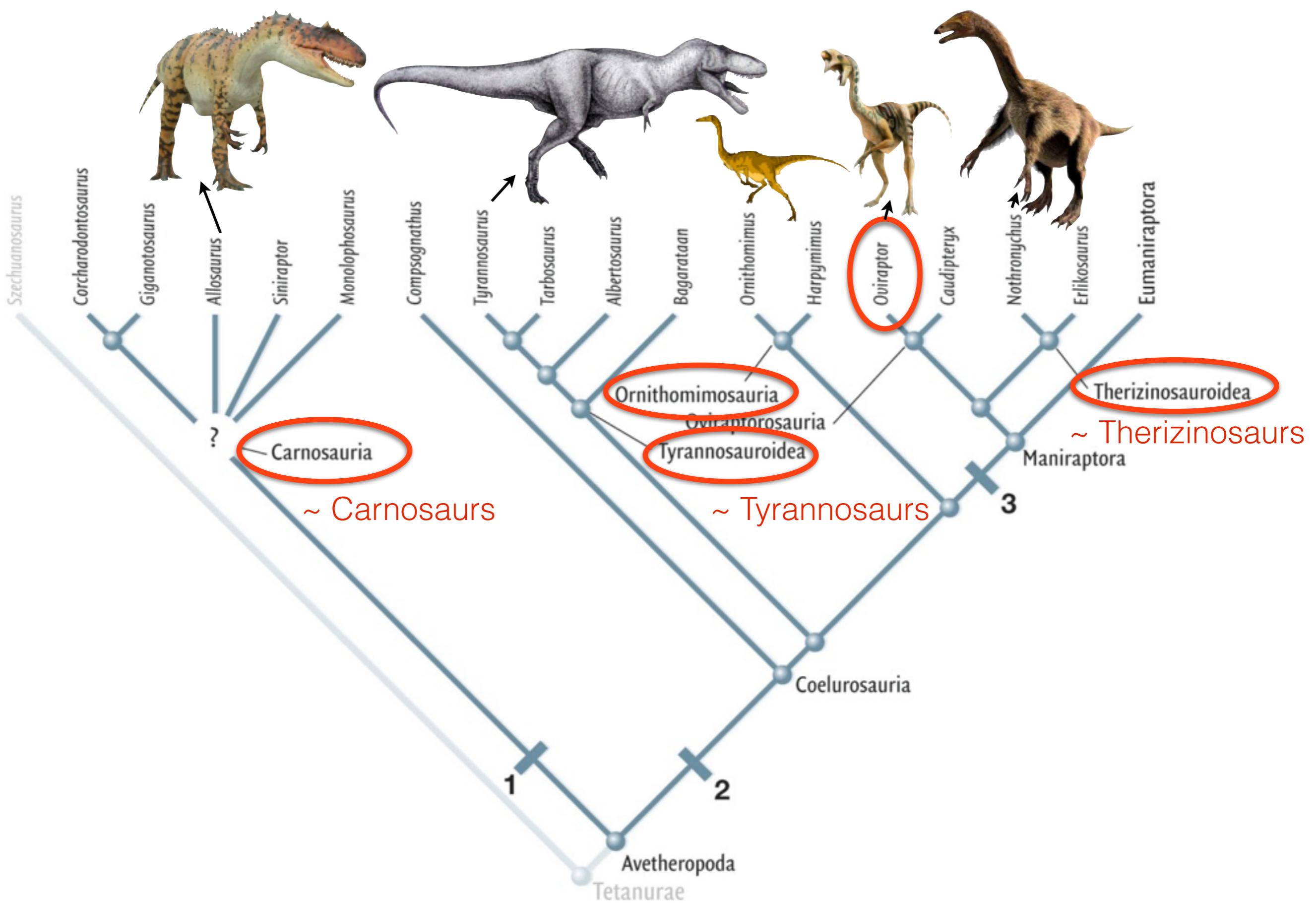
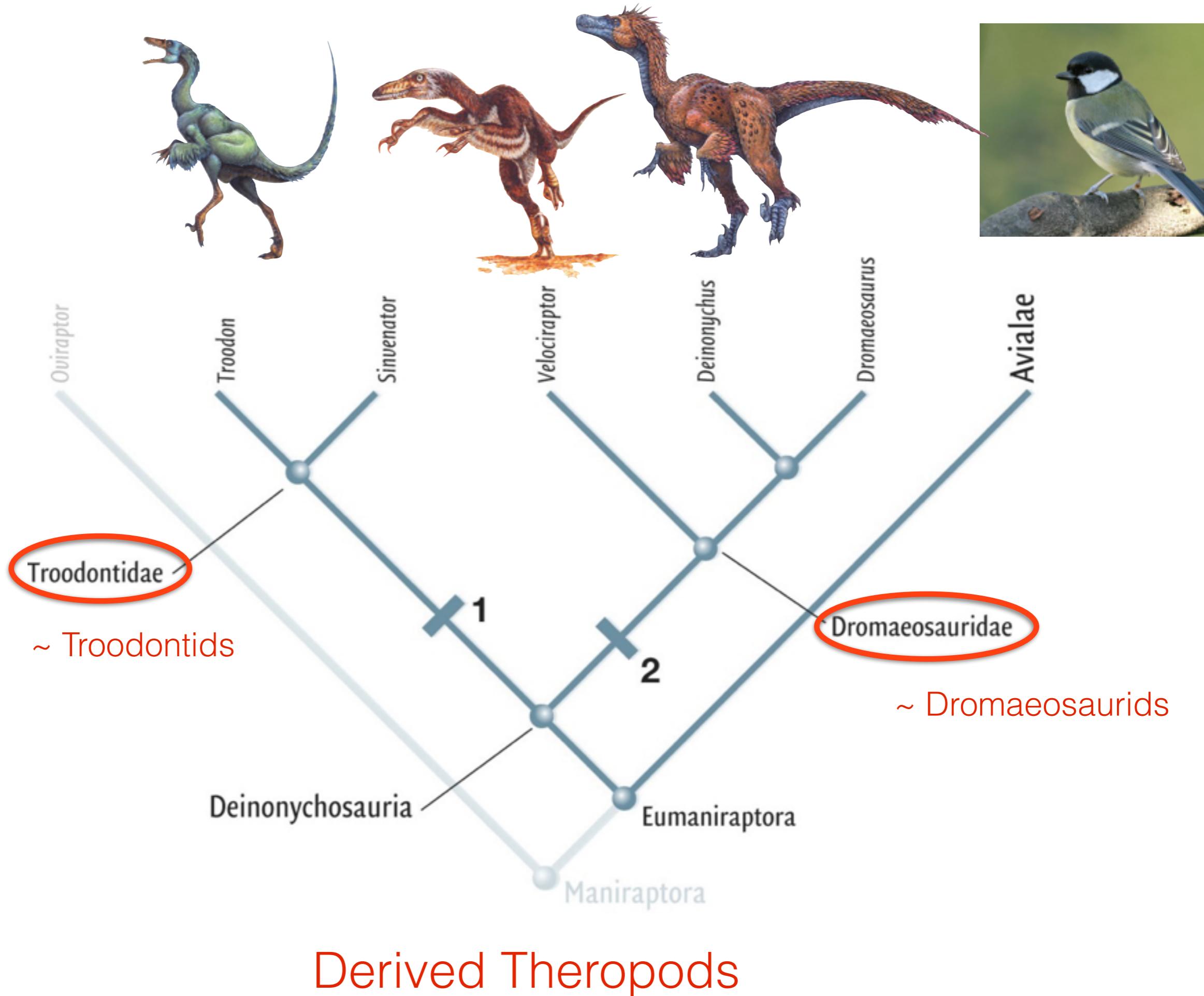
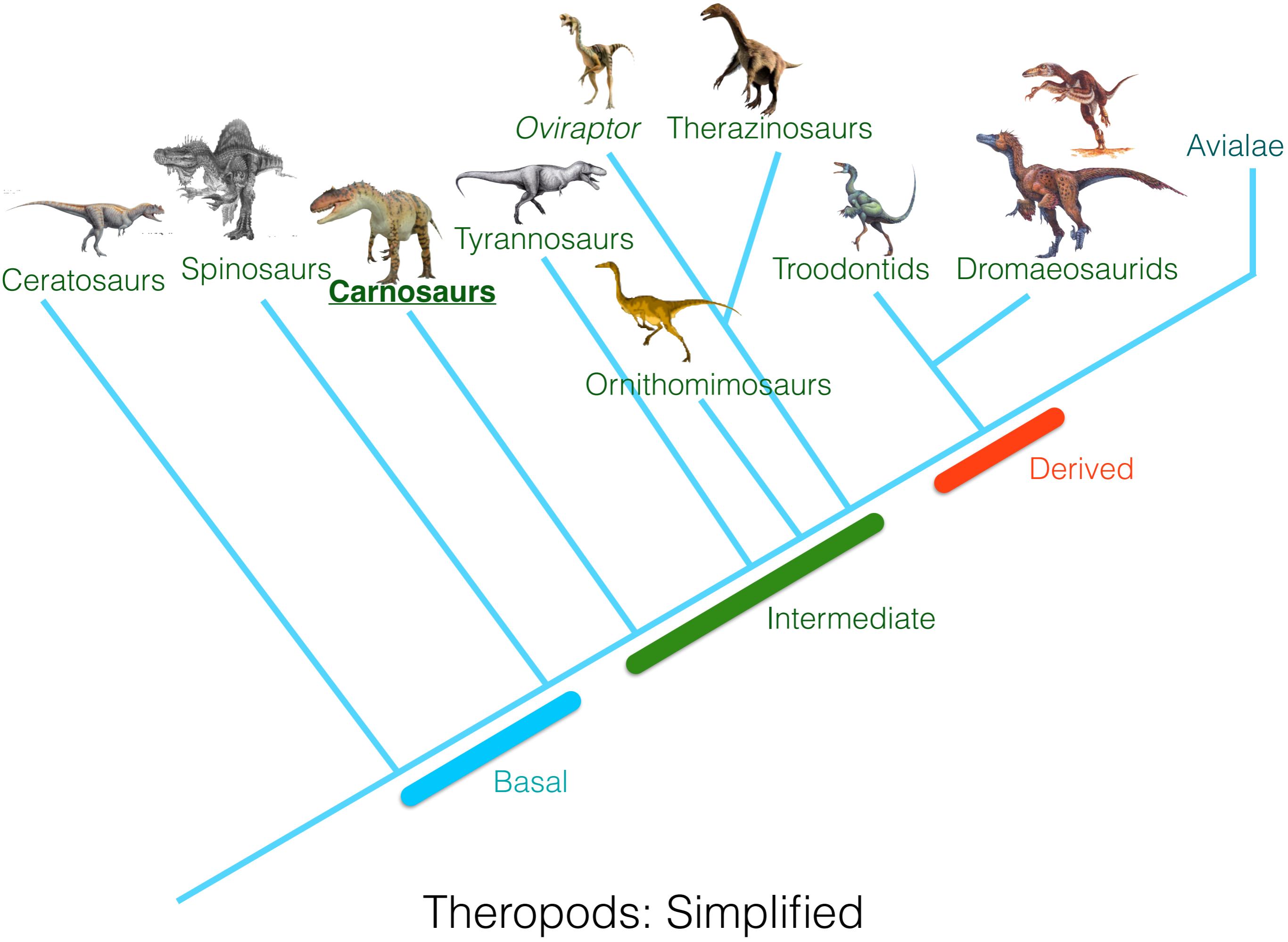


Basal Theropods



Intermediate Theropods





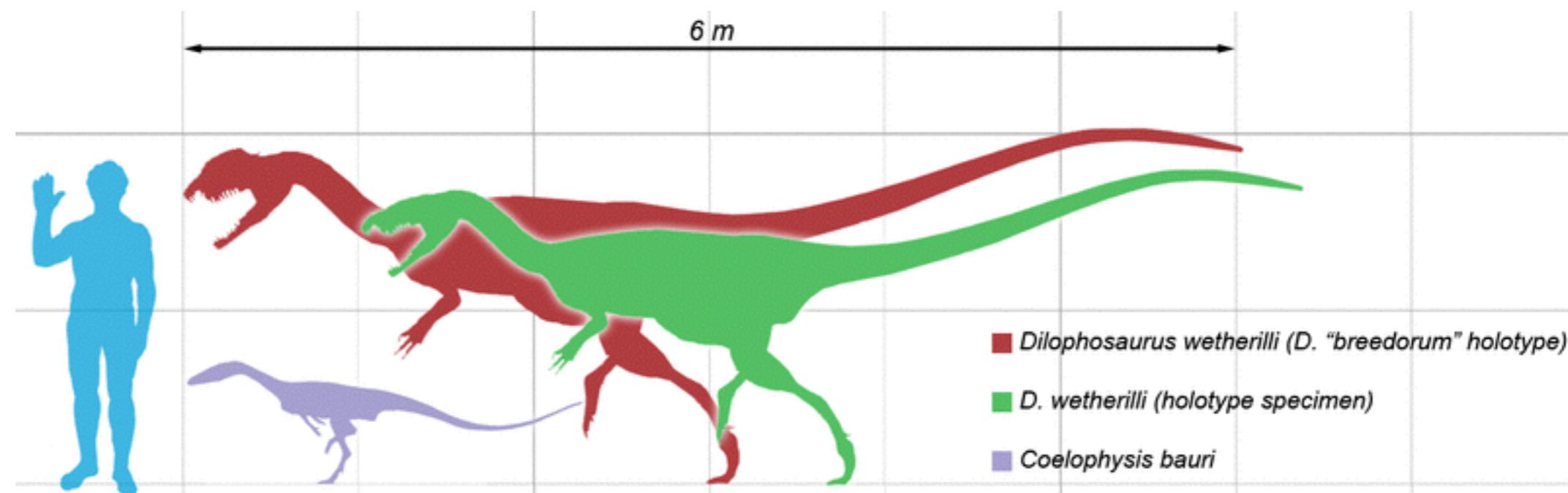
Theropods: Specializations

Cranial Ornamentation

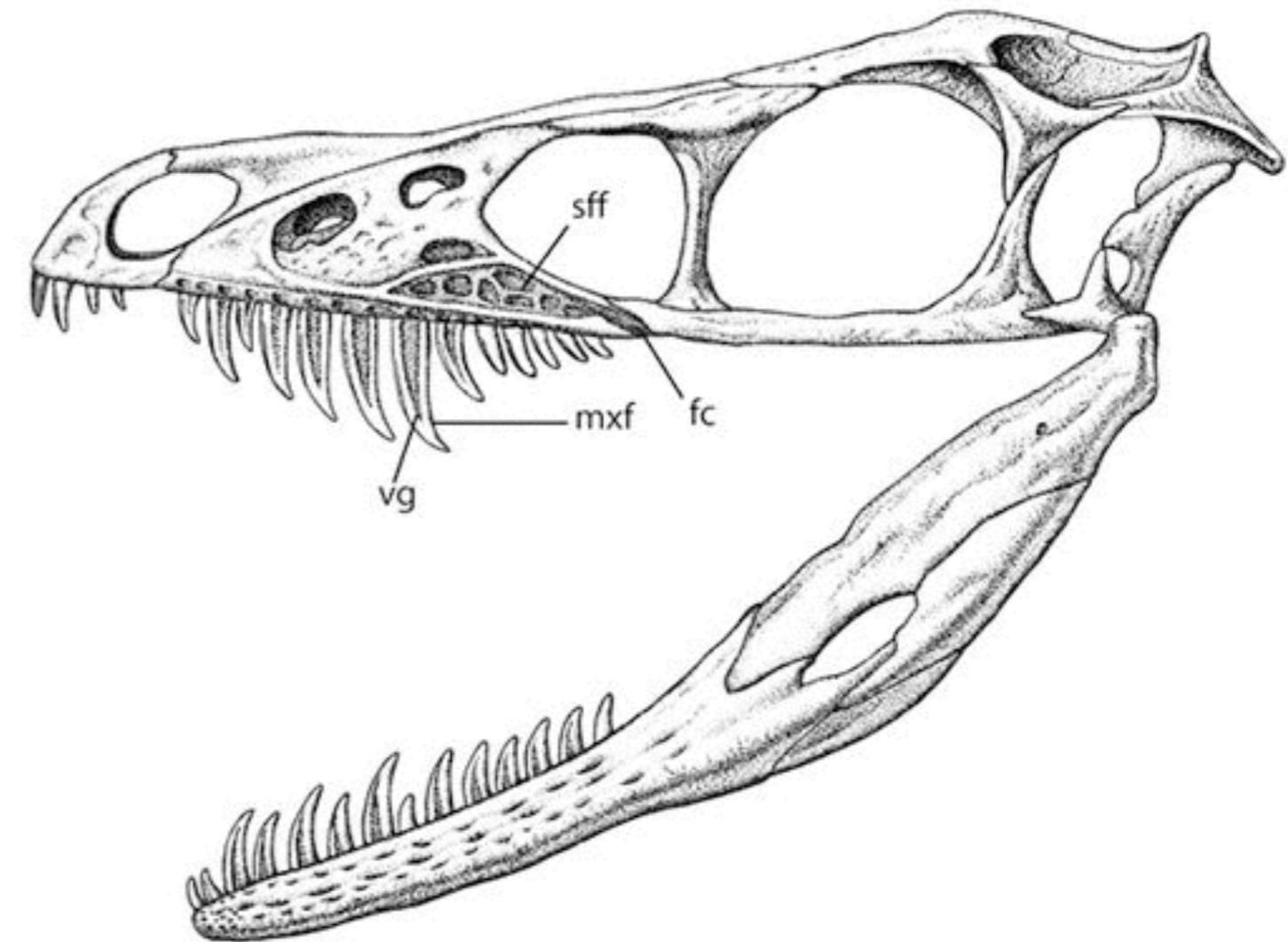
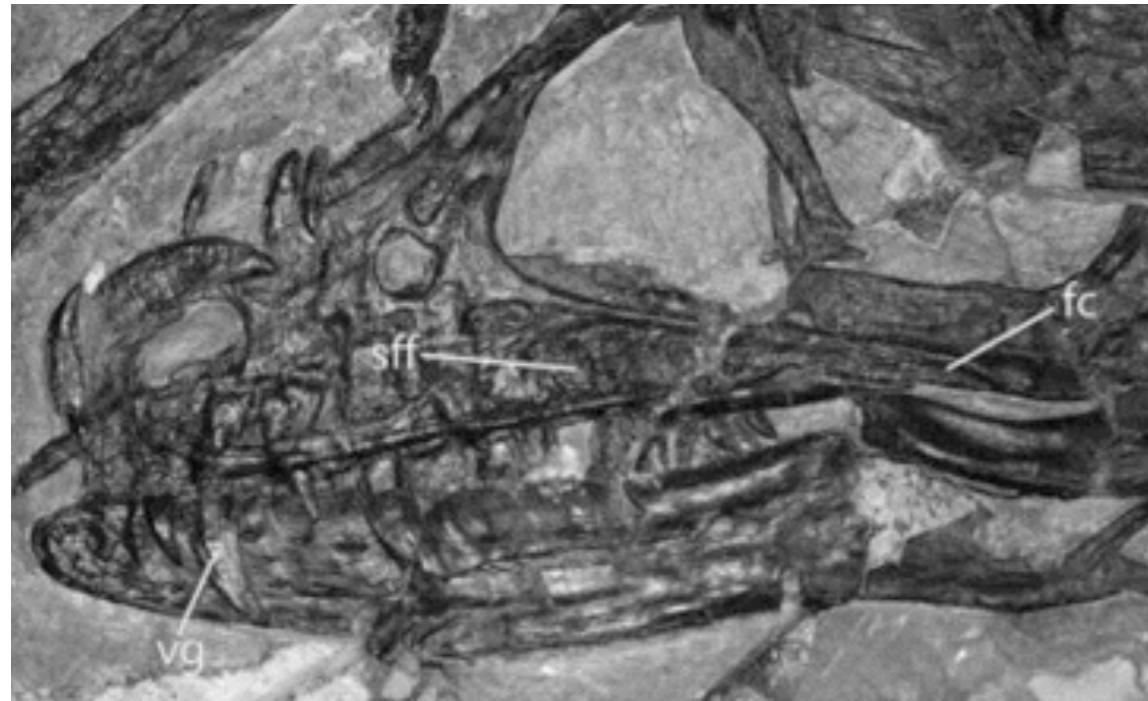
No evidence for frill
or venom glands



Dilophosaurus: Basal Theropod



No evidence for frill or venom glands in
Dilophosaurus... but: *Sinornithosaurus*
(Dromaeosaur) 2009



Rear-fanged
Rear-fanged snakes don't inject venom; toxin flows down a groove
Stupifying venom?



“The dragon's venom rapidly decreases blood pressure, expedites blood loss, and sends a victim into shock, rendering it too weak to fight.”

Theropods: Specializations

Cranial Ornamentation



*Cryolophosaurus: Early Jurassic,
Antarctica*

*Monolophosaurus: Mid Jurassic,
China*

*Pneumatic connections w/ nasal
cavities*

Resonating chamber?



Theropods: Specializations

Cranial Ornamentation



Suggests some form of sociality
If they lived in groups and hunted in packs,
we might expect sexual dimorphism

Only known for *Syntarsus* and *Coelophysis*
(both Coelophysids, or basal theropods)

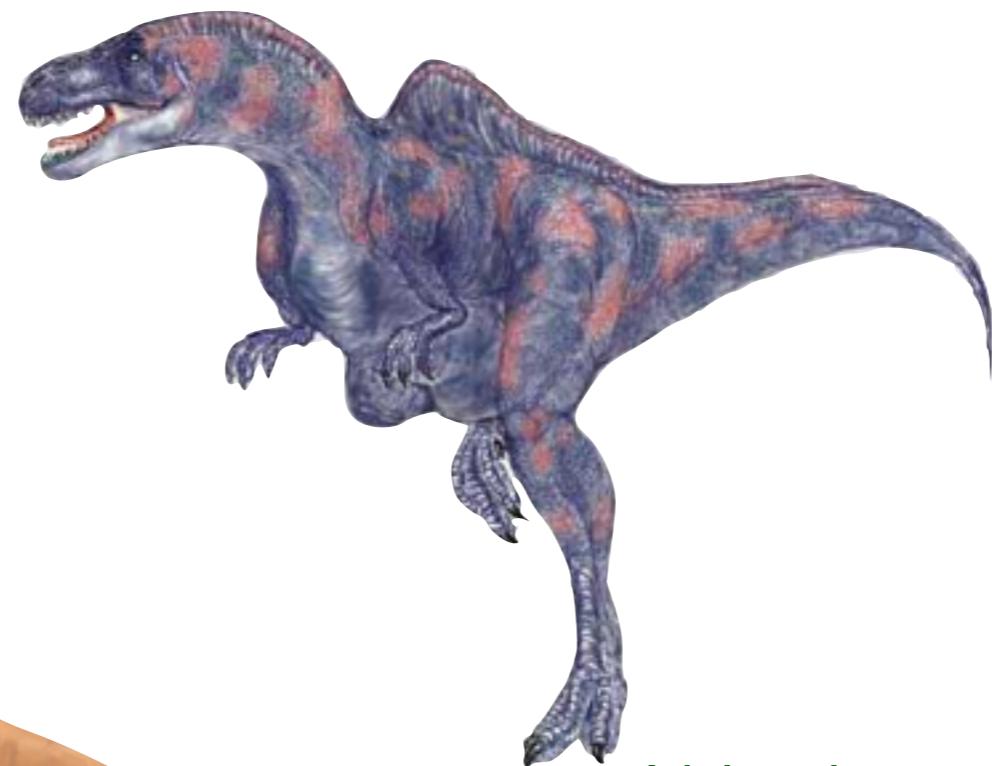


Theropods: Specializations

Vertebral Spines



Acrocanthosaurus



Altispinax



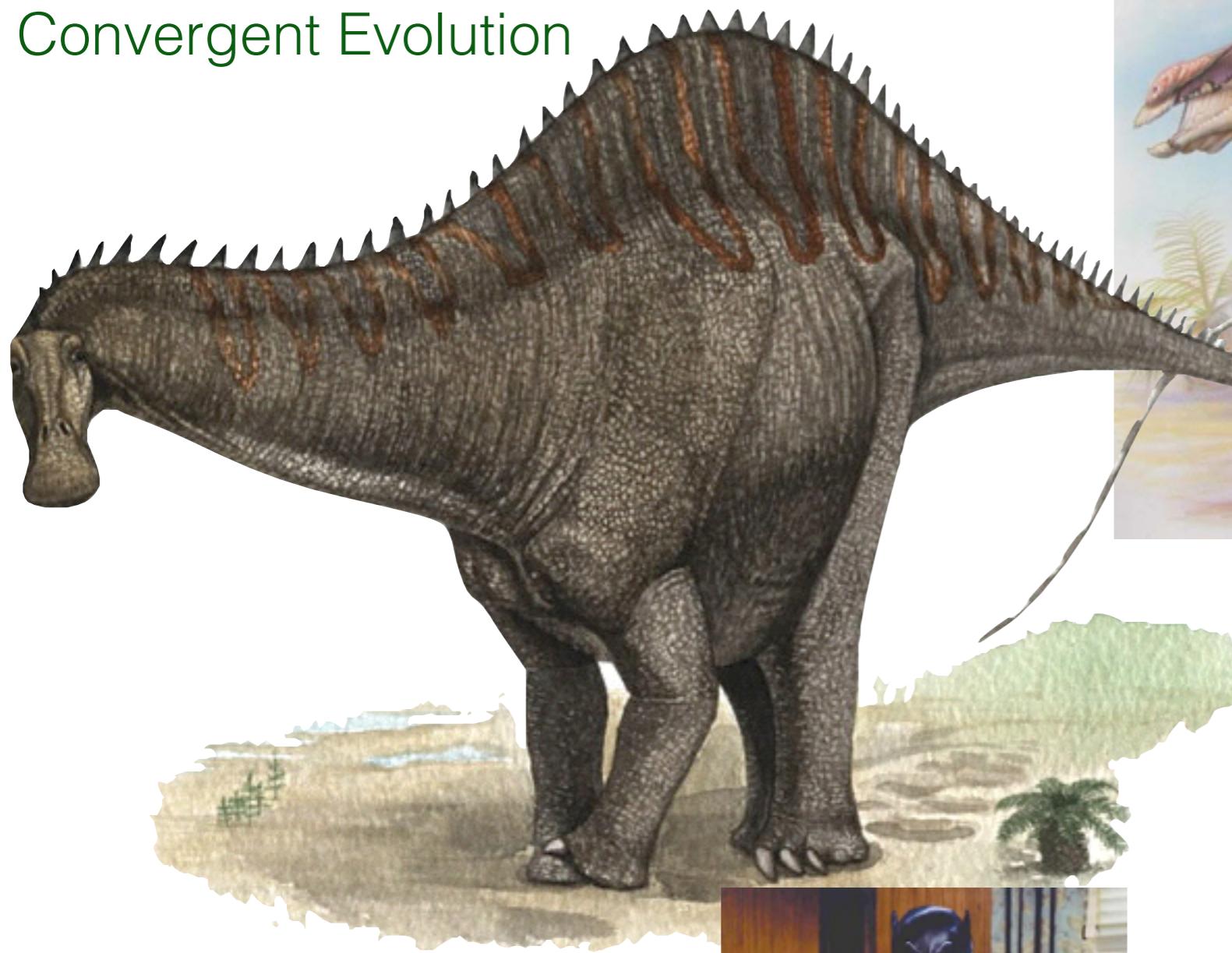
Spinosaurus

*All lived at sea level
All lived near ocean
Thermoregulation?*

Theropods: Specializations

Vertebral Spines

Convergent Evolution



Rebbachisaurus

Same bat-time

Same bat-habitat

Same bat-evolutionary forces



Ouranosaurus



Spinosaurus

Theropods: Parental Care



Theropods: Parental Care



Theropods: Parental Care

Tyrannosaurus

Young Tyrannosaurs found with adult Tyrannosaurs, but no evidence of gregariousness

Tyrannosaurs were likely altricial (needed parental care)



Precocial young vs. small Theropods

Large Theropod juveniles (if Precocial) would have competed with smaller fully grown Theropods

Large Theropod juveniles (if Altricial) would have relied on adults for food, lifting competition from other small Theropods

Hypothesis:

IF Tyrannosaurids raise altricial young, THEN you should find coexisting small-bodied Theropods



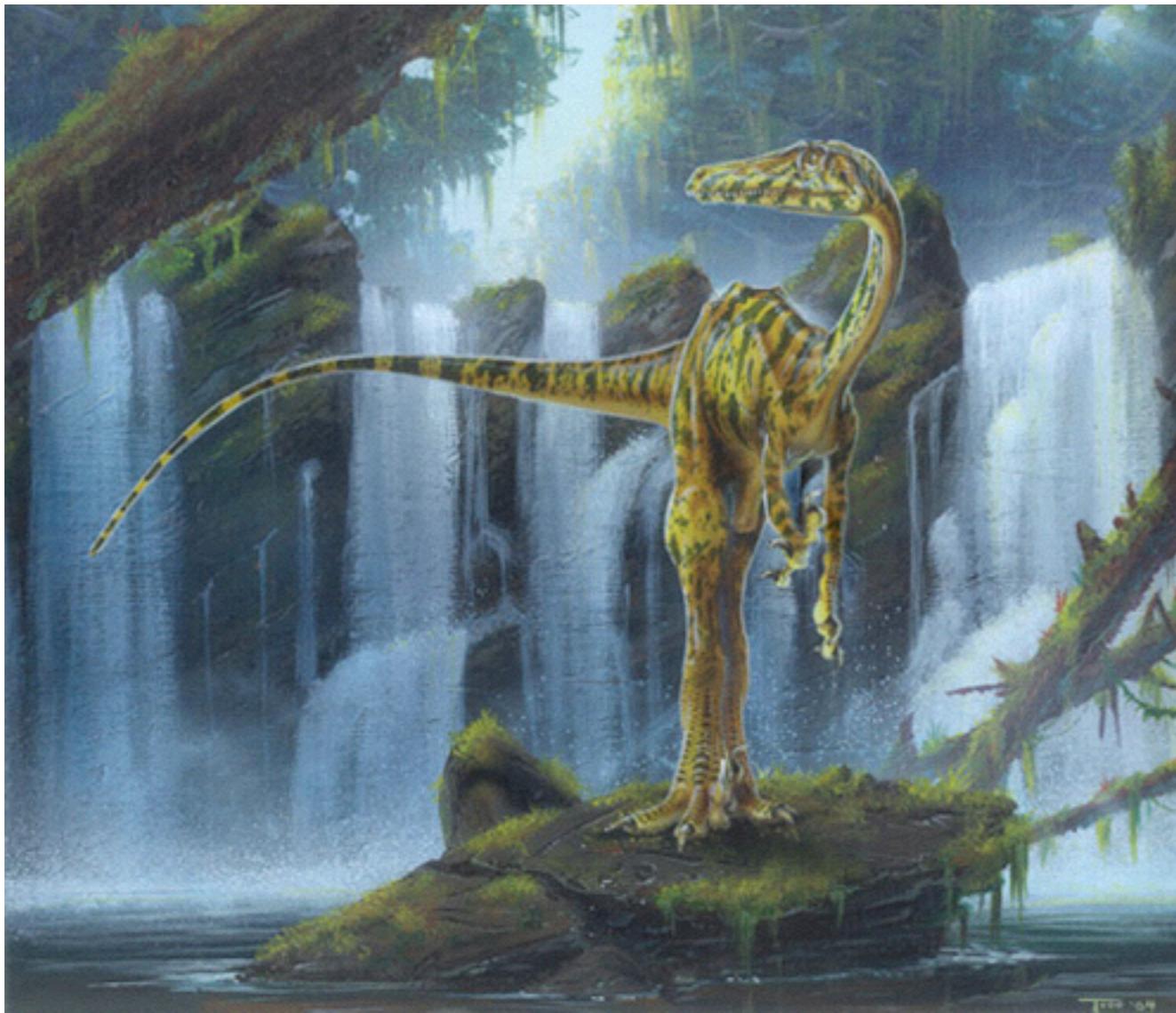
~The greatest diversity of small-bodied Theropods are found within Tyrannosaurids

Theropods: Specializations

Claws



Troodontids

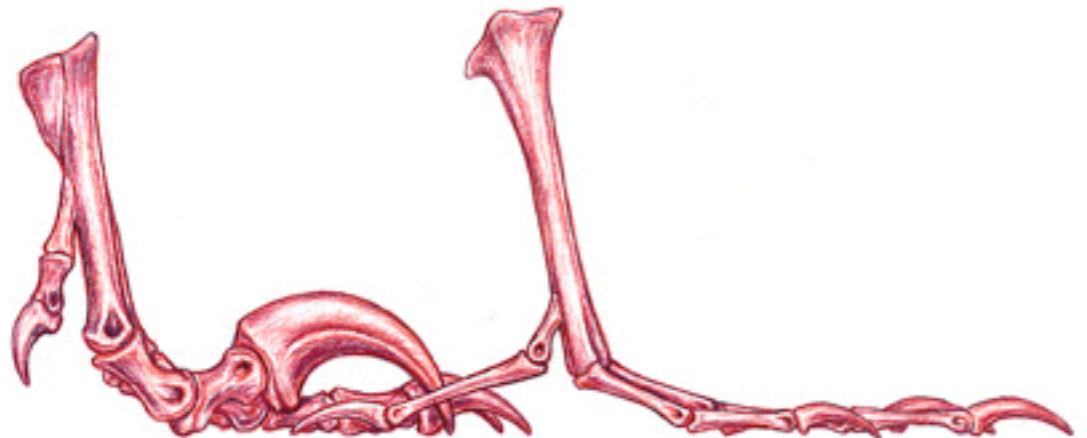


Dromaeosaurids



Troodon





When muscles were contracted, the large claw retracted (during walking, running)

Claw base-to-tip angle maximized the transmission of forces from the leg to the claw tip

Maneuverable tail would be used for balance while the front of the body was slashing

Small Theropods were almost certainly active hunters.

What about Large Theropod dinosaurs?



Predators vs. Scavengers

Active Hunters

Leg length: efficient runners

Stereoscopic Vision

Disproportionately long teeth

Healed bitemarks on Sauropod bones

Direct Evidence



Skull of Spotted Hyena: profile. (Gervais.)



Skull of Spotted Hyena, seen from above.*

Scavengers

Rounded teeth

Small arms

Large olfactory lobes in brain



Hyenas: modern scavenger ‘specialists’
Typically only scavenge prey 30% of the time

What is the tangible evidence for Dinosaur predation?

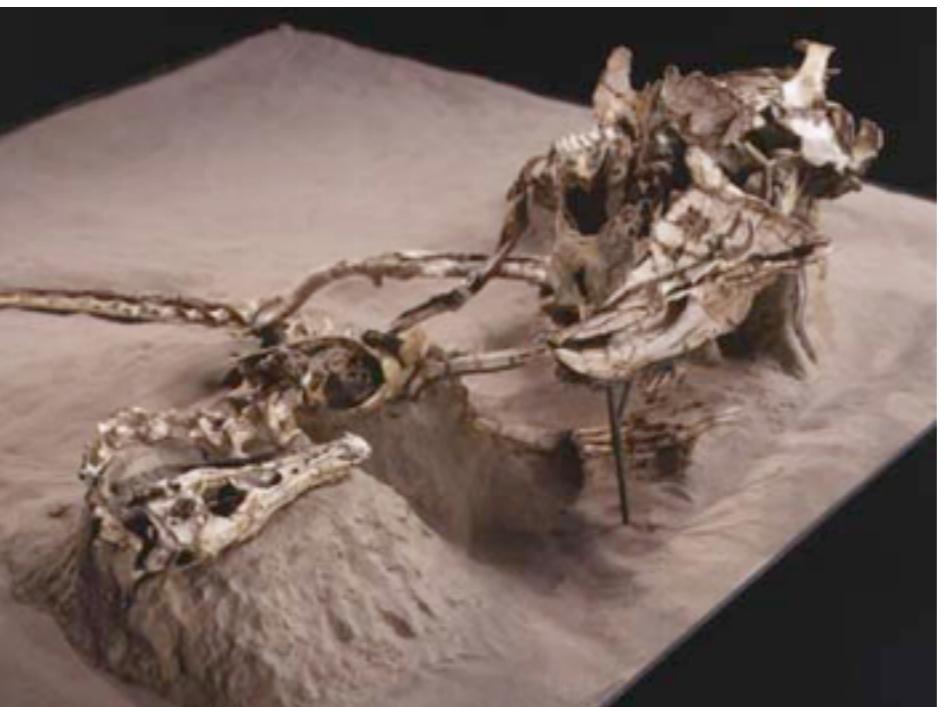
1) Coelophysis @ Ghost Ranch: Found immature Coelophyses in the stomach of larger male Coelophyses

Lots of modern animals participate in cannibalism/
intraspecific killing (lions, sharks)

2) Protoceratops vs. Velociraptor in Mongolia



Lion Ambush

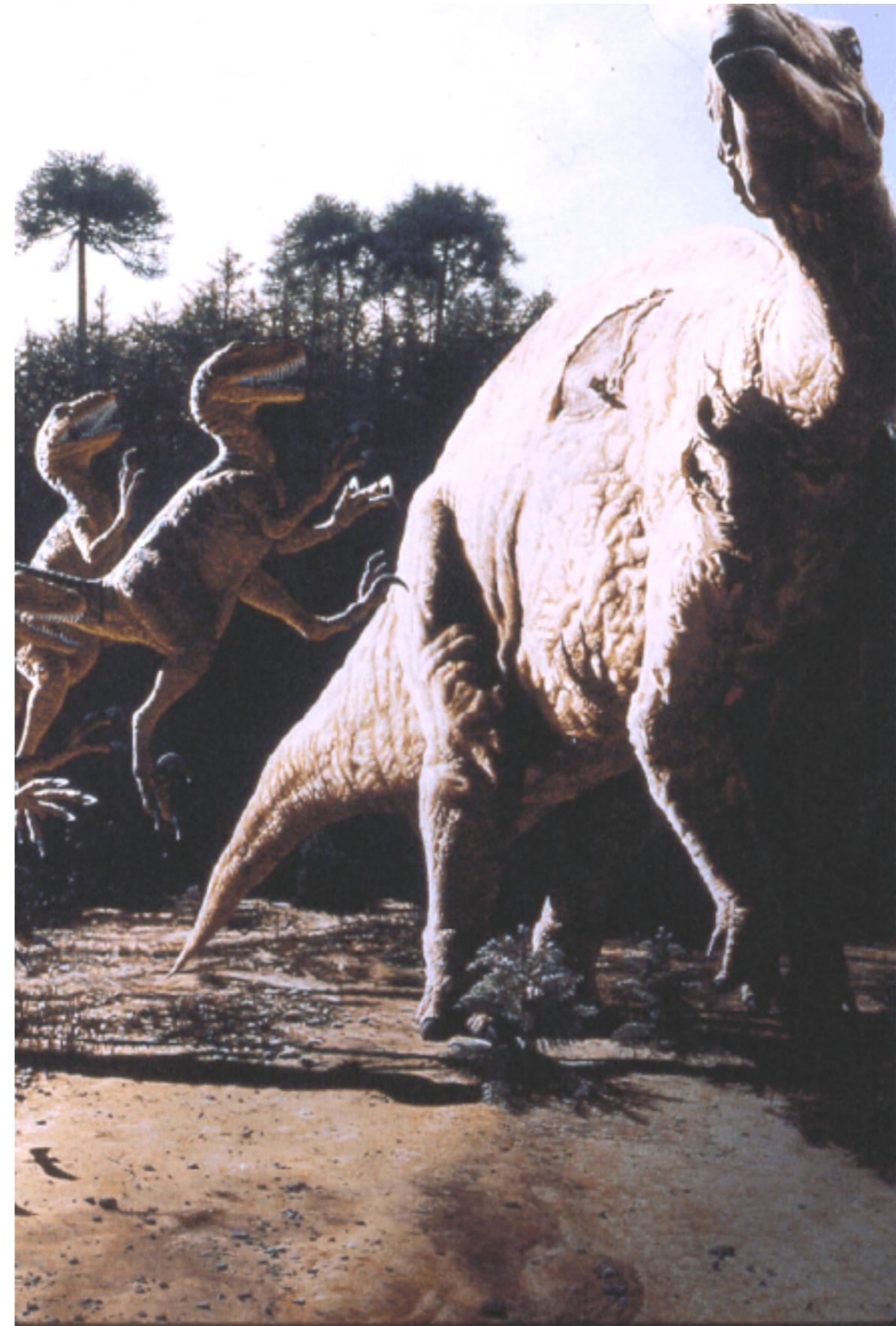
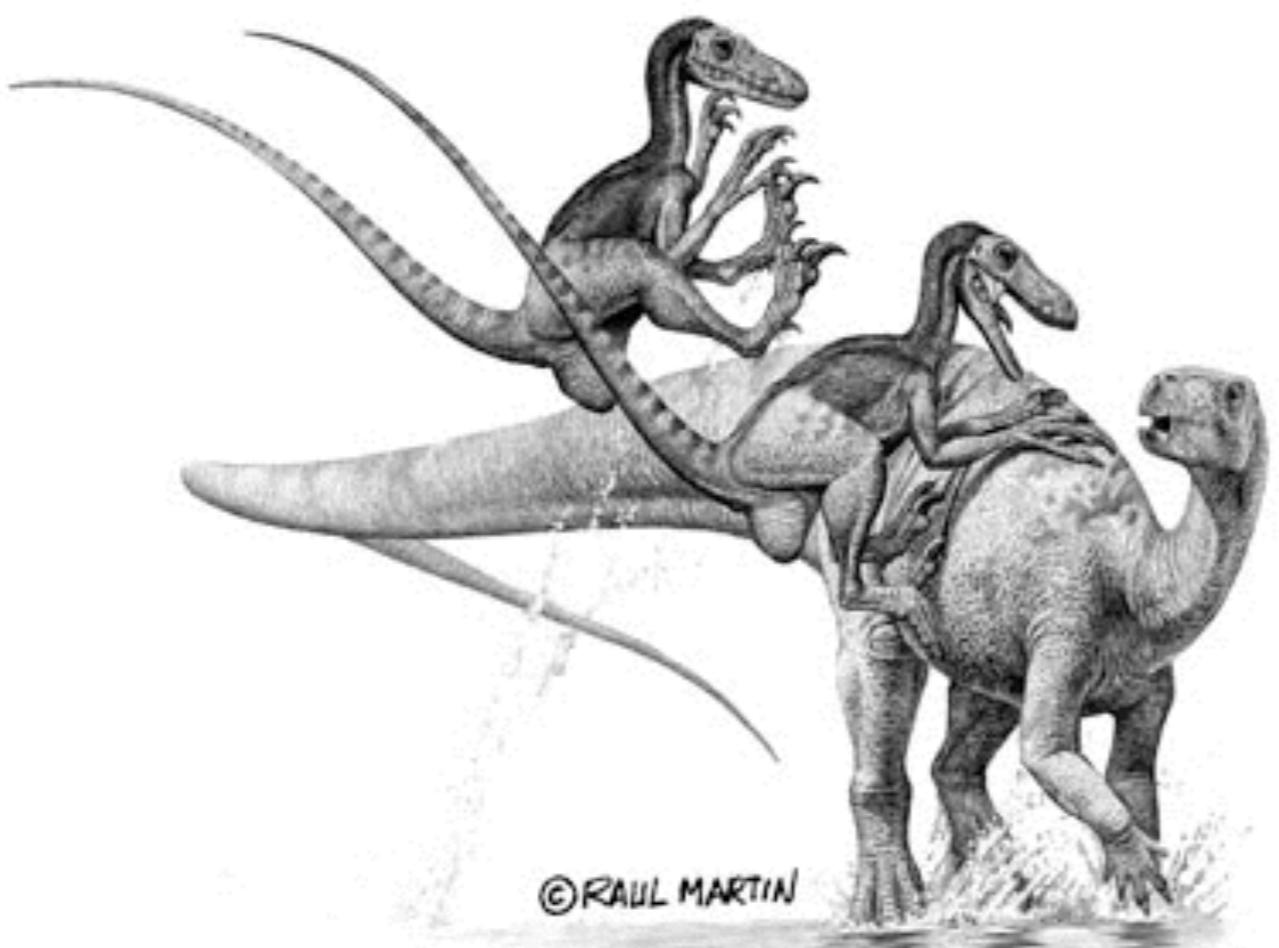




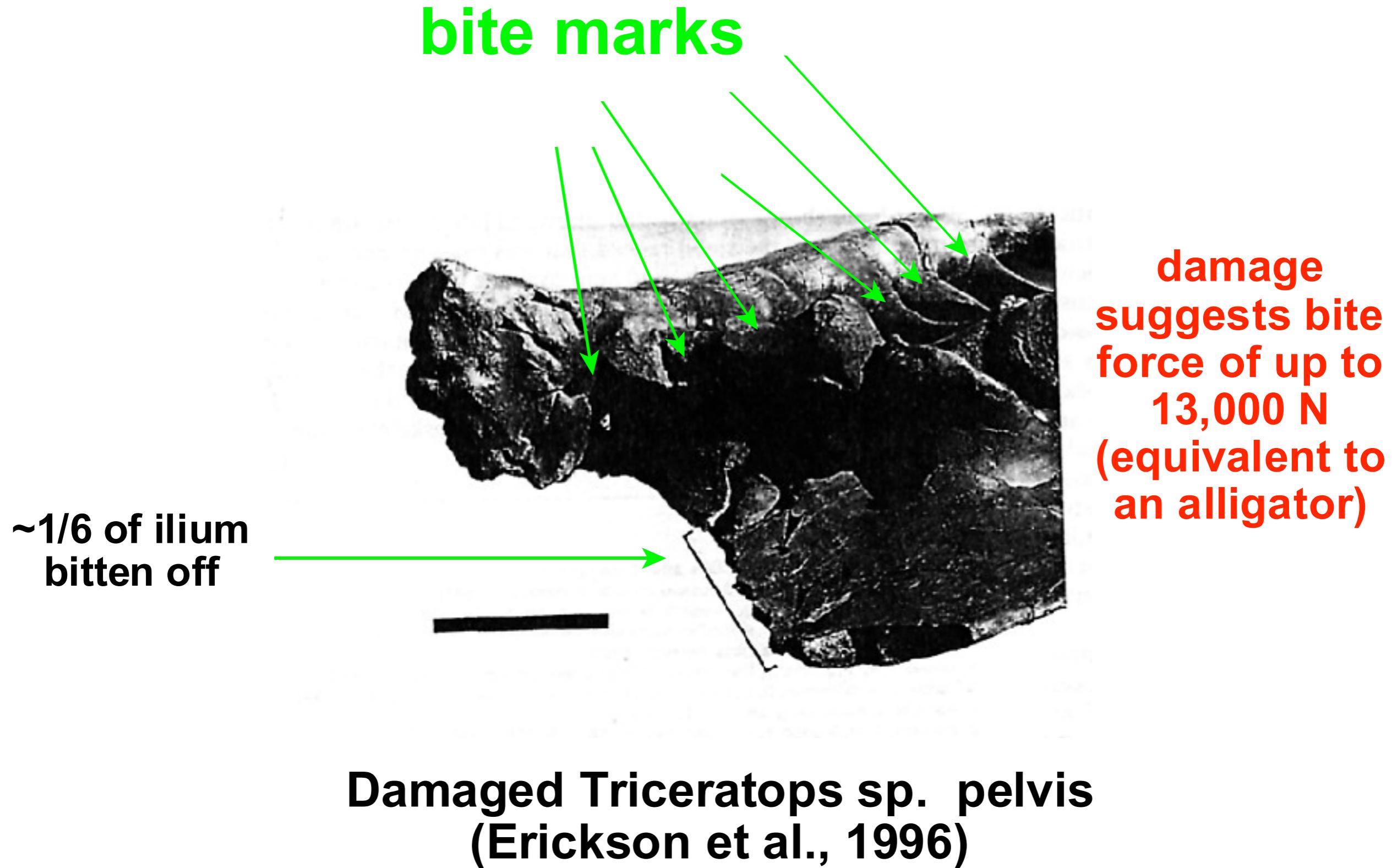
What is the tangible evidence for Dinosaur predation?

3) Three *Deinonychus* found underneath a *Tenontosaurus* ornithopod that had apparently been predated upon by other *Deinonychus* dinos

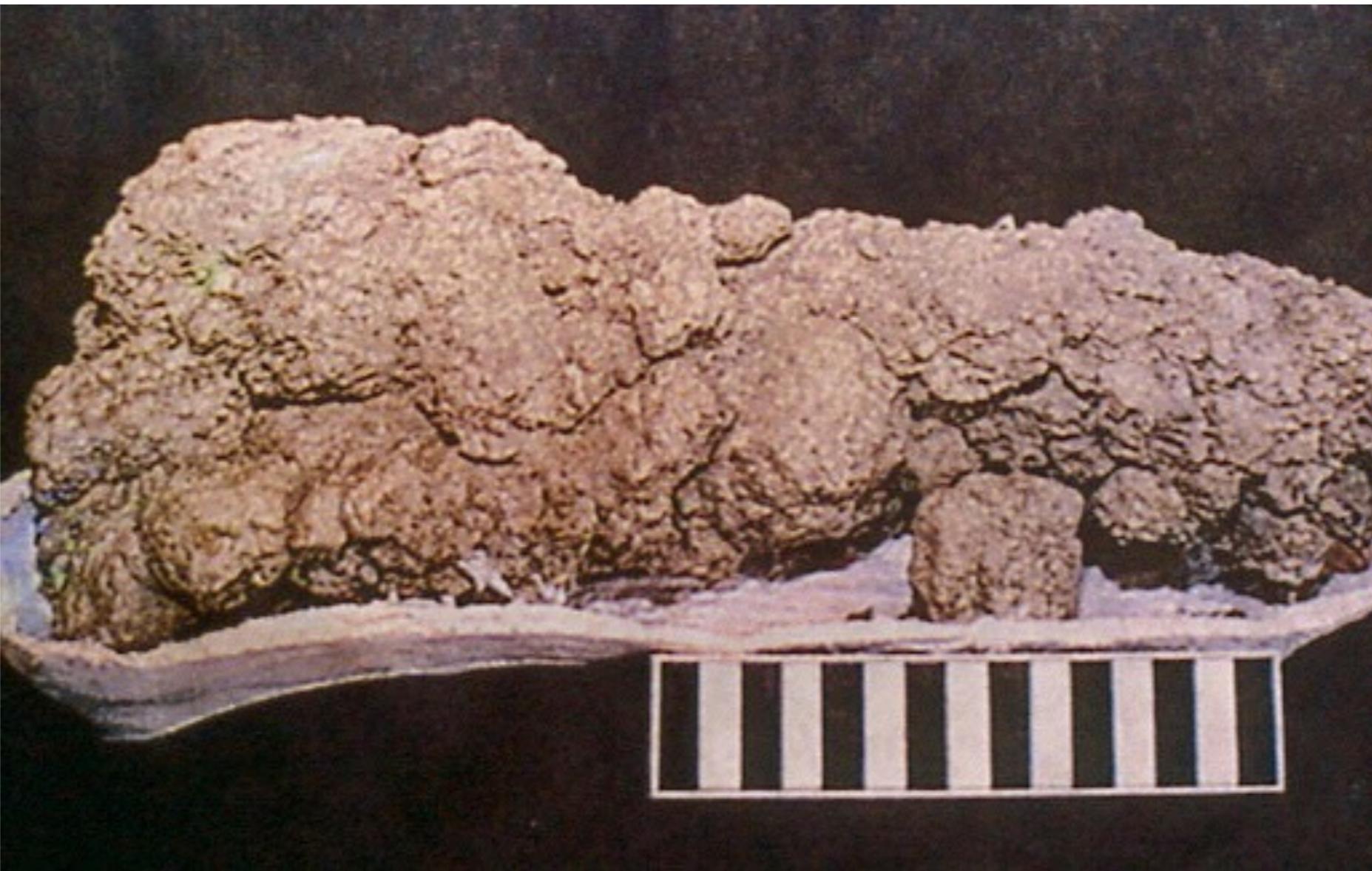
- Suggests not only predation
- But PACK HUNTING



What is the tangible evidence for Dinosaur predation?



What is the tangible evidence for Dinosaur predation?



Bone-filled coprolites

What is the tangible evidence for Dinosaur predation?

Trackways

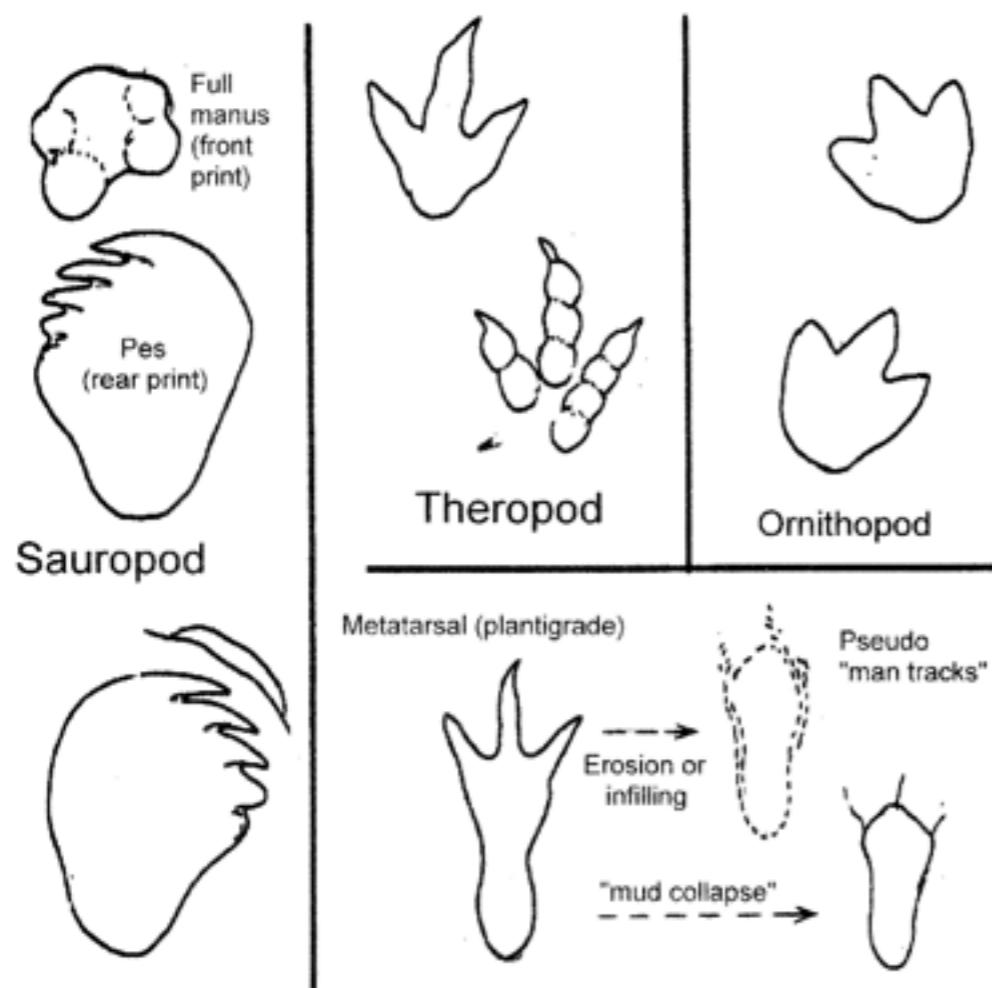
Major Types of Dinosaur Tracks in Texas



Sauropod ("brontosaur")
Trackname: *Brontopodus birdi*
Trackmaker: *Paluxysaurus*

Theropod (bipedal meat-eater)
Trackname: *Eubrontes*
Trackmaker: *Acrocanthosaurus*

Ornithopod (bipedal plant-eater)
Trackname: *Amblydactylus (?)*
Trackmaker: Iguanodont?





Paluxy Valley, Texas

A large Theropod appears to be following a Sauropod in deposits that were not open to the atmosphere for a very long period of time

BEWARE: trackways leave a lot to be INTERPRETED

Holyoke, Massachusetts

Early Jurassic



*Potentially a pack of up to 40
Theropod dinosaurs*





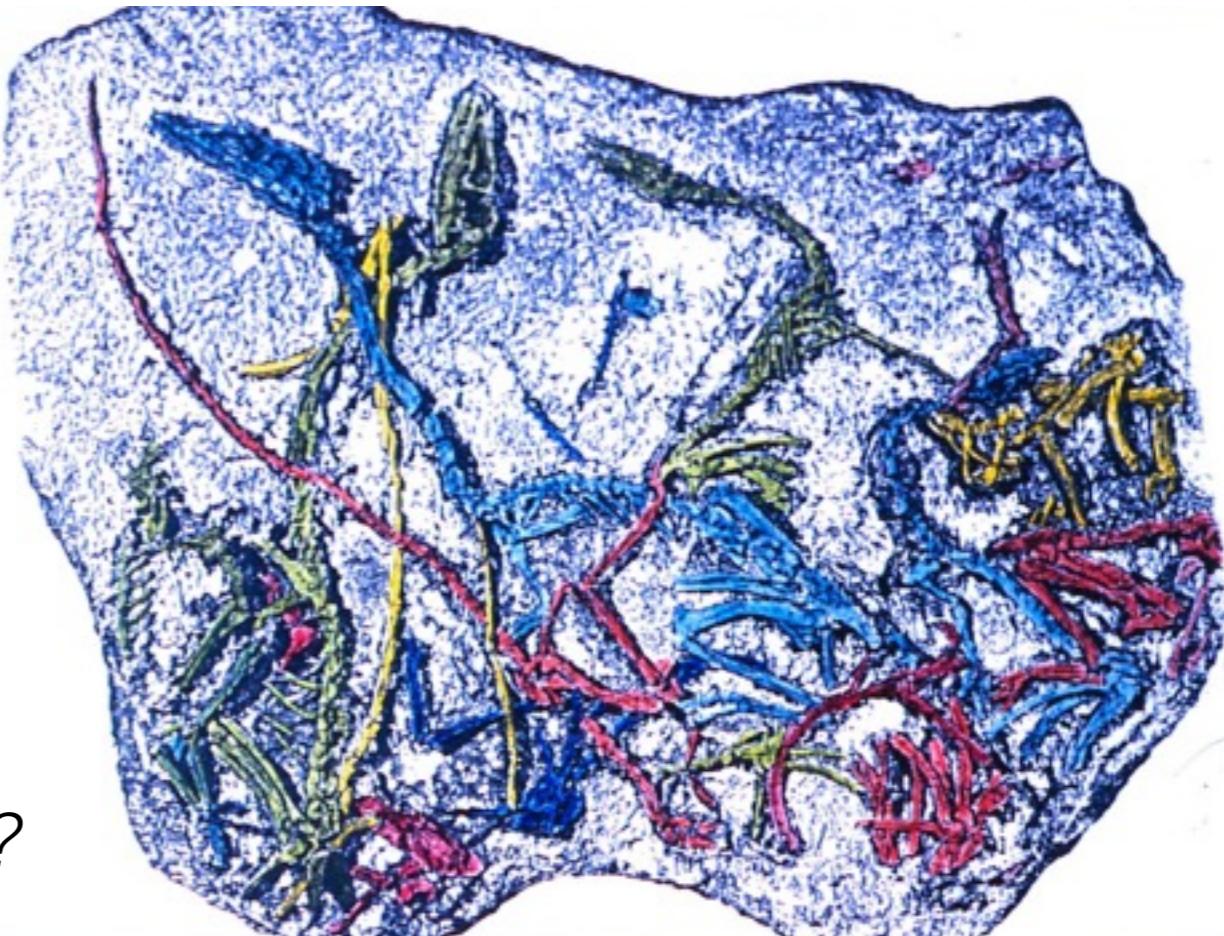
FIGURE 3.6

This map shows some of the scattered bones at the Cleveland-Lloyd dinosaur quarry in Utah, where the remains of at least 44 individuals of *Allosaurus* were collected. The bones apparently accumulated in an oxbow-like deposit, but the cause of this "predator trap" remains unknown.

Cleveland-Lloyd Dinosaur Quarry, Utah

*Evidence of gregariousness?
A predator Pit?*

44+
Allosaurus
skeletons



Theropods: Ecology

*Where do you find Theropods?
Wherever you find herbivores.*



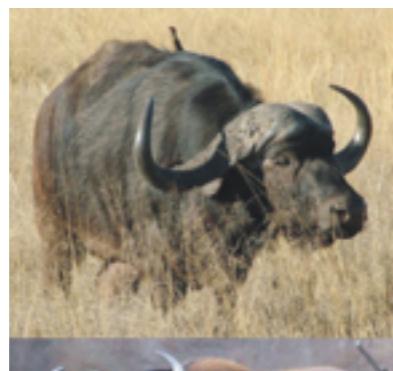
RULES OF ENGAGEMENT

Large Theropods tend to associate with large herbivores

Environmentally stressed regions (Mongolian deserts) typically have smaller Theropods

Specific environmental factors select for specific herbivores

*But this doesn't always apply to Theropods~ they are far ranging and adaptable
e.g. Historical distribution of lions*



Why?

Herbivores are more specific in terms of food partitioning

Accordingly, carnivores are less constrained by climate, vegetation

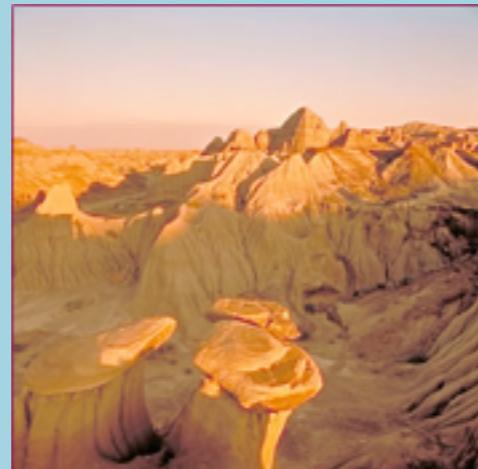
Carnivores rely on larger-scale attributes to partition their resources, such as body size.



Theropods: Ecology

Dinosaur Provincial Park
Alberta, Canada
vs.
Devil's Coulee.
Canada
300 Km apart

Huge difference in
herbivore assemblage



Dinosaur Park
Higher Rainfall
Well watered
More vegetated

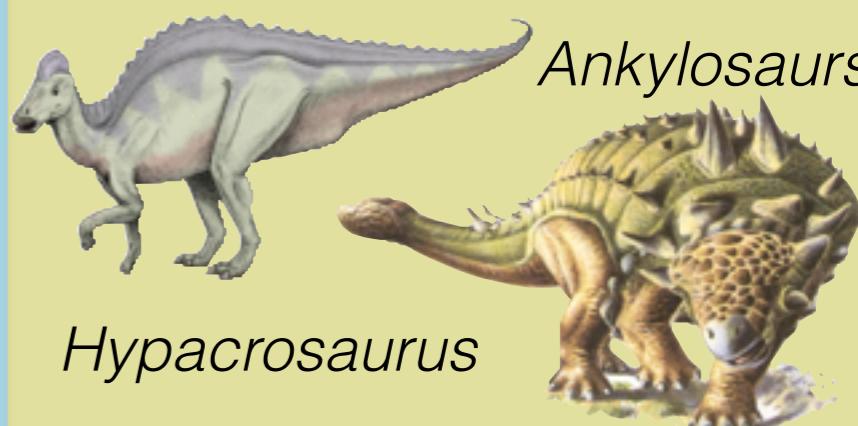


Corythosaurus

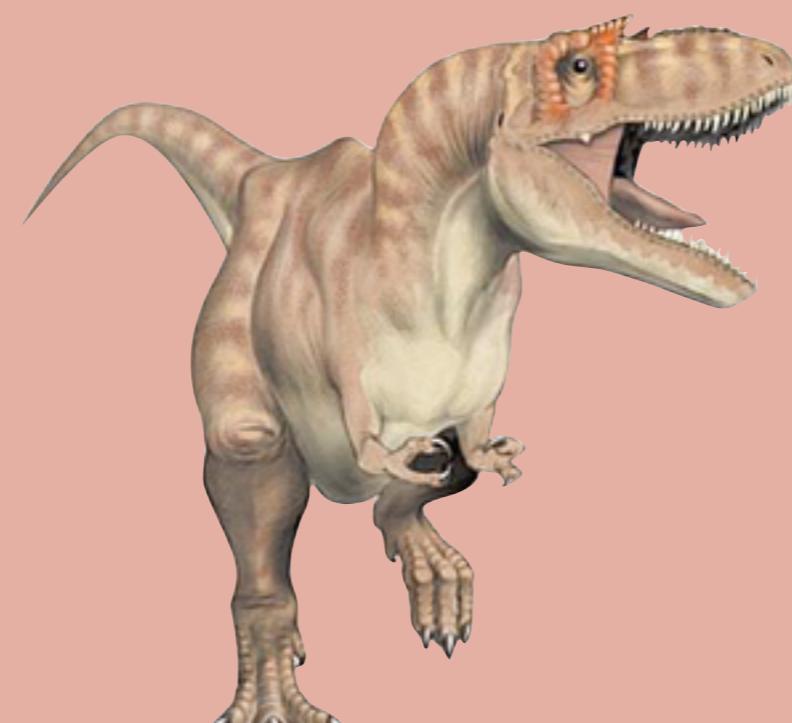


Devil's Coulee
Rain shadow

Drier on a seasonal basis



No difference in
carnivore assemblage



Gorgosaurus



Saurornitholestes



Troodon



赵闯 恐龙

Reconstructed by Zhao Chuang & Xing Lida