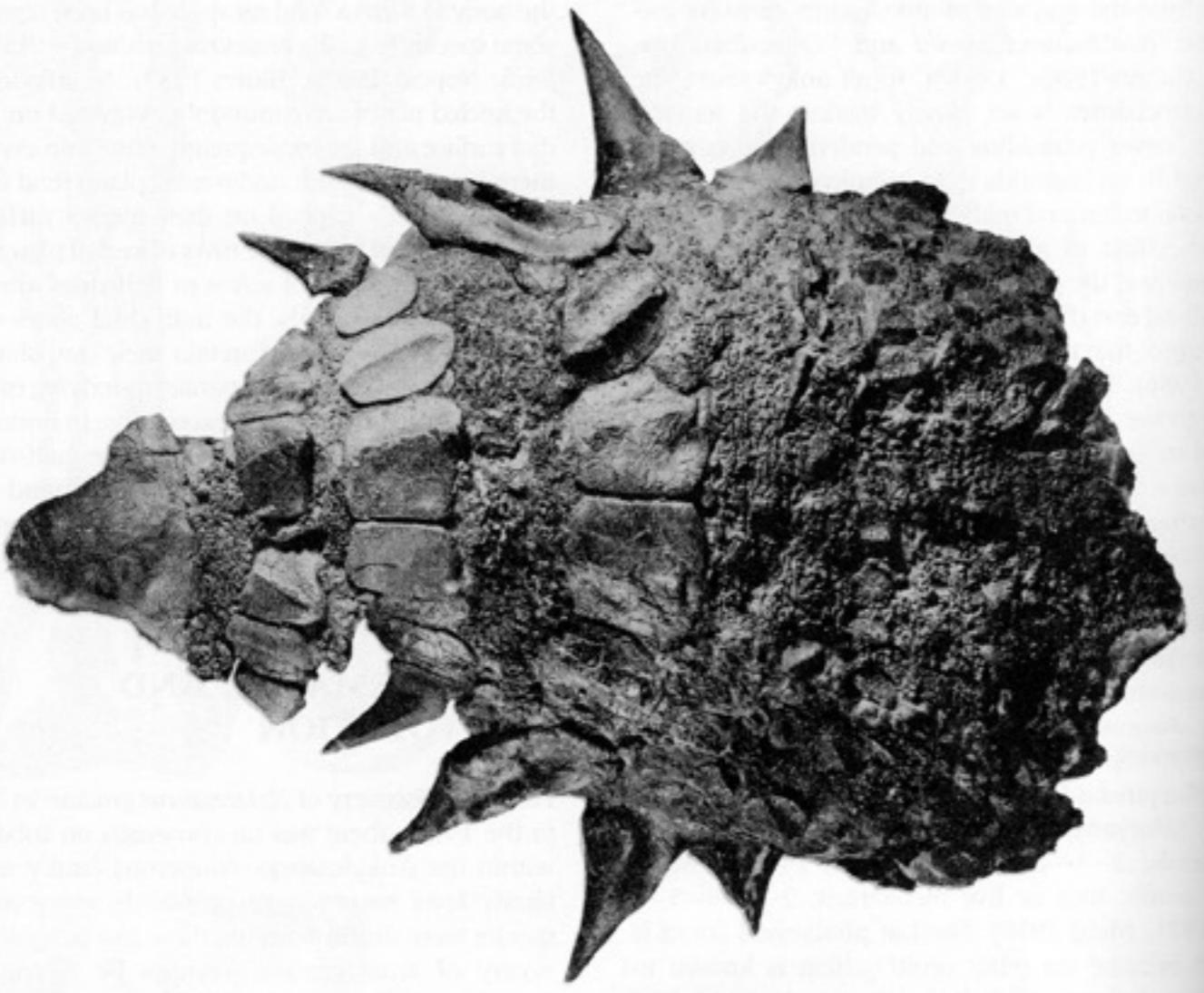
A

B



C

Ankylosaurs:
Squamosal horns



Armour:

Edmontonia

Passive defense against predators

Male-male competition; elements of armour may have been used to 'look bigger'

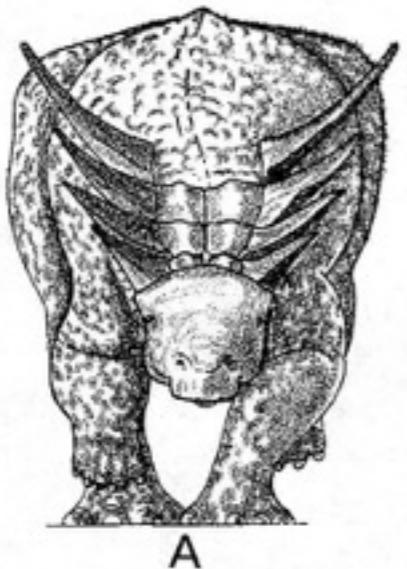
-showy structures/competition structures- like antlers in mammals

Armour has imprints of blood vessels: likely covered in skin, could be flushed with blood

Active Defense

Nodosaurids: shoulder spines

Ankylosaurids: Tail clubs



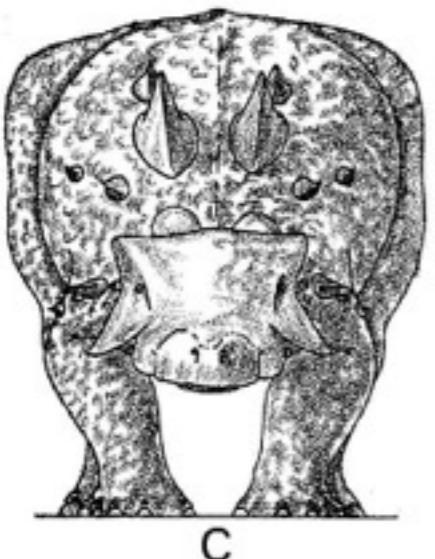
A

Sauropteryx
Nodosaurid



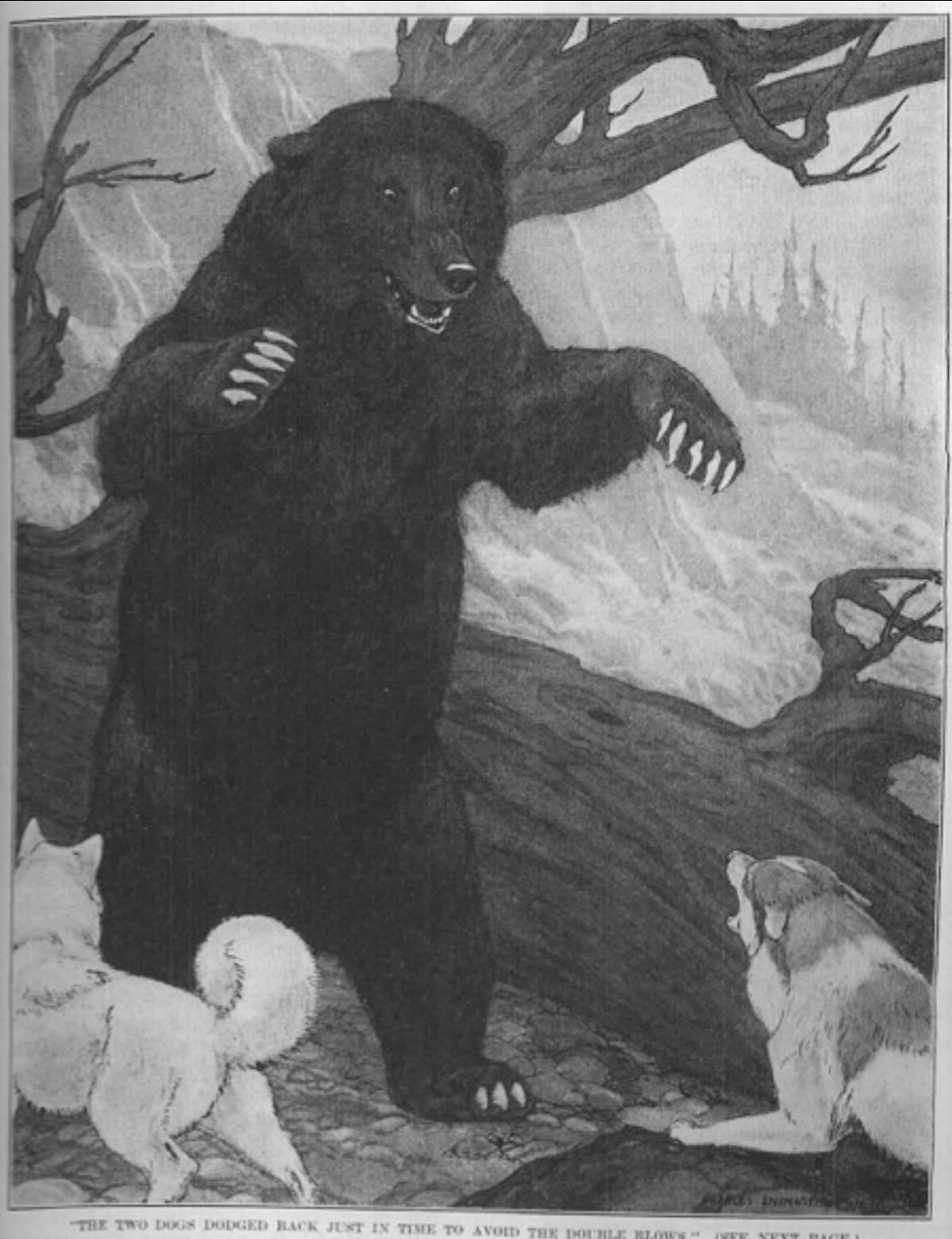
B

Edmontonia
Nodosaurid



C

Dyoplosaurus
Nodosaurid



"THE TWO DOGS DODGED BACK JUST IN TIME TO AVOID THE DOUBLE BLOWS." (SEE NEXT PAGE.)

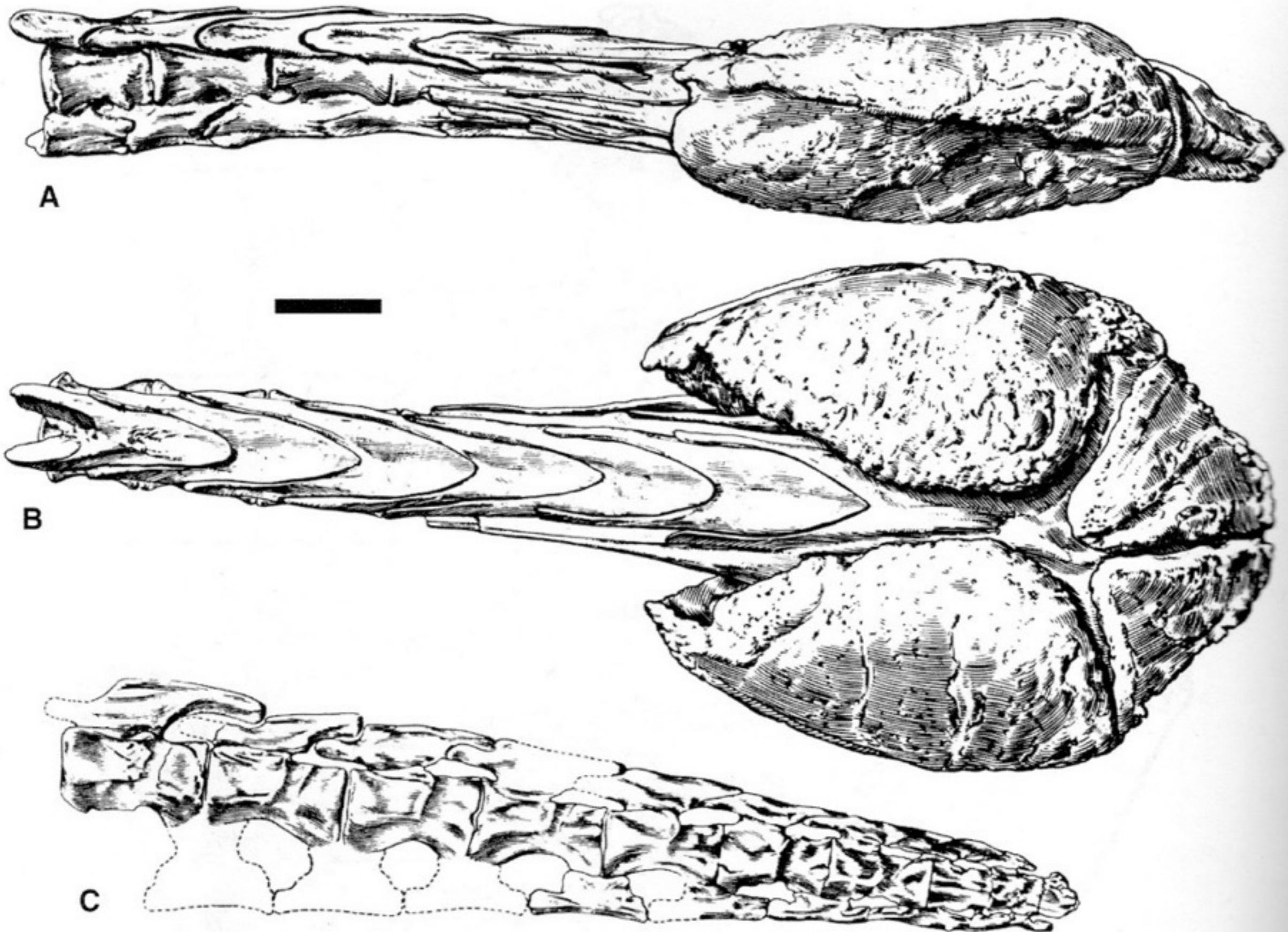


FIGURE 17.16. Ankylosaur distal caudal vertebrae: A, B, distal caudal vertebrae and tail club of *Euoplocephalus tutus*, lateral and dorsal views; C, distal caudal vertebrae of *Sauropelta edwardsorum*, lateral view. Scale = 10 cm. (After Coombs 1978b, 1979.)



Euoplocephalus



<http://www.youtube.com/watch?v=2rFPfbb5nSI>





© myart10







Ancient Greek: Ouroboros Cyclical







HEINRICH HARDER.

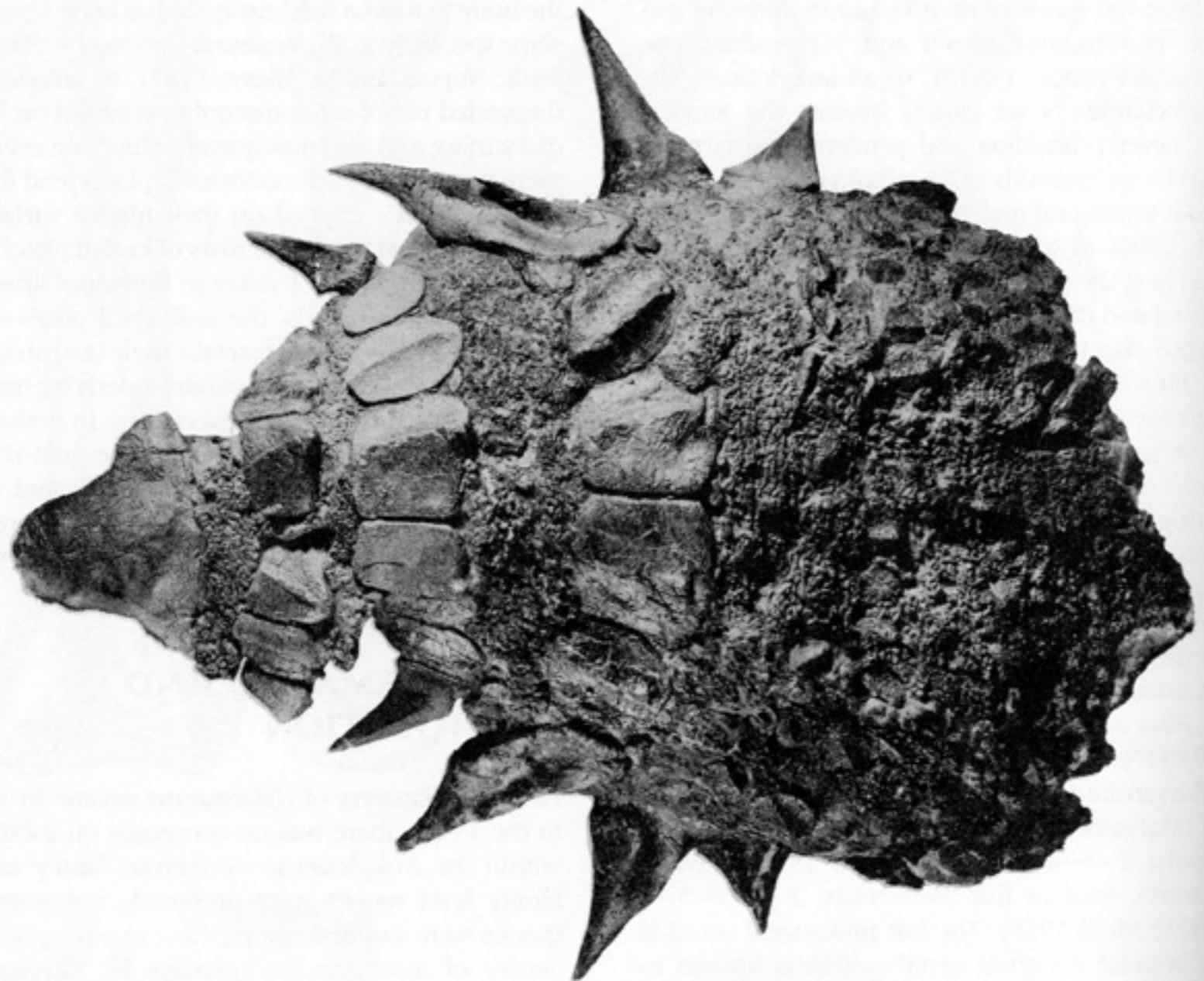




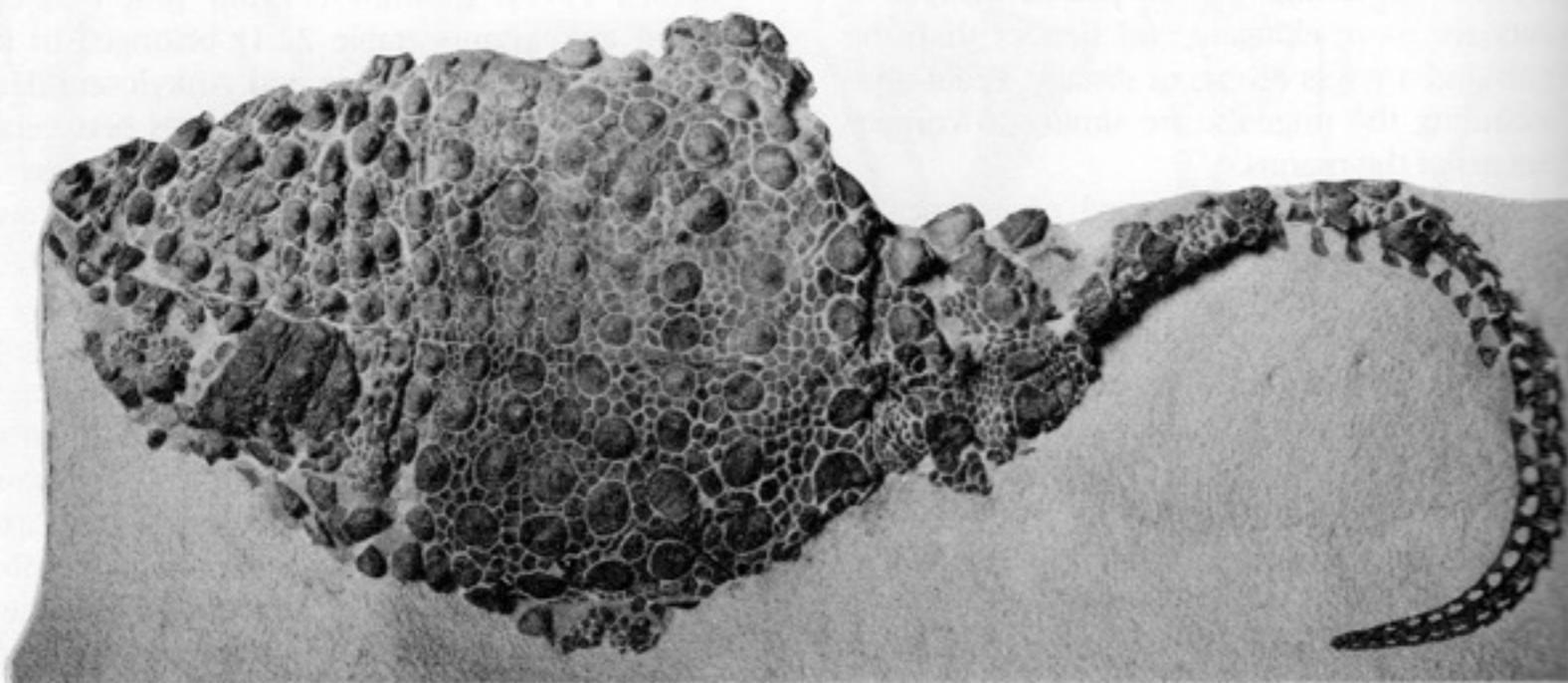
Taphonomy



Sauropterygia



Edmontonia



Sauropterygia



Pinacosaurus

