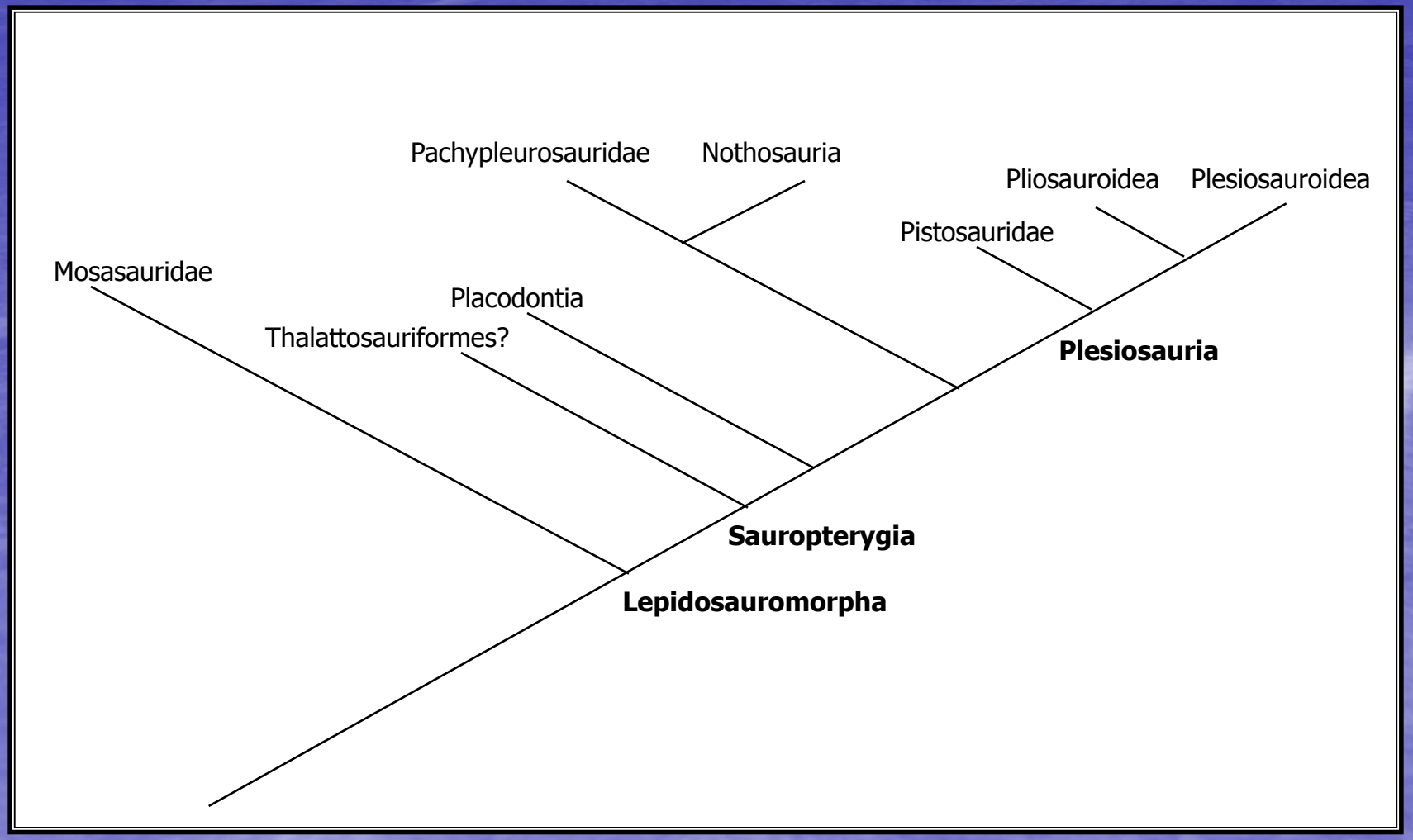
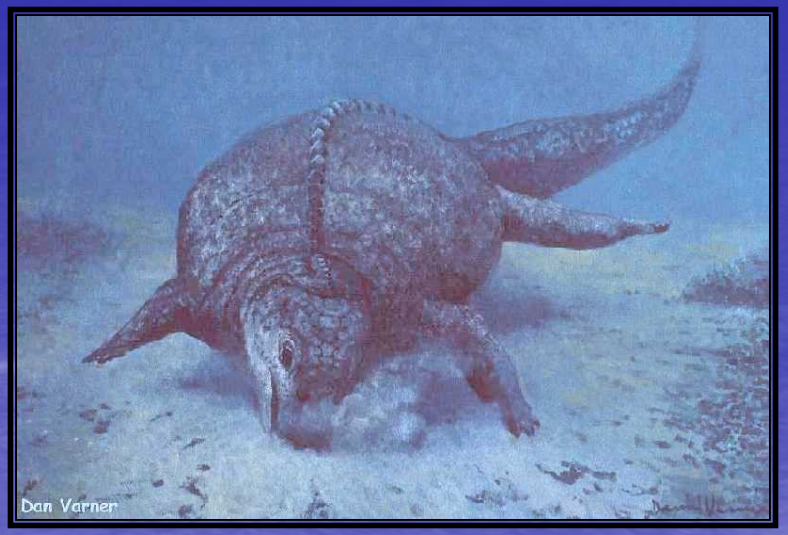
Sauropterygia

Lepidosauromorpha



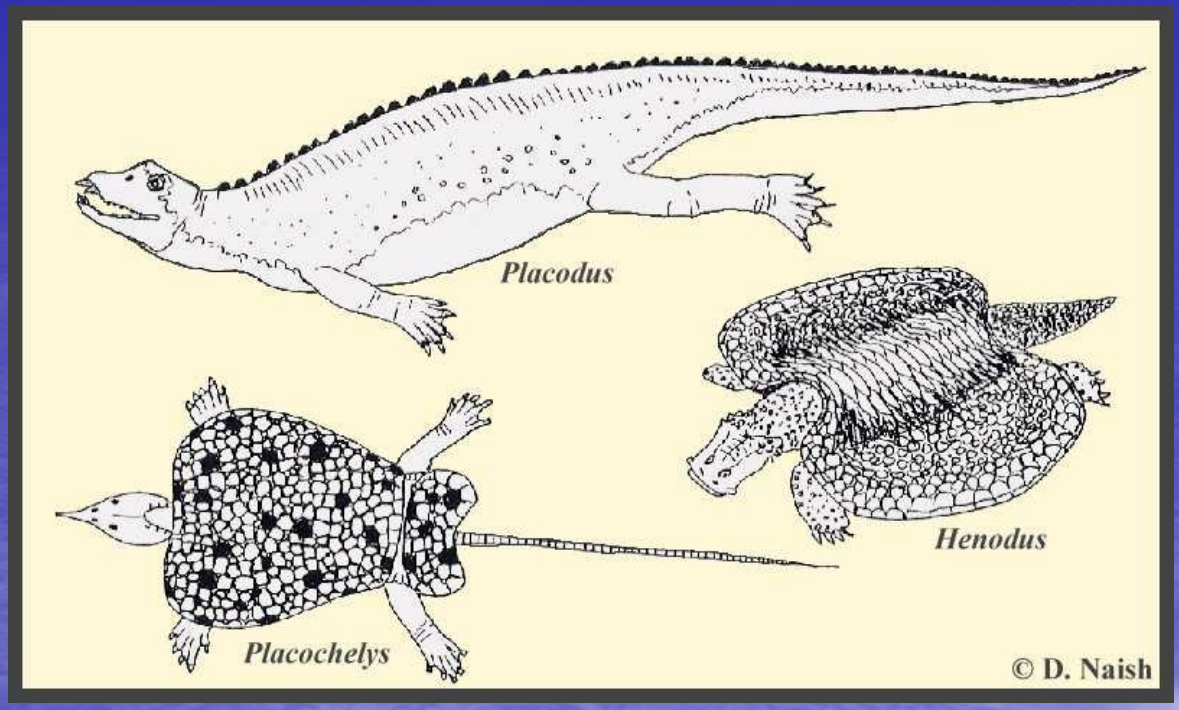
Placodonts

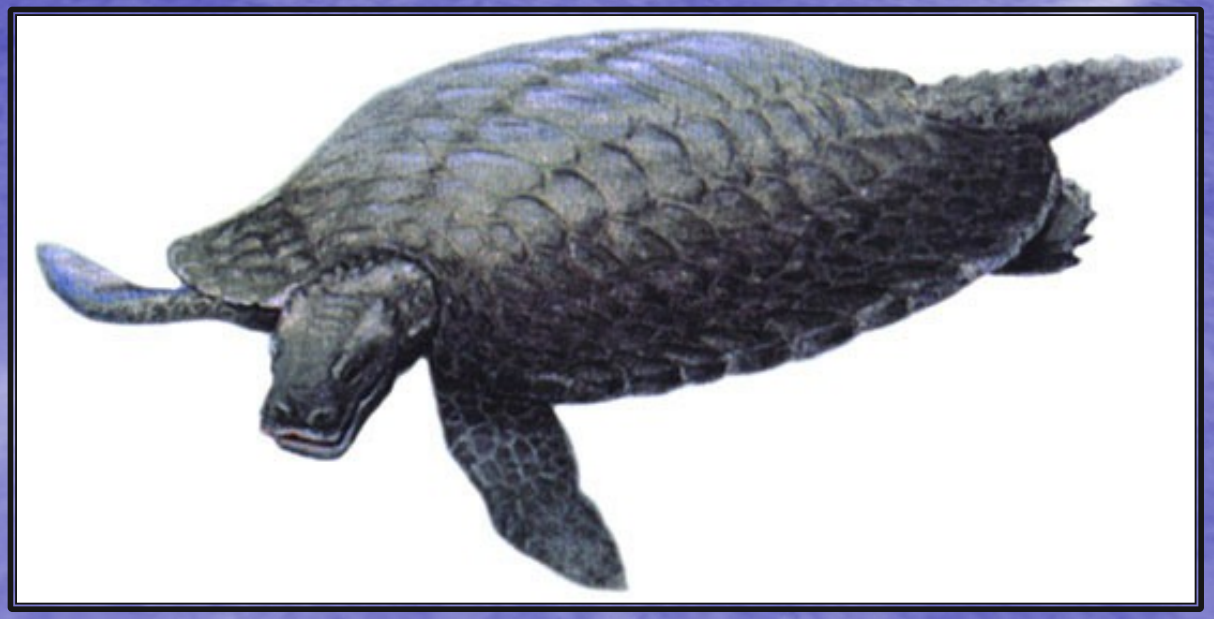


- Triassic Sauropterygians that browsed for mollusks and brachiopods in shallow marine environments (like walruses)
- Had dermal armor and dense bone, with large, flat palatte teeth used to crush shells

Placodonts

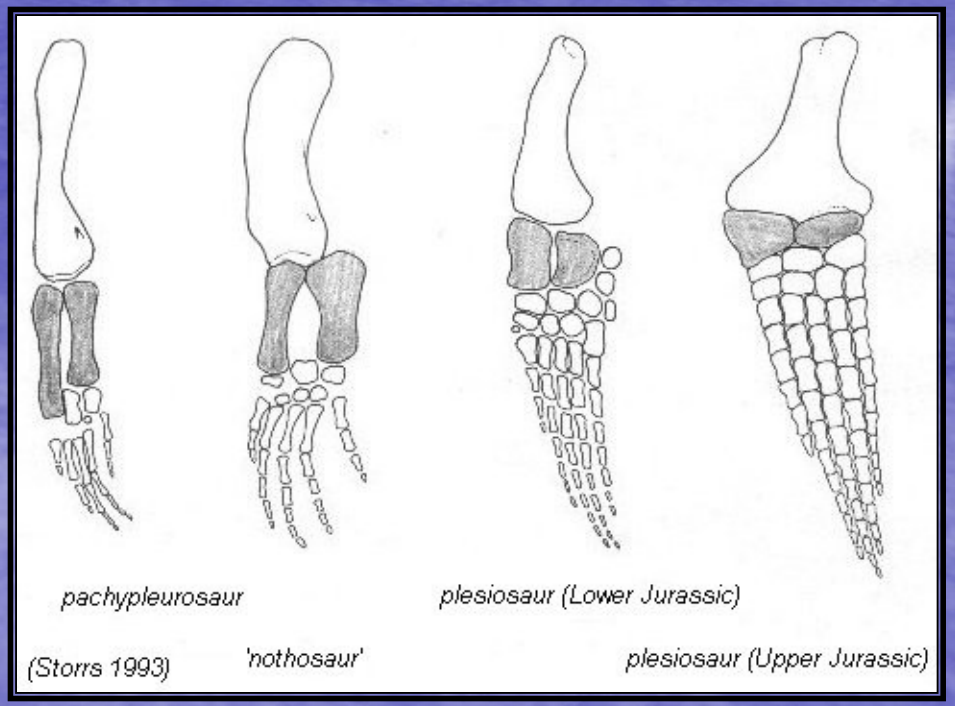
- Some, like *Henodus* and *Placochelys*, had a collection of bony plates covering their backs, a convergent feature with turtles





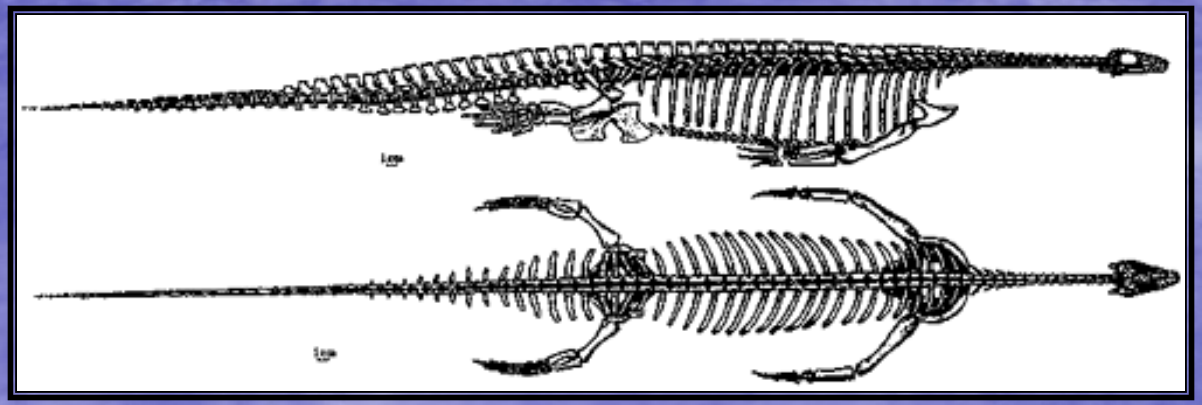
Limb Morphology

- As in ichthyosaurs, hyperphalangy indicates more derived condition (up to ten)
- NO polydactyly
- Oar-like paddles



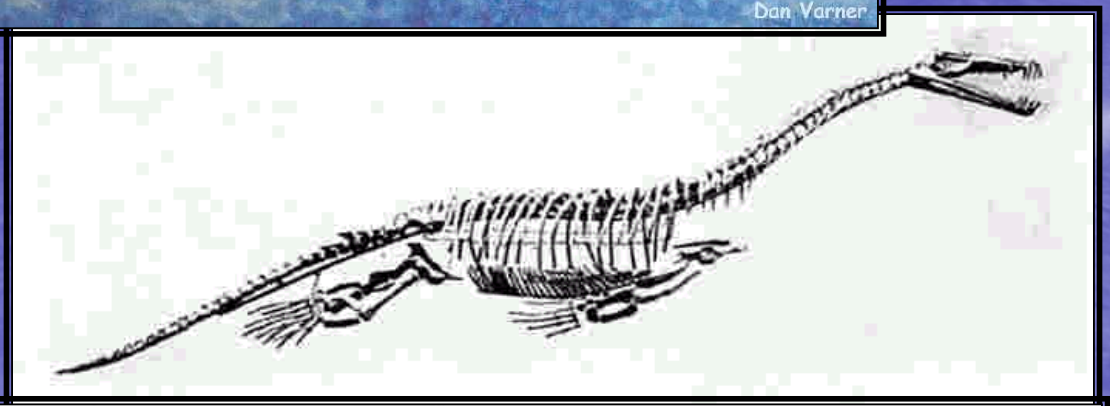
Pachypleurosaurs

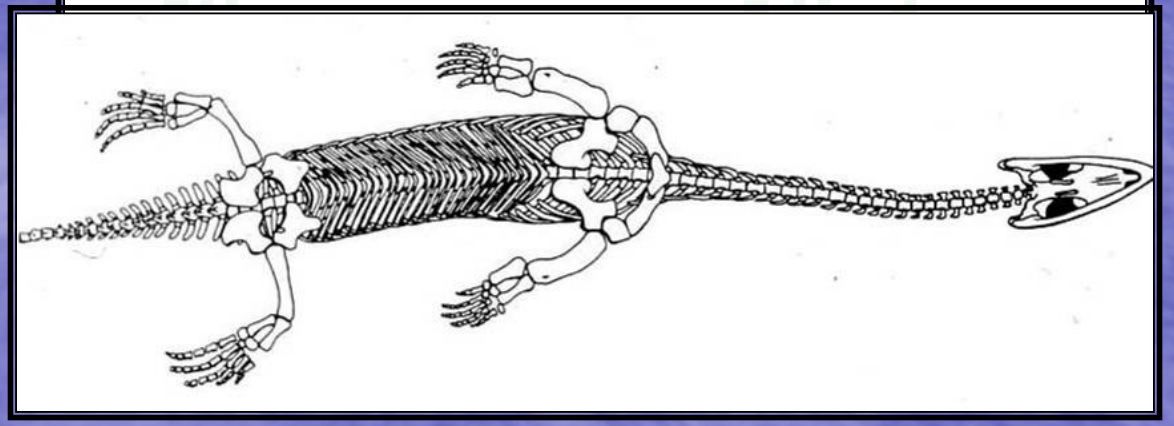
- Primitive Triassic Sauropterygians with completely aquatic life
- Peg-like teeth indicate fish diet
- *Keichousaurus Hui* is one of the most common Sauropterygian fossils, popular for collectors



Nothosaurs

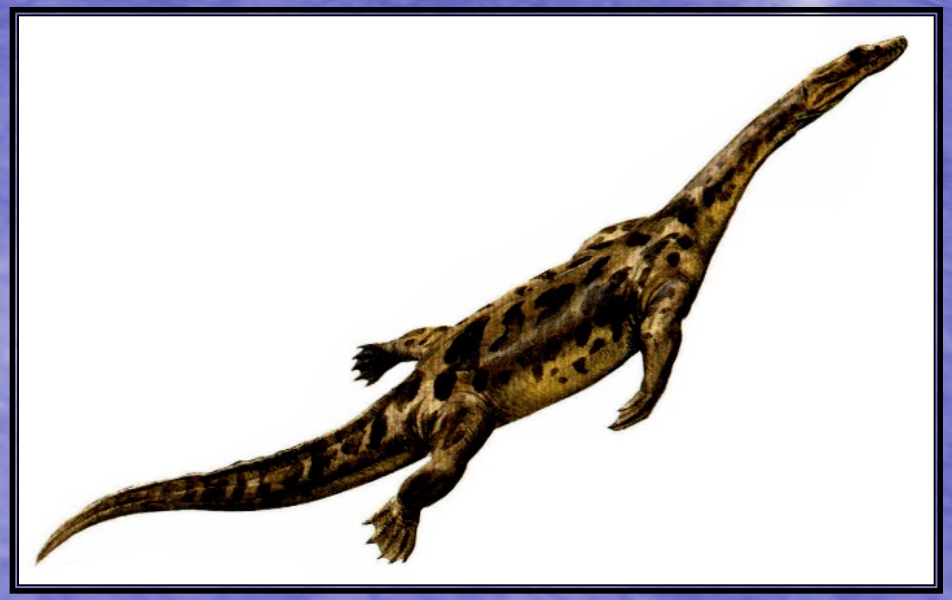
- Evolved from early pachypleurosaurs, replaced by plesiosaurs at the end of the Triassic
- Likely led an amphibious lifestyle, as they retained webbed feet
- Diet probably consisted of fish, occasionally larger prey





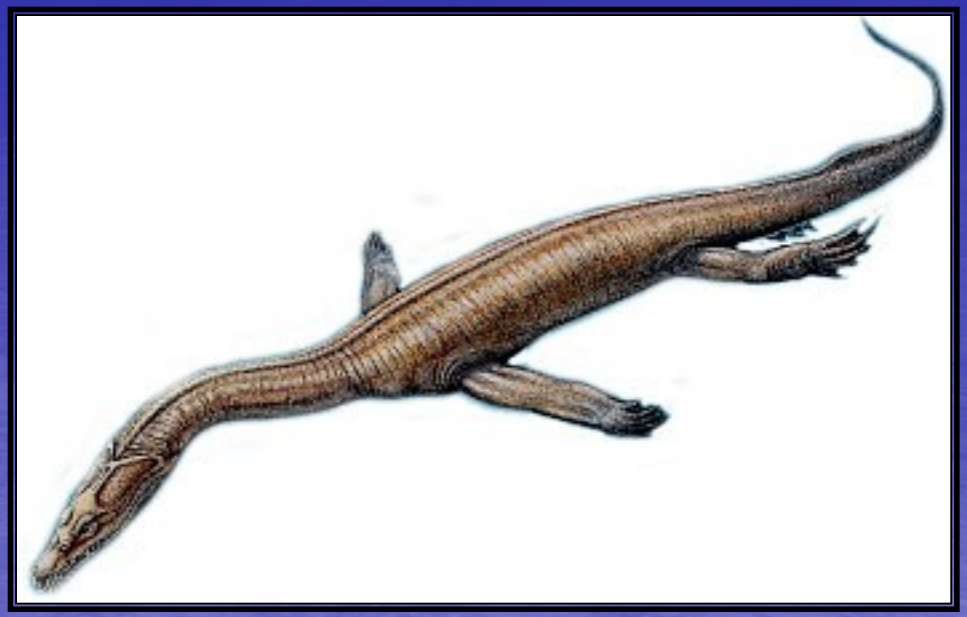
Nothosaurs

- Many different varieties, some more aquatic than others
- Many similarities to proto-whales, as we'll see

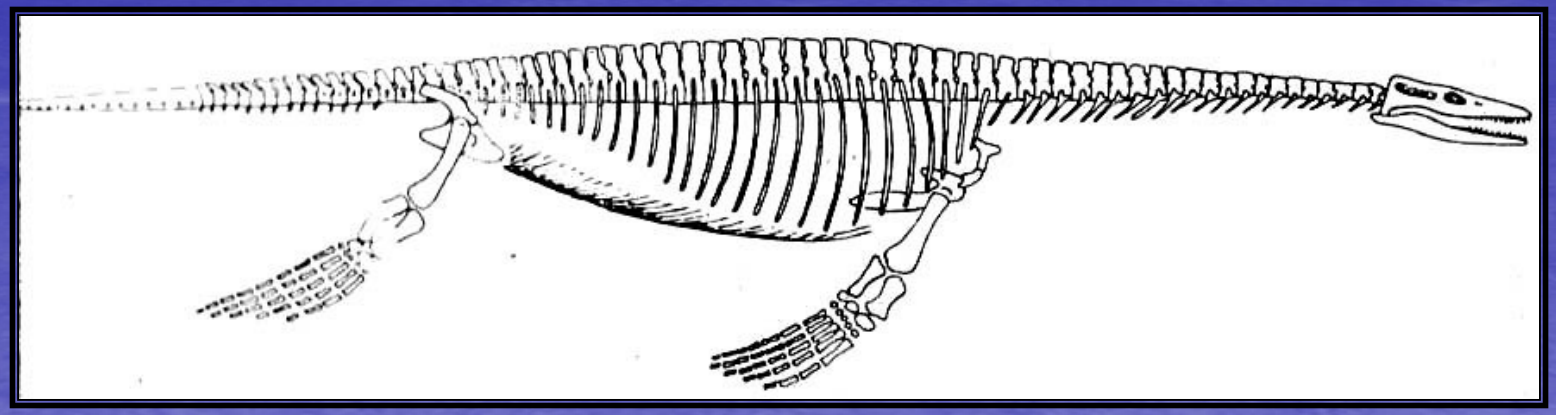


Ceresiosaurus

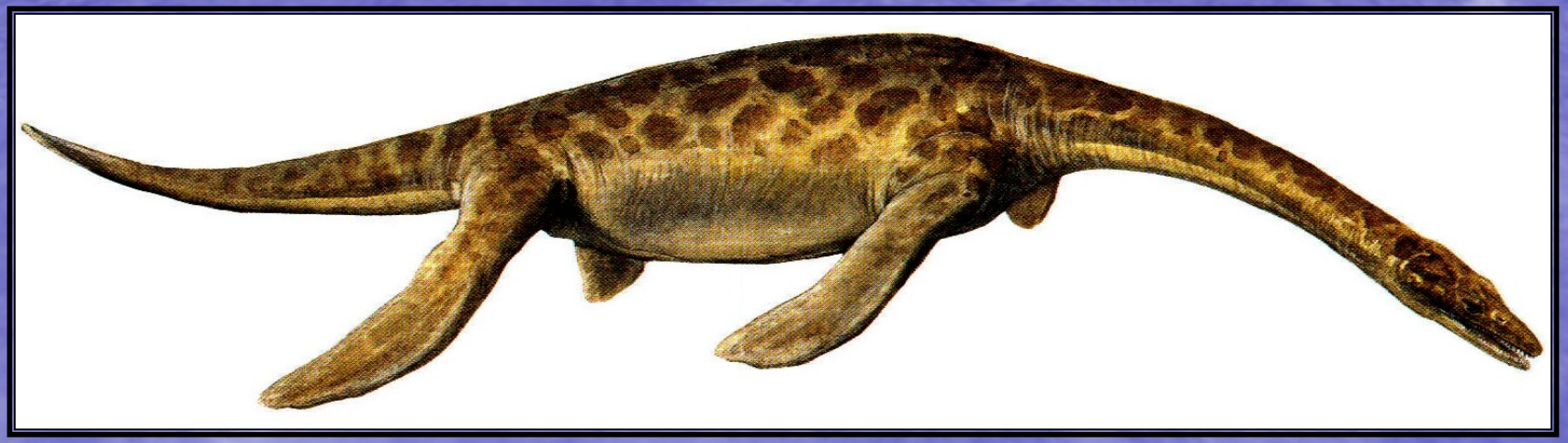
- A type of nothosaur that may be the most direct relative of plesiosaurs
- Had no discernable toes (pure flippers), and was likely one of the first marine reptiles to propel itself paraxially



Pistosaurs



- Most primitive plesiosaur (mid-Triassic)
- Only Triassic plesiosaur
- Shows traits of nothosaurs (has palate) and plesiosaurs (stiffened vertebral column)



THE DORSOVENTRAL STABILIZING SYSTEM

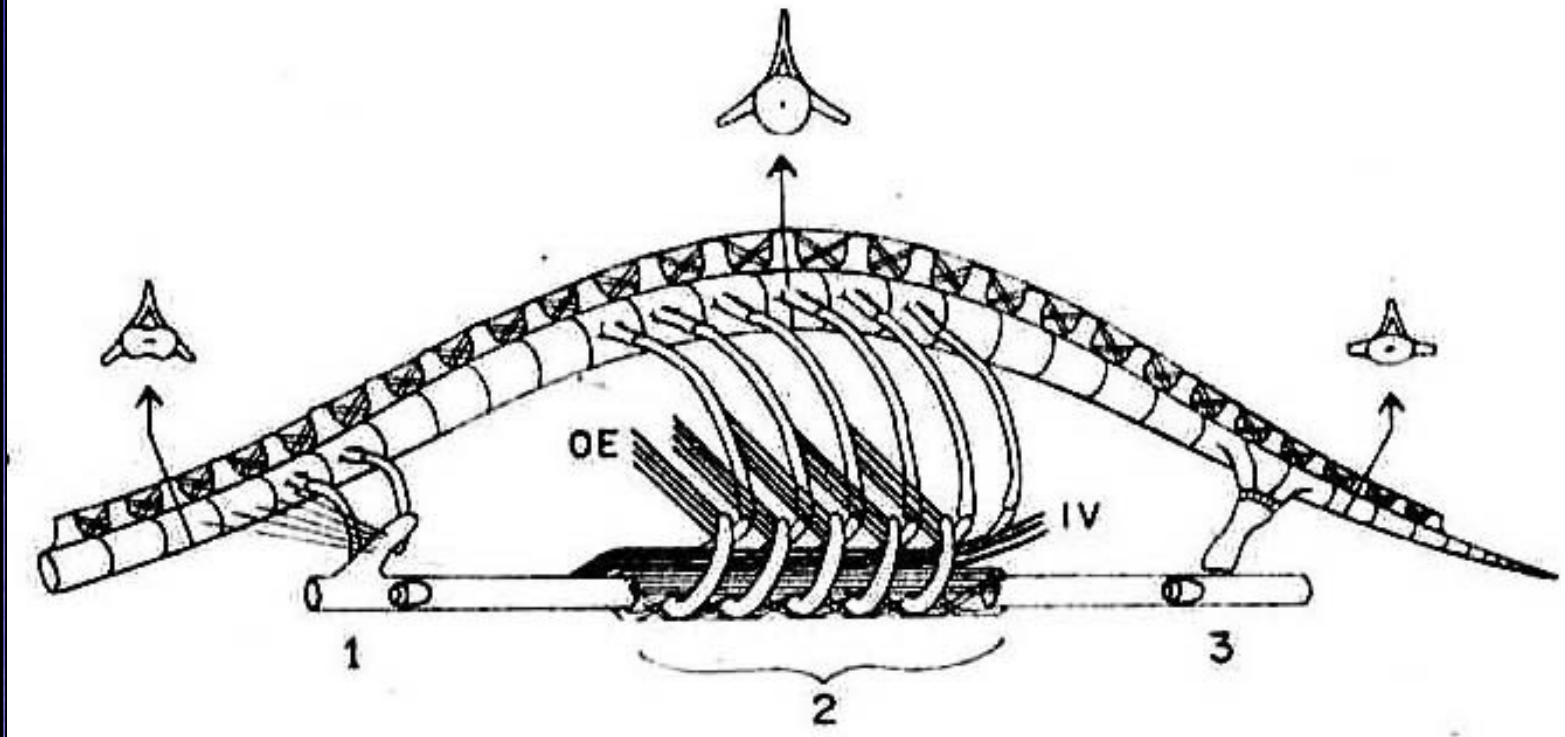
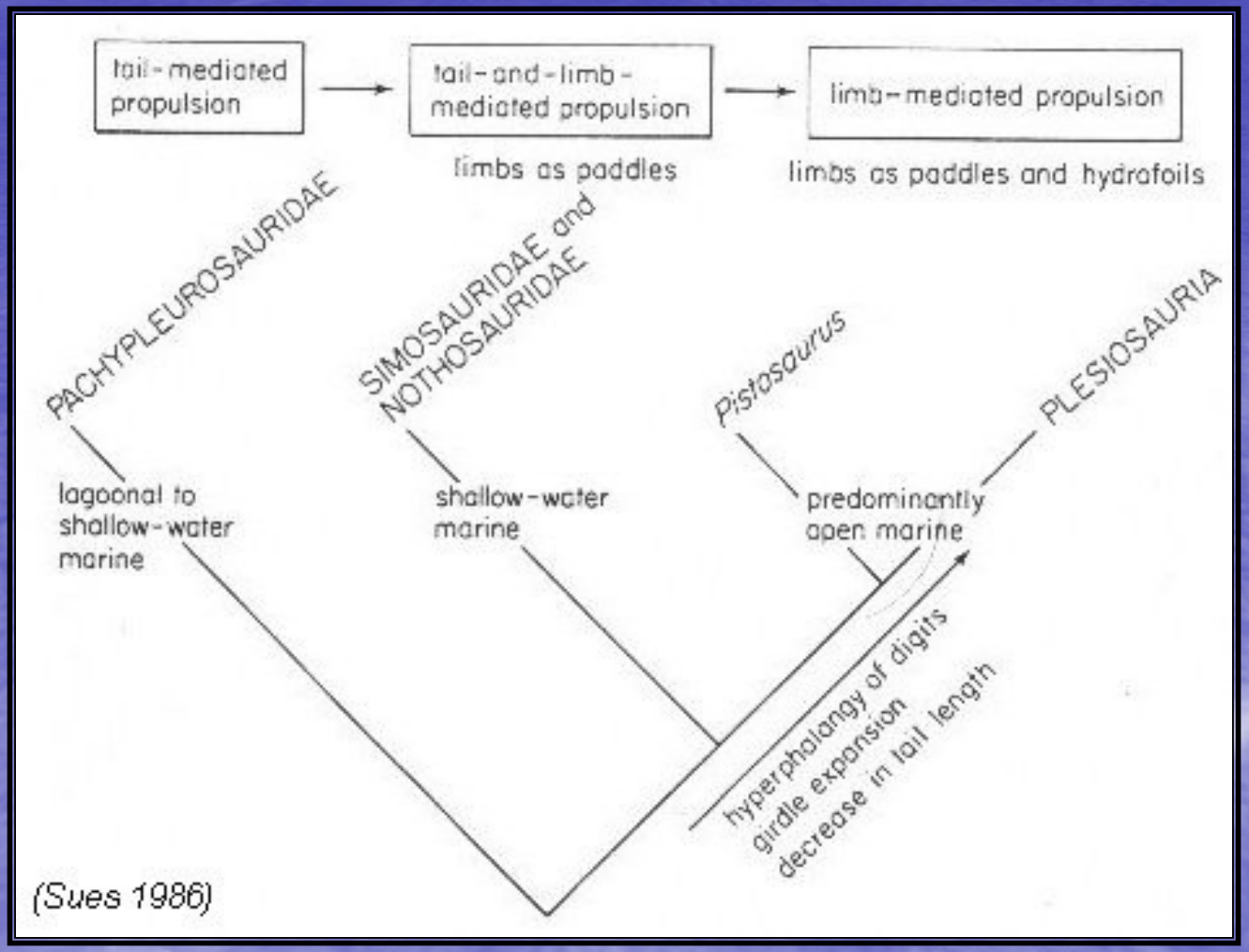


Figure 15. The dorsoventral stabilizing system of plesiosaurs. 1: the anterior pectral component, consisting of the scapular blade, the M. Levator scapulae and the pectoral ribs. 2: the midventral component, consisting of true ribs, costal cartilages, gastralia and the muscles and ligaments tying these elements together 3: the posterior pelvic components, consisting of the ilium and the sacro-iliac ligaments.

End views of vertebrae from various parts of the column are drawn above it. IV: M. Intercostalis ventralis — OE: M. Obliquus externus.

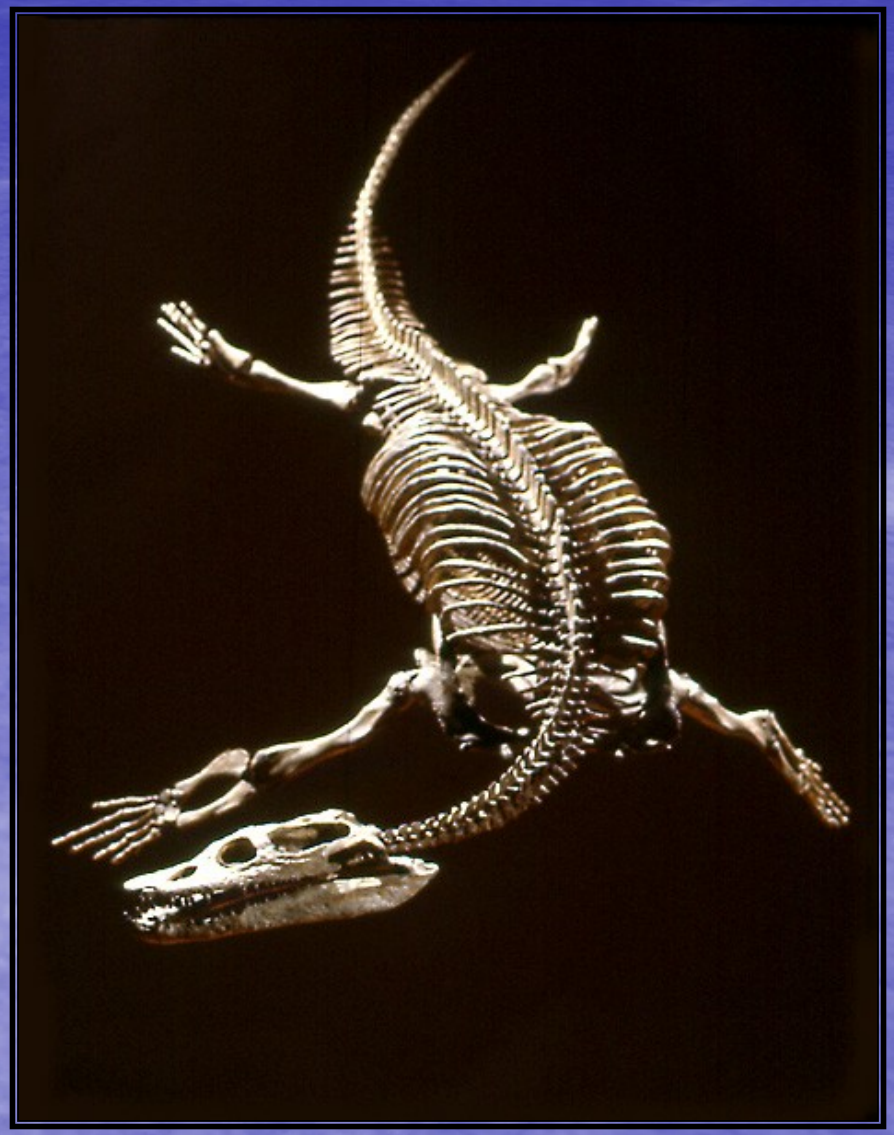
Jurassic Sauropterygia

Phylogeny Review



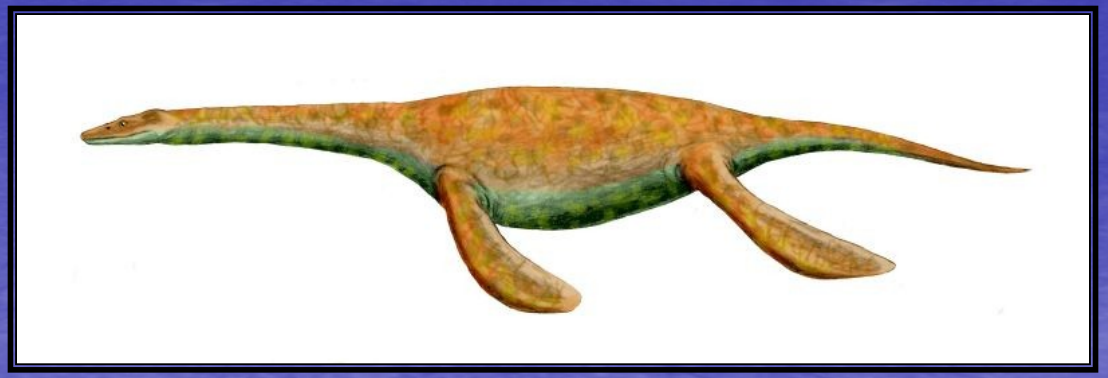
Phylogeny Review

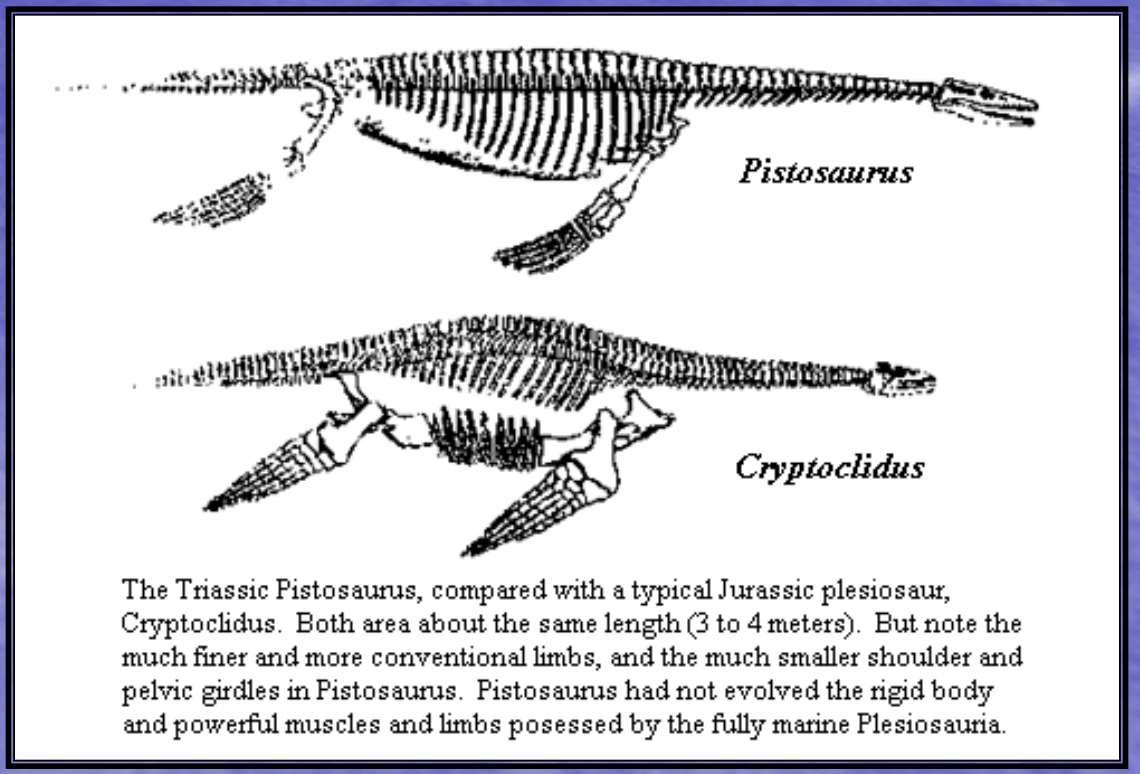
- Advanced nothosaurs like *Ceresiosaurus* and *Simosaurus* (right) shared many traits in common with the fully adapted plesiosaurs



Phylogeny Review

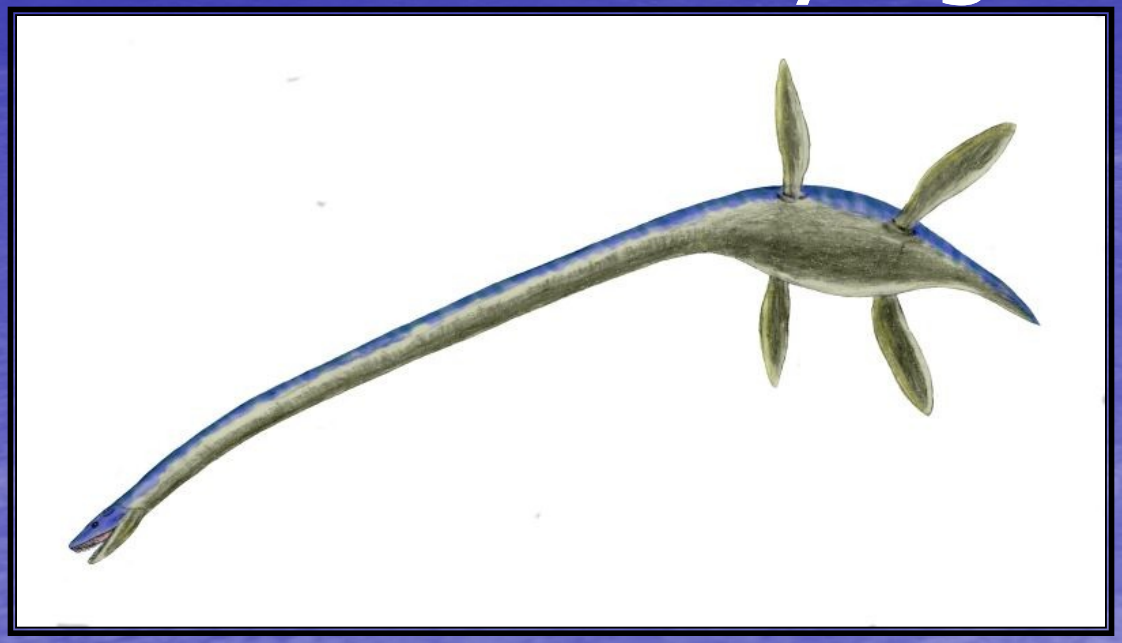
- Pistosaurs (*Pistosaurus, Corosaurus*) also share traits with nothosaurs and plesiosaurs, and are considered the most basal plesiosaurs



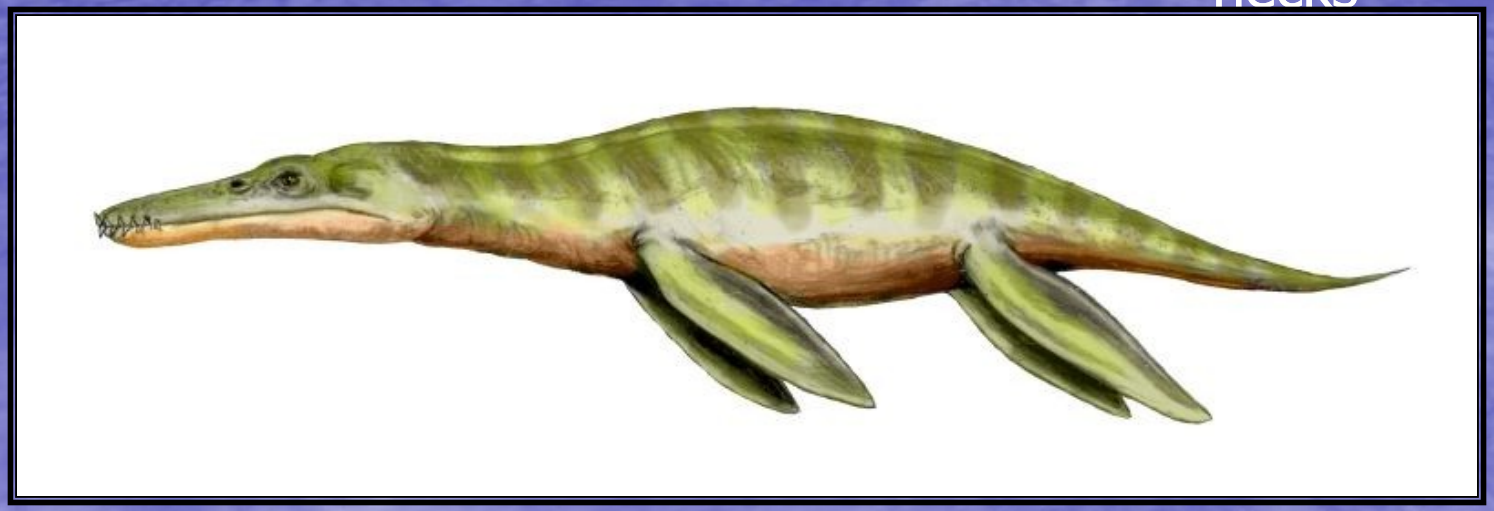


The Triassic Pistosaurus, compared with a typical Jurassic plesiosaur, Cryptoclidus. Both area about the same length (3 to 4 meters). But note the much finer and more conventional limbs, and the much smaller shoulder and pelvic girdles in Pistosaurus. Pistosaurus had not evolved the rigid body and powerful muscles and limbs posessed by the fully marine Plesiosauria.

Plesiosaur Phylogeny

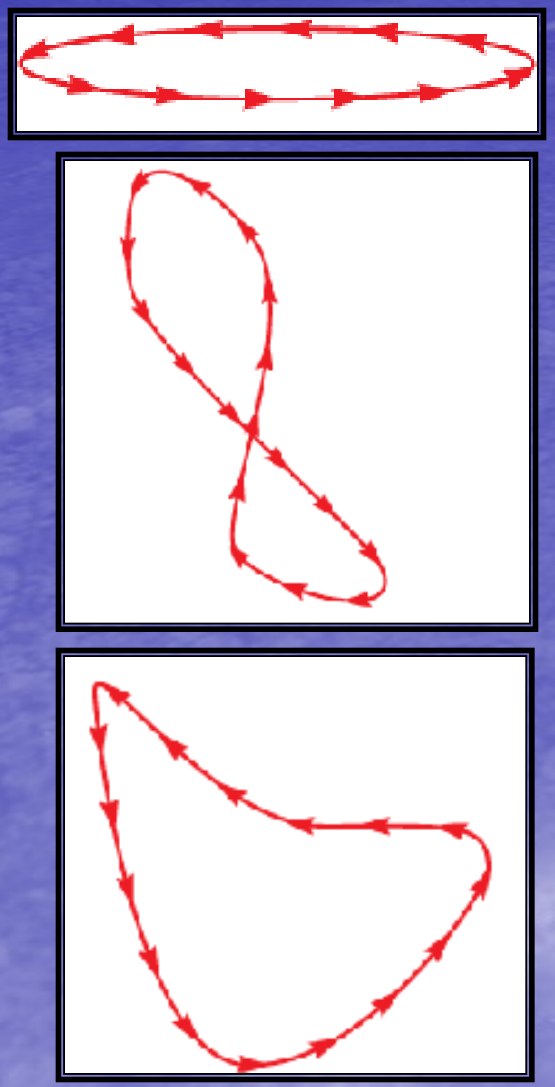


- Order Plesiosauria is broken into 2 major suborders: the Plesiosauroidea, with long necks and small heads, and the Pliosauroidea, with larger heads and shorter necks



Plesiosaurs

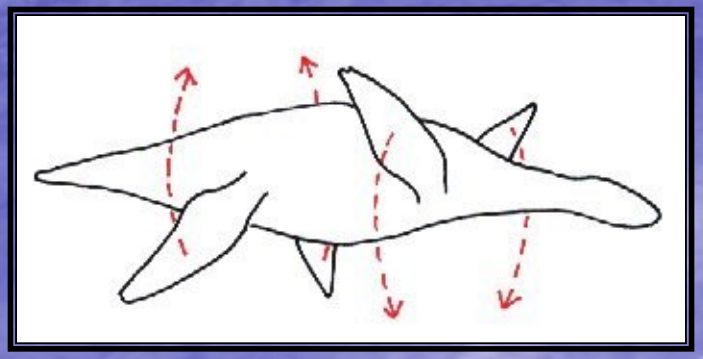
Plesiosaur Morphology

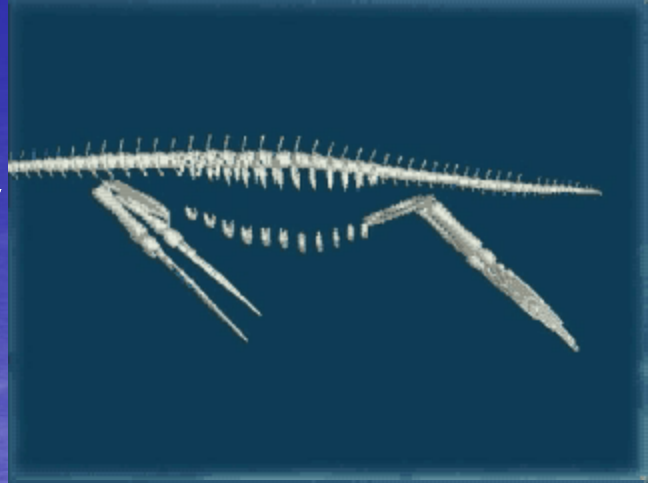


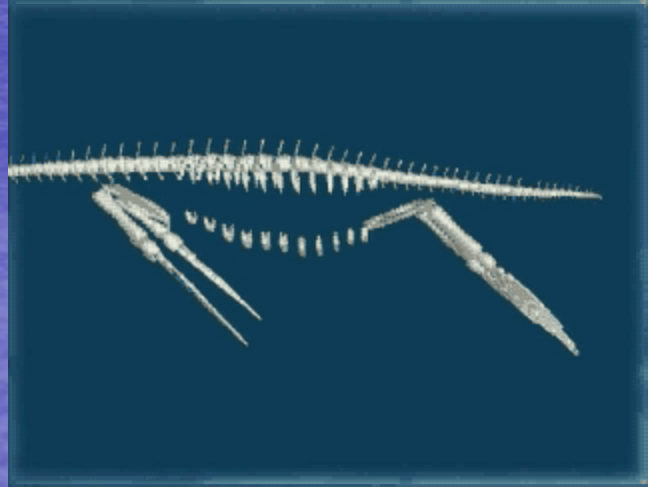
- Limbs articulated in either rowing motion,
- Flying motion (like penguins),
- Or a combination
- What do you think?

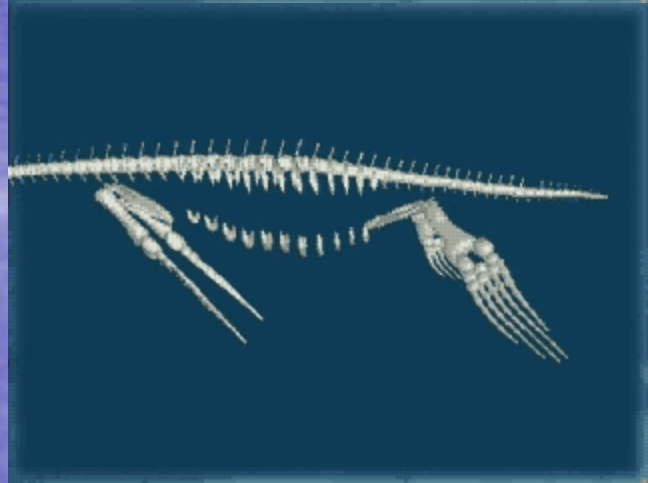
Plesiosaur Morphology

- Limbs could also either move all together, forelimbs only, or alternating
- Alternating limb strokes would be most efficient









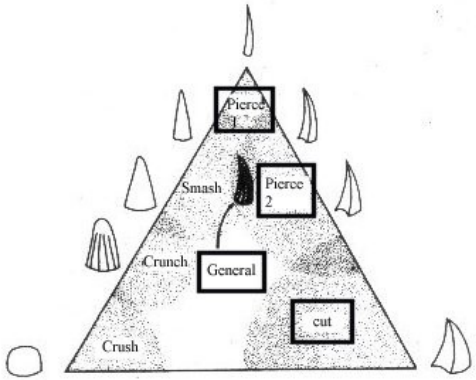
Plesiosaur Morphology

- Some Sauropterygia exhibit **pachyostosis**: an unusual amount of bone thickening
- May be larger, more dense, or have greater mineral content
- Probably aided in ballasting animals hunting for benthic organisms, as only animals alive today with this condition are marine mammals (sirenians)
- Also saw this in mesosaurs

Eocene Sirenian

Plesiosaur Morphology

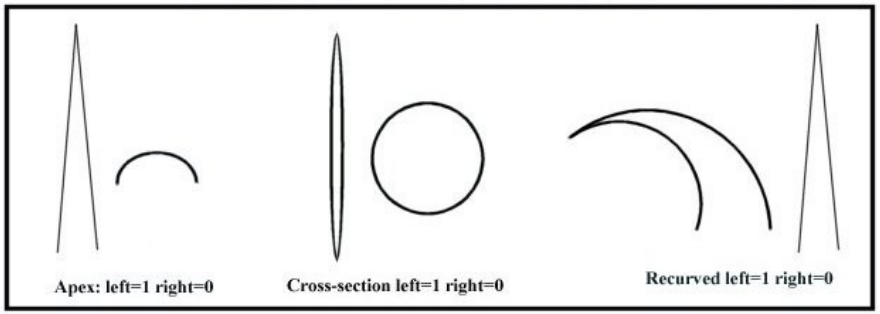
- Feeding/Teeth:
  - Most plesiosaur teeth were sharp and narrow, though some were more daggar-like
  - What would these be good for eating?



FEEDING GUILDS

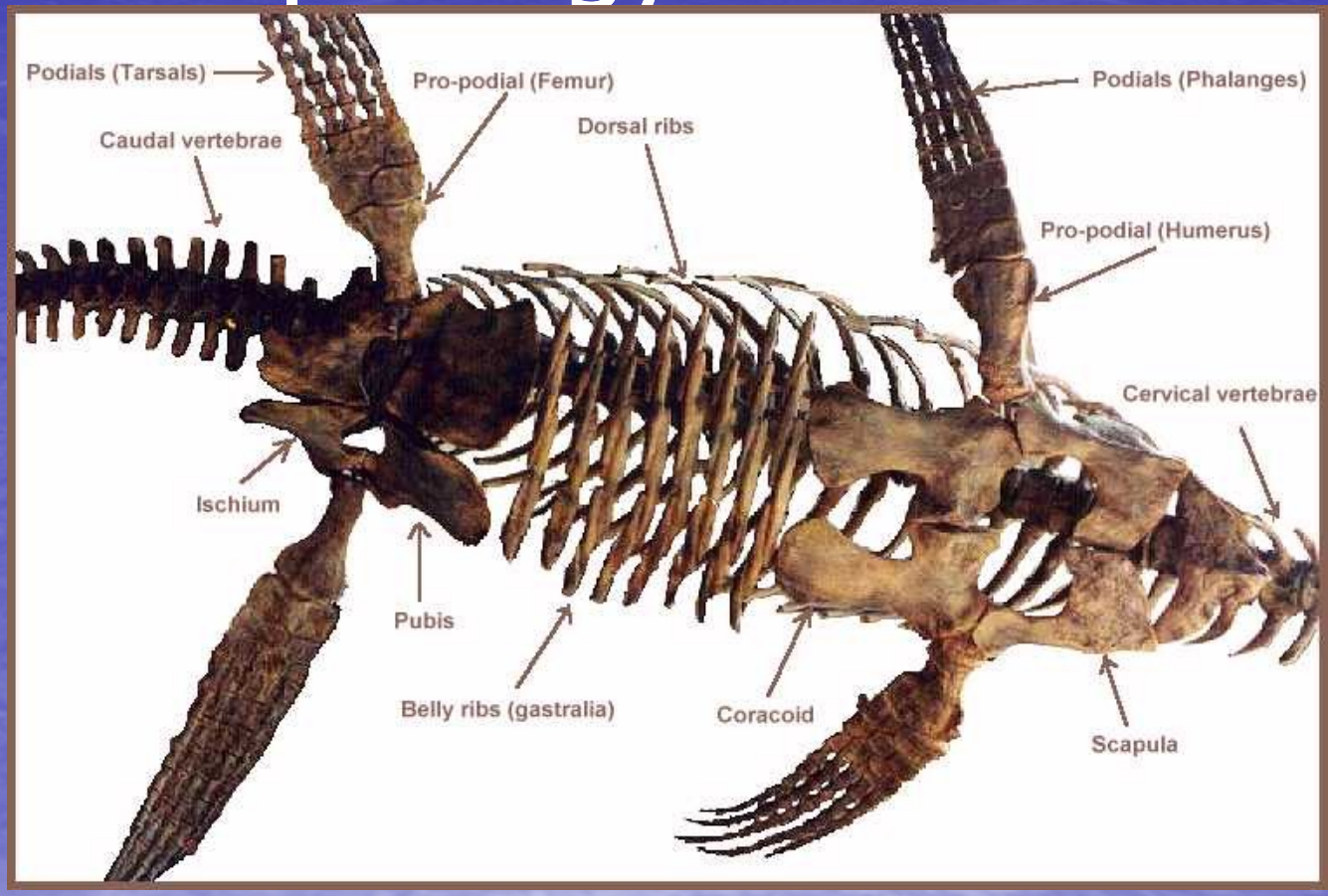
Fig 11. Seven feeding guilds for Marine reptiles defined on tooth crown morphology. Those guilds occupied in part by plesiosaurians are boxed: pierce (1&2), cut and general. (Modified from Massare, 1987)

Fig 12. **Standard guide for semi-quantitative properties of teeth**



Plesiosaur Morphology

- The pectoral and pelvic girdles are large and flattened on the bottom of the body, helping to streamline the animal and provide anchoring for the powerful limb musculature



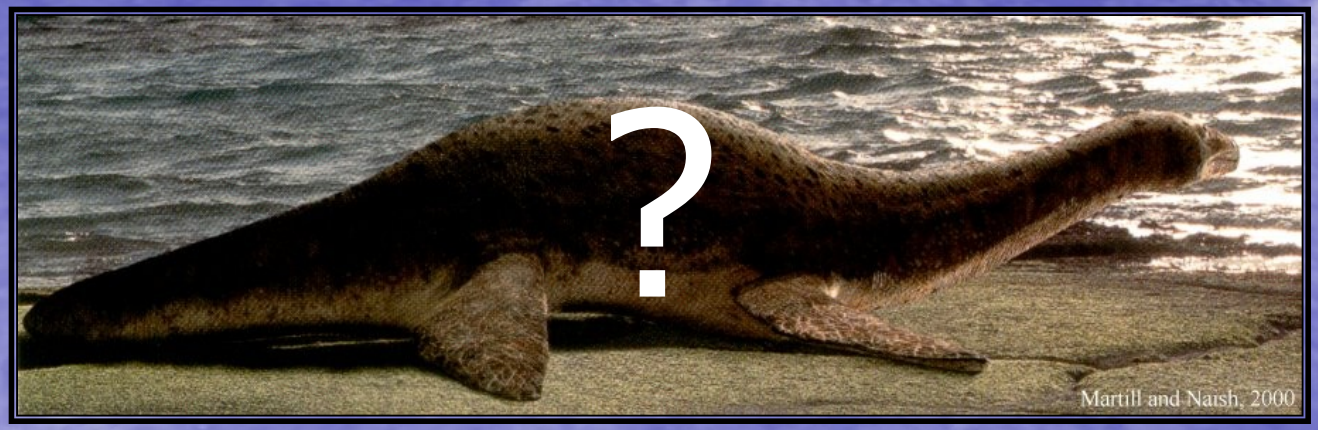
- Gastralia, or "belly ribs" (though not real ribs, as they do not attach to skeleton), help stiffen the thorax for rigidity in many animals (including Saurischians), and are common in plesiosaurs

Gastroliths

- Smooth stones found in stomachs of many plesiosaurs
- Since diet did not consist of plant material, stones probably used for ballast, though recent work suggests there may be other uses

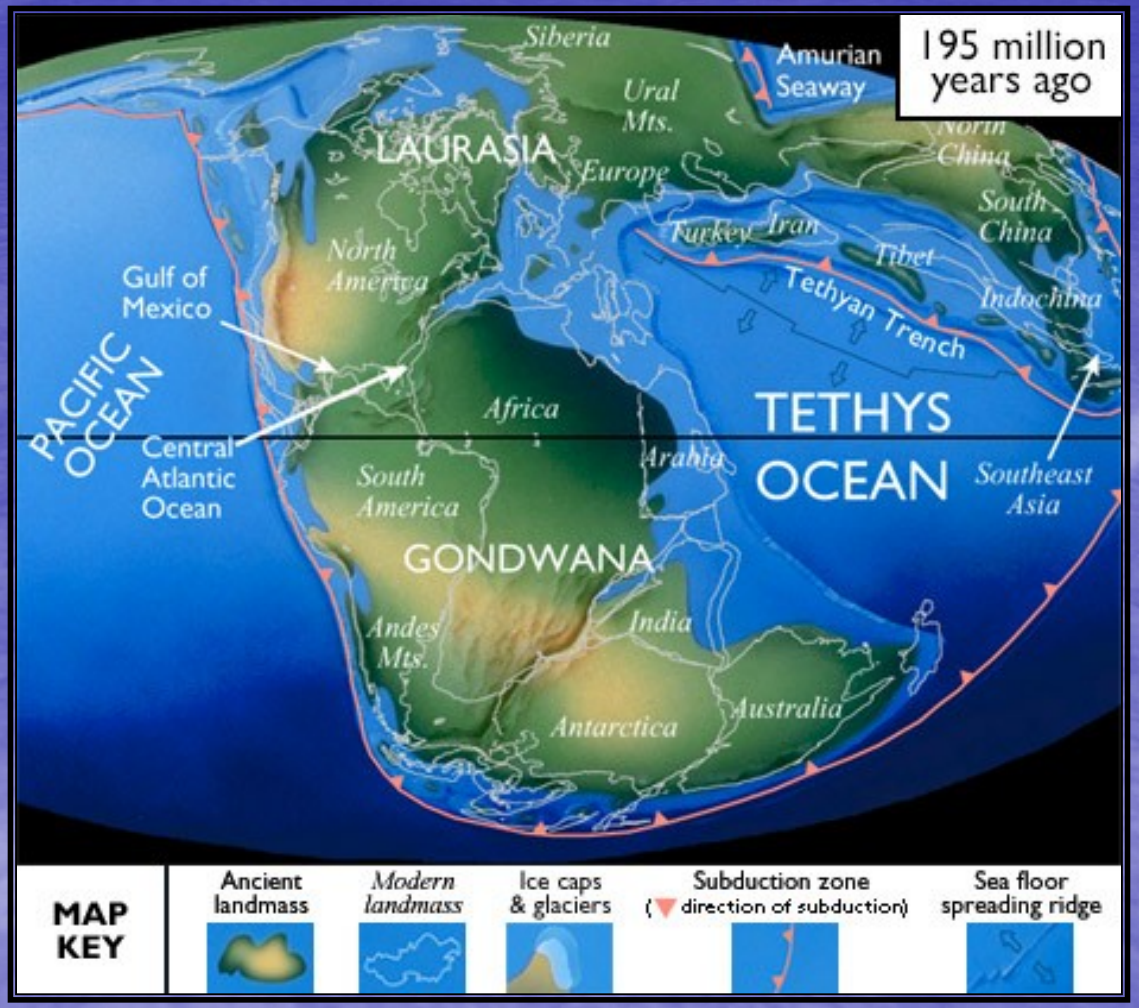
Plesiosaur Morphology

- Viviparity: Recent pachypleurosaur finds have moveable pelvis, indicating possible live birth
- Although smaller plesiosaurs could have been powerful enough to haul themselves out of the water, larger ones were too big, limbs girdles are not braced against the backbone, and no eggs nor embryos have ever been found



Jurassic Seas

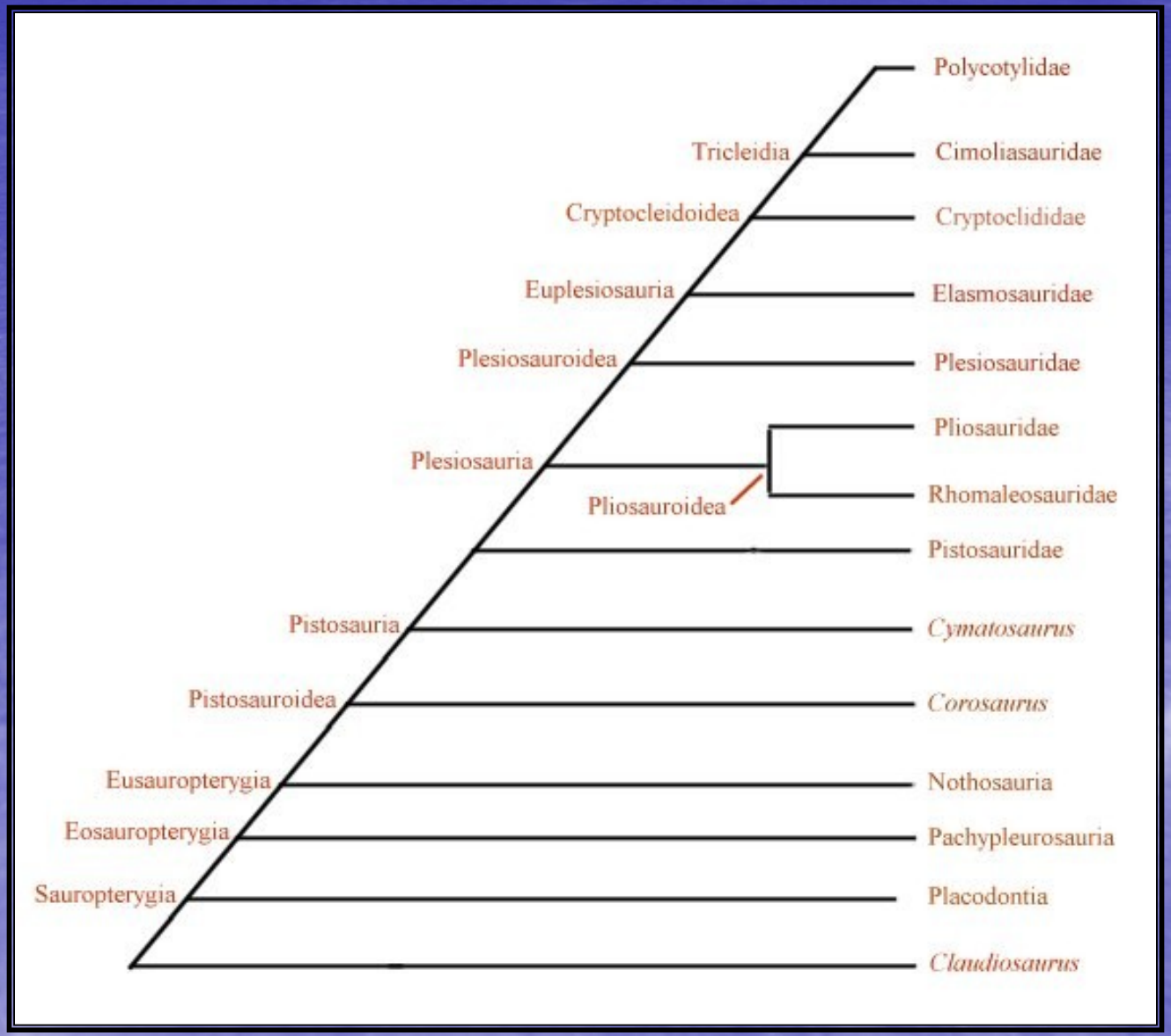
- Ichthyosaurs, plesiosaurs, and marine crocodiles (teleosaurs/ metriorhynchids) highest predators
- Belemnite squid and ammonites diversify
- Rise in bioerosion of carbonate shells, hardgrounds



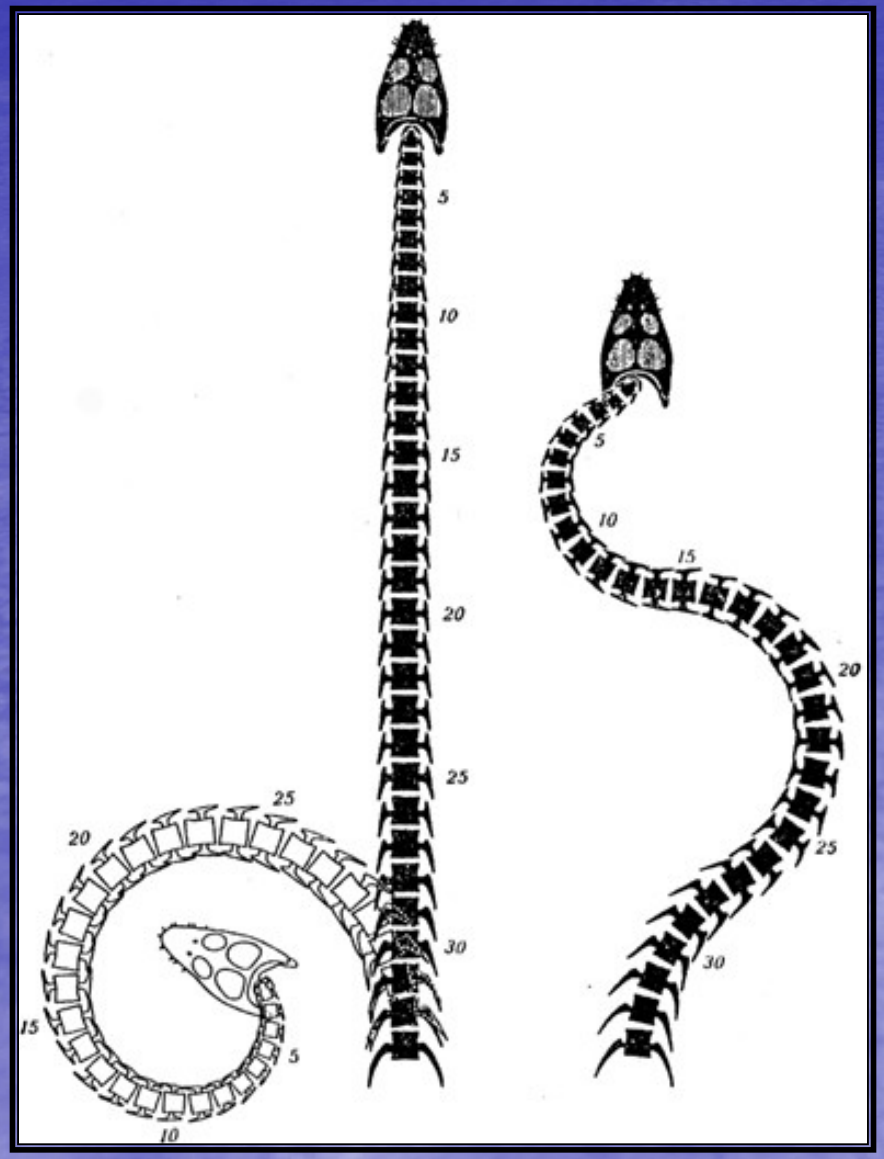
Plesiosaurs

- Plesiosauroids (hereafter plesiosaurs) are grouped into about a half dozen familes, with many different shapes (Plesiosaurids, Cryptoclidids, Polycotylids, and Elasmosaurids).

Plesiosaurs



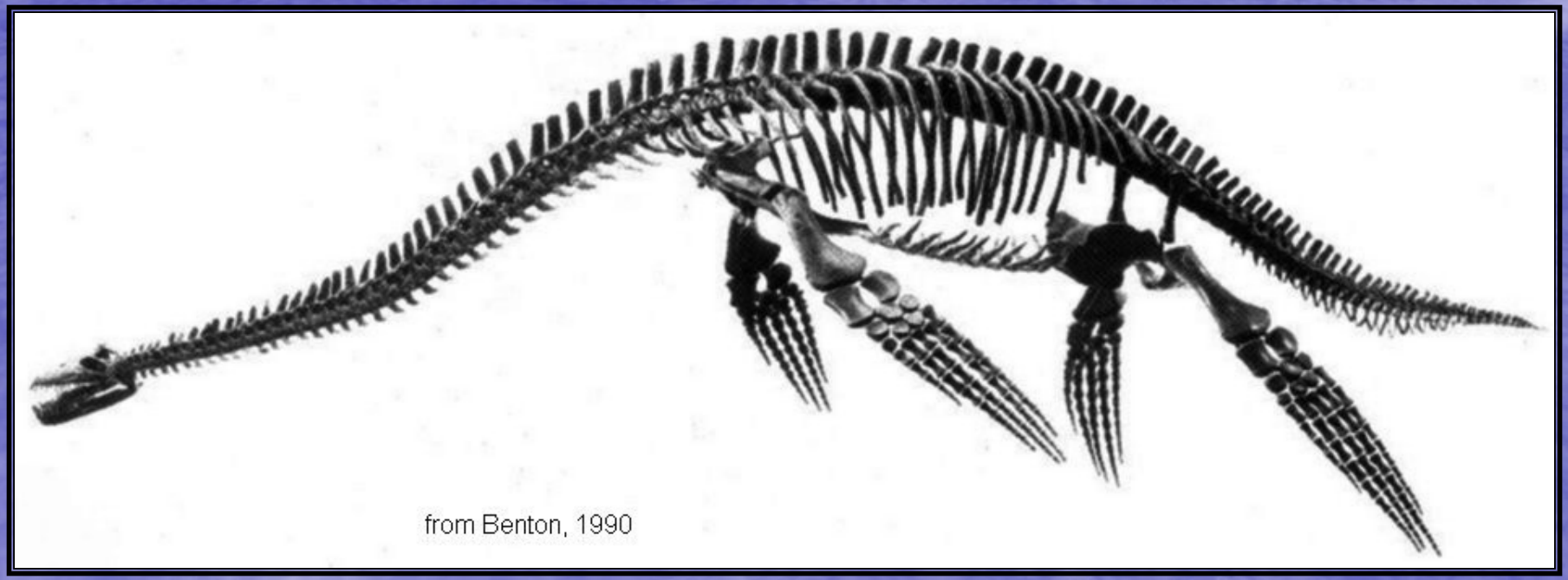
Plesiosaur Neck Morphology



- Plesiosaur necks are actually quite stiff (flattened zygopophyses on vertebrae)
- Likely long to hide body from prey as it approaches

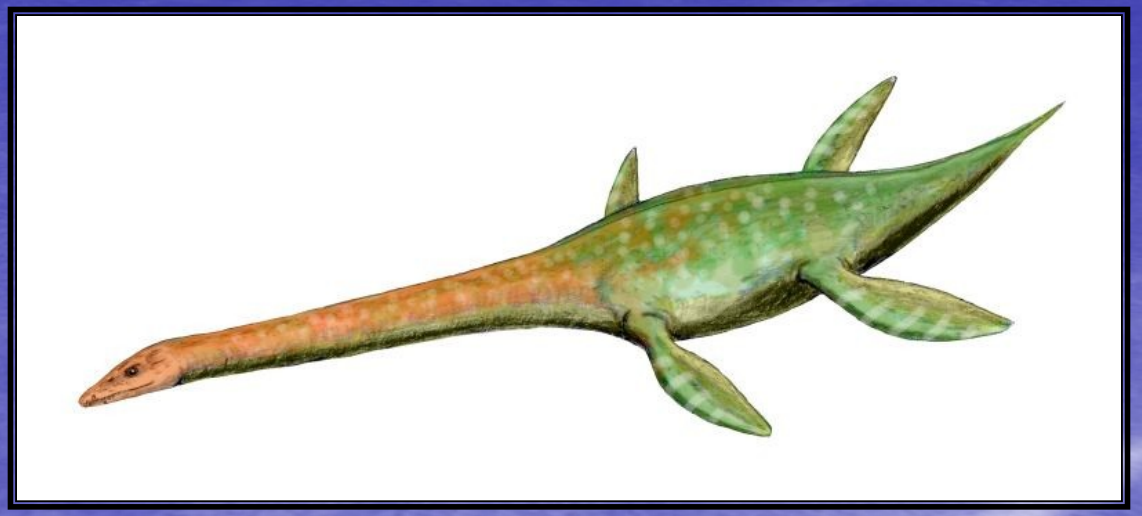
Plesiopterys

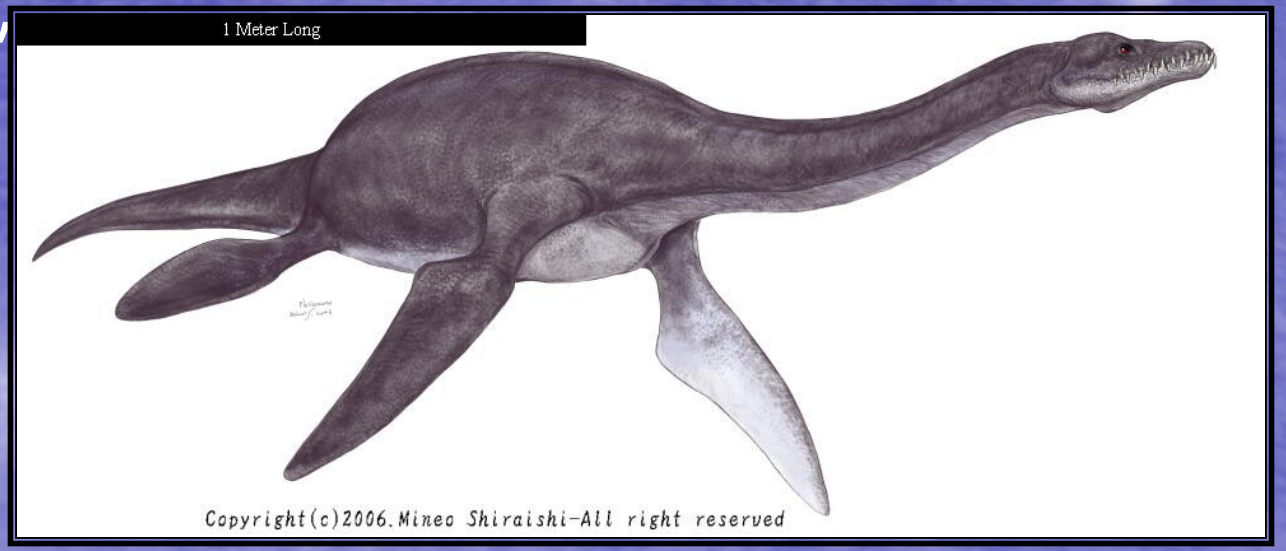
- Sister taxon to Plesiosauroidea makes *Plesiopterys* the most basal true plesiosaur from Early Jurassic



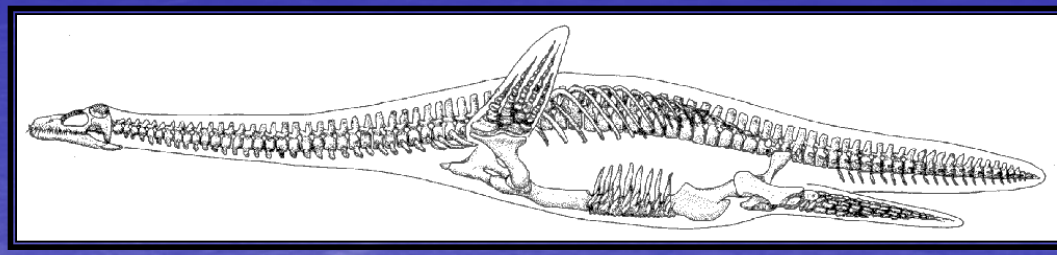
Plesiosauridae

- *Plesiosaurus* and *Attenborosaurus* belong to family Plesiosauridae
- Relatively long tails compared to other plesiosaurs, larger flippers, and somewhat short necks (28 vertebrae)
- Only about 3 meters long





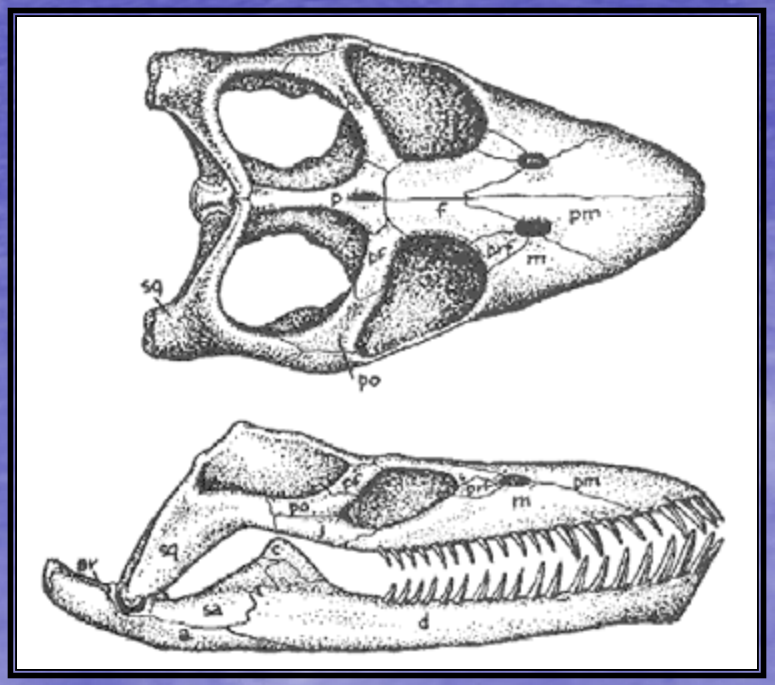
Cryptoclididae



- Cryptoclidids include *Cryptoclidus* and *Muraenosaurus,* medium-sized (8 tons) long necked plesiosaurs of the mid Jurassic

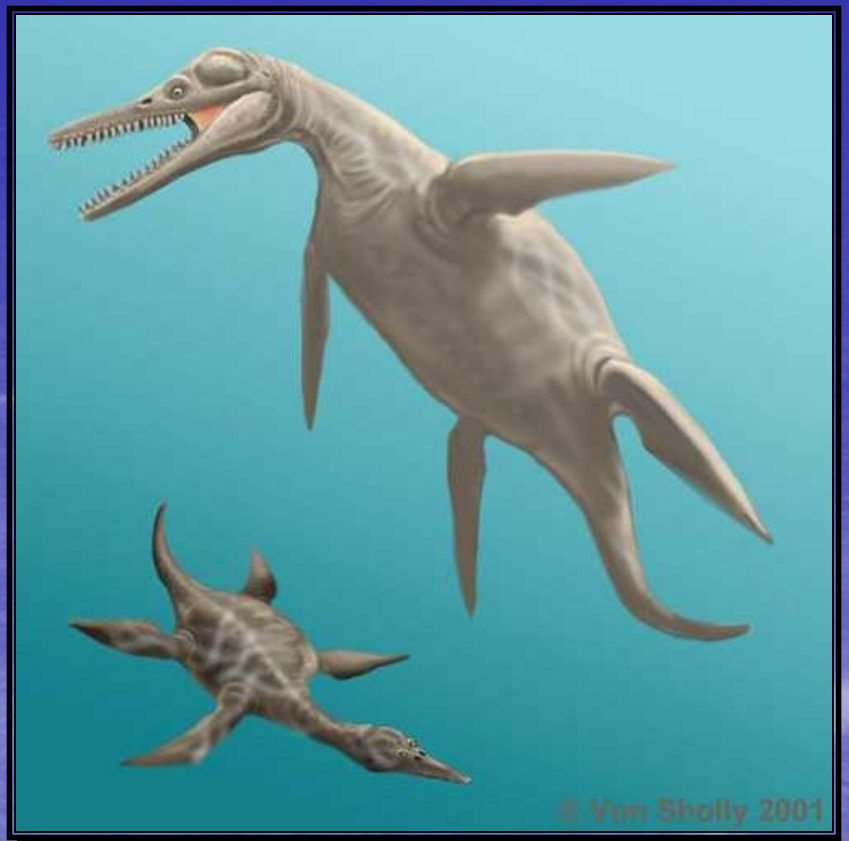
Cryptoclididae

- Around 30 cervical vertebrae
- 100 long, sharp interlocking teeth for catching squid, fish, and sifting crustaceans out of the bottom sediment

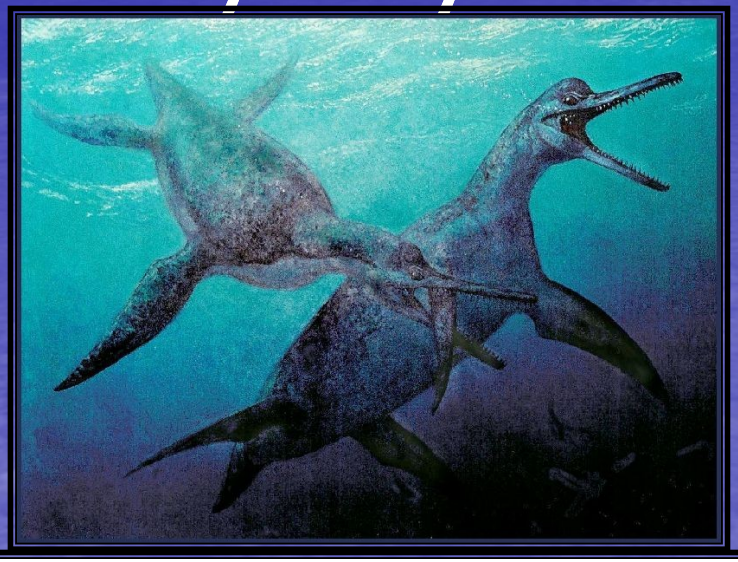


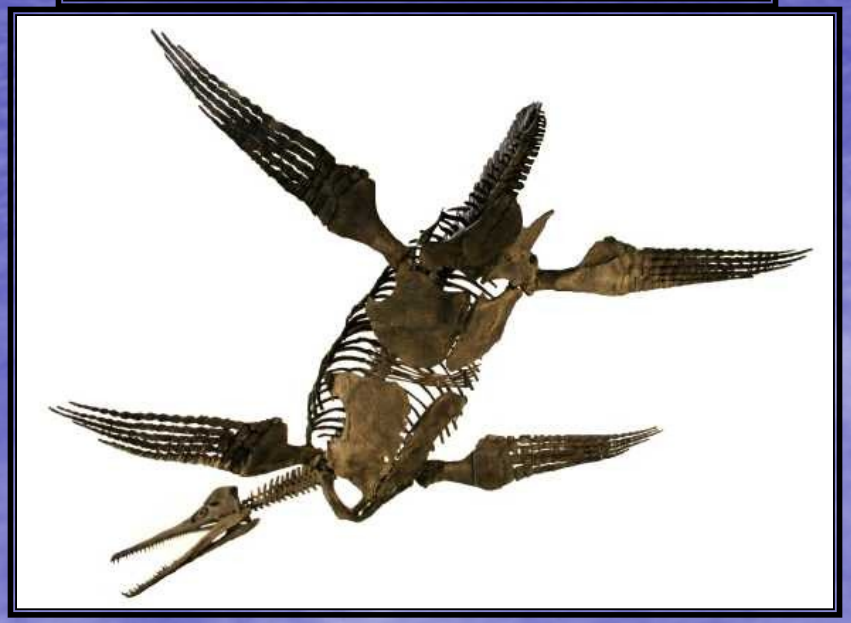
Polycotylids

- Used to be considered pliosaurs because of large head/short neck, but are actually related to elasmosaurs and cryptoclidids



Polycotylids



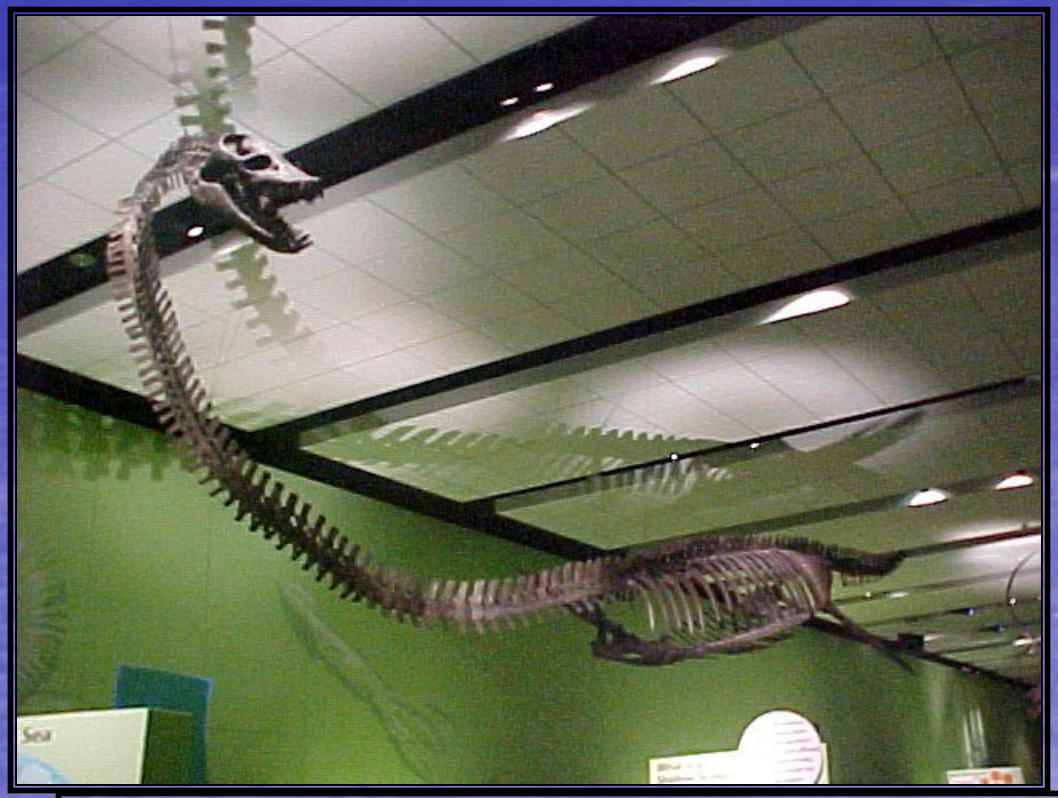


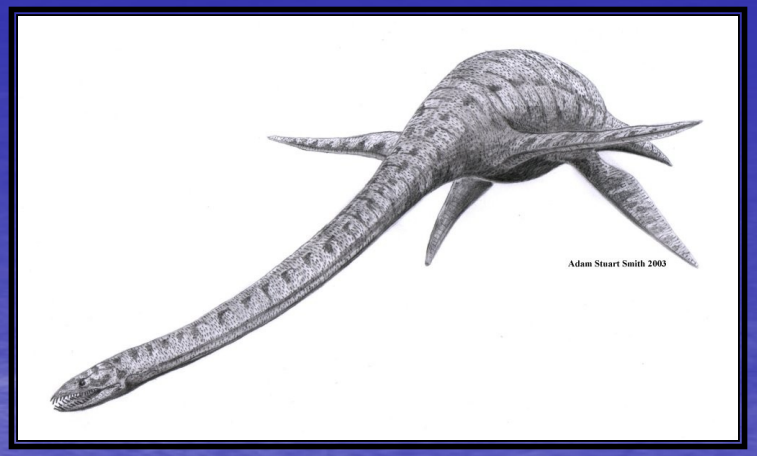
- Worldwide distribution in Cretaceous: *Dolichorynchops, Trinacromerum, Polycotylus*
- Had elongate rostrum and short postorbital region

Elasmosaurs

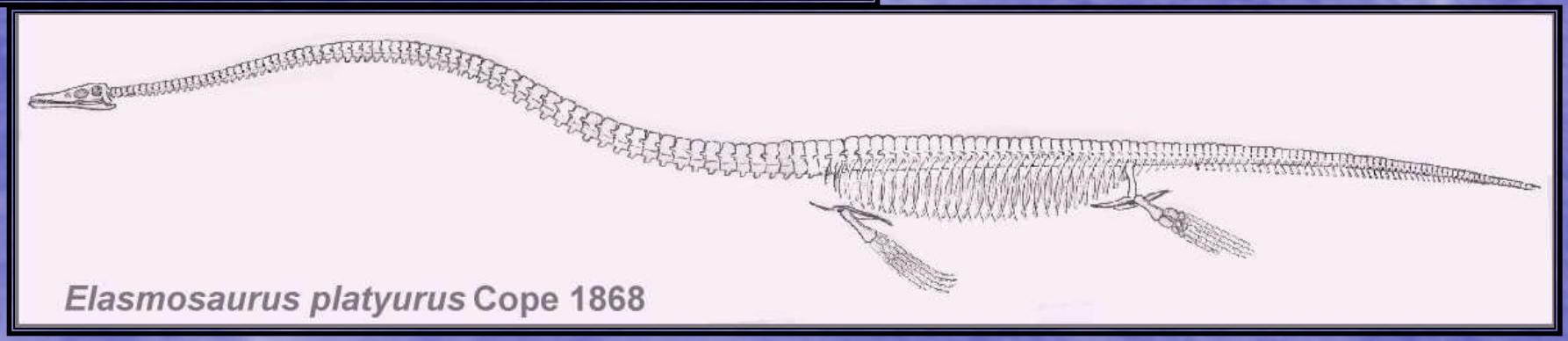
- Most advanced plesiosaurs
- Though they thrived in the late Cretaceous, their fossil record extends back to the Early Jurassic
- *Elasmosaurus, Microcleidus, Styxosaurus, Thalassomedon*

Elasmosaurs





- Grew as long as 14 meters, with anywhere from 32 to 71 cervical vertebrae

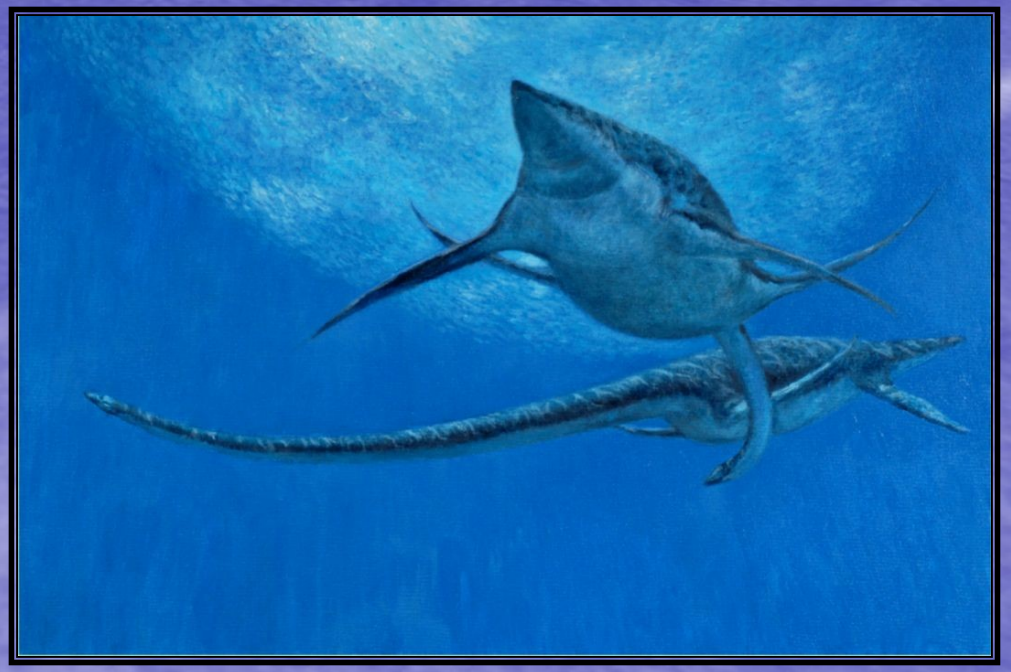


Elasmosaurs

- Long neck likely useful in hiding approaching body from schools of fish/squid

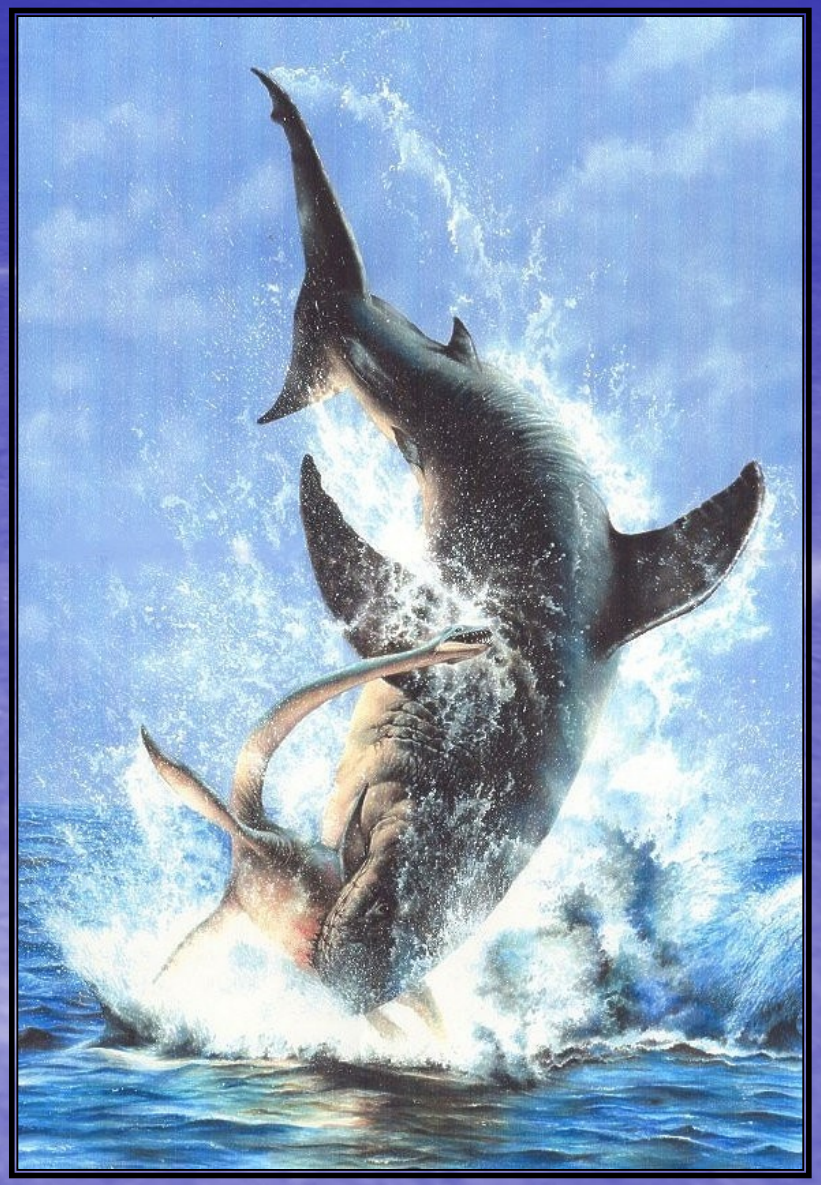
Elasmosaurs

- Long neck relatively inflexible (too much water resistance)
- Could not raise head high out of water or turn underwater

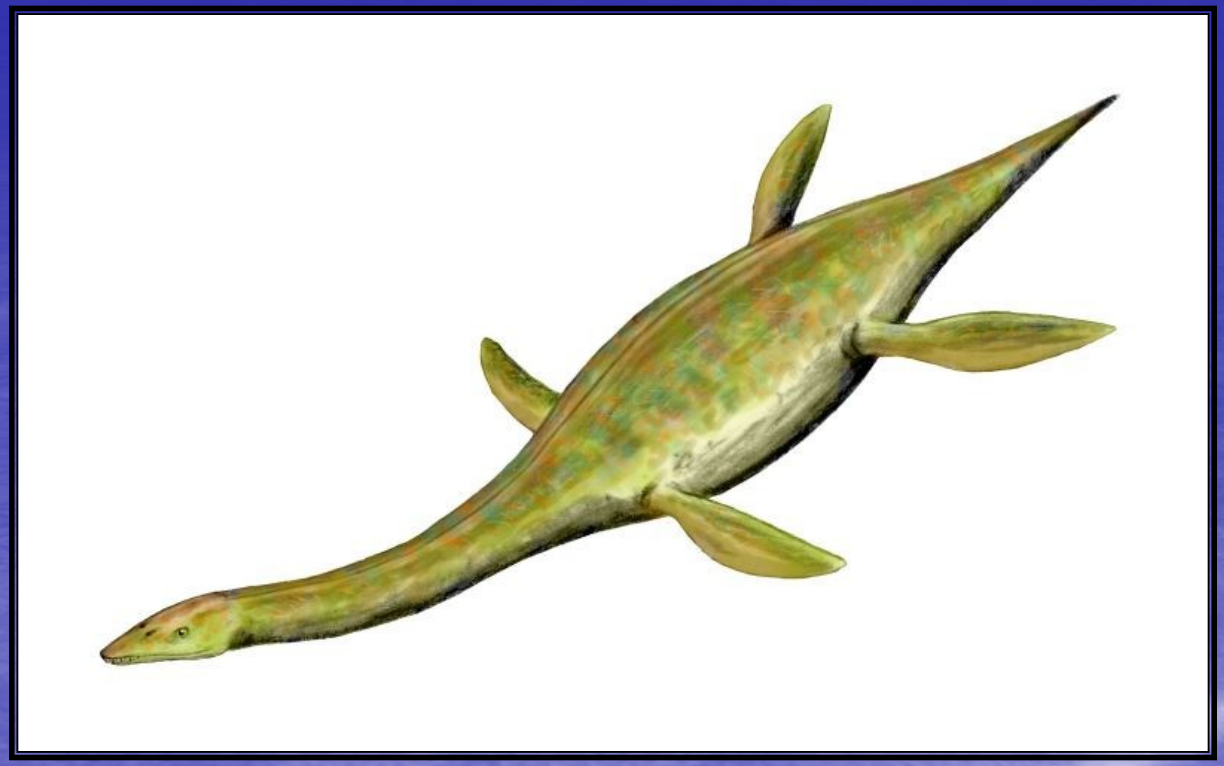


Plesiosaur Ecology

- Plesiosaurs and pliosaurs were the dominent marine predators through the Jurassic and early Cretaceous, though sharks were never far behind…



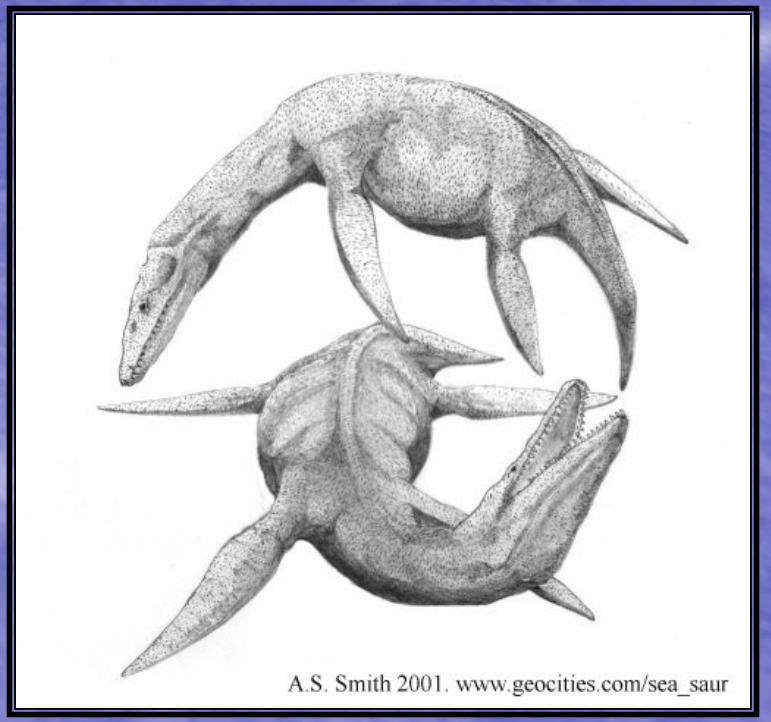
Pliosaurs



- In the Early Jurassic, the pliosaurs split off from the mainstream plesiosaurs with transitional species such as *Thalassiodracon*

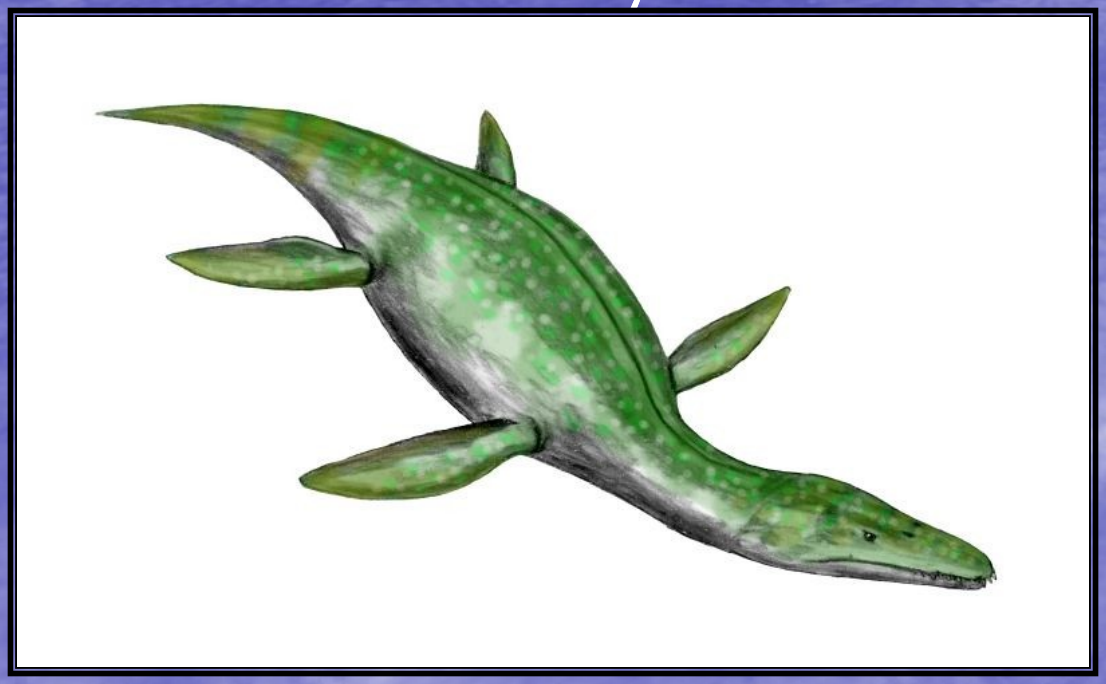
Basal Pliosaurs

- Early pliosaurs had shorter necks and larger heads than plesiosaur contemporaries, but were similar enough to cause confusion for taxonomists (*Eurycleidus, Leptocleidus*)
- Rhomaleosaurs represent first "true" transition to pliosaur morphology



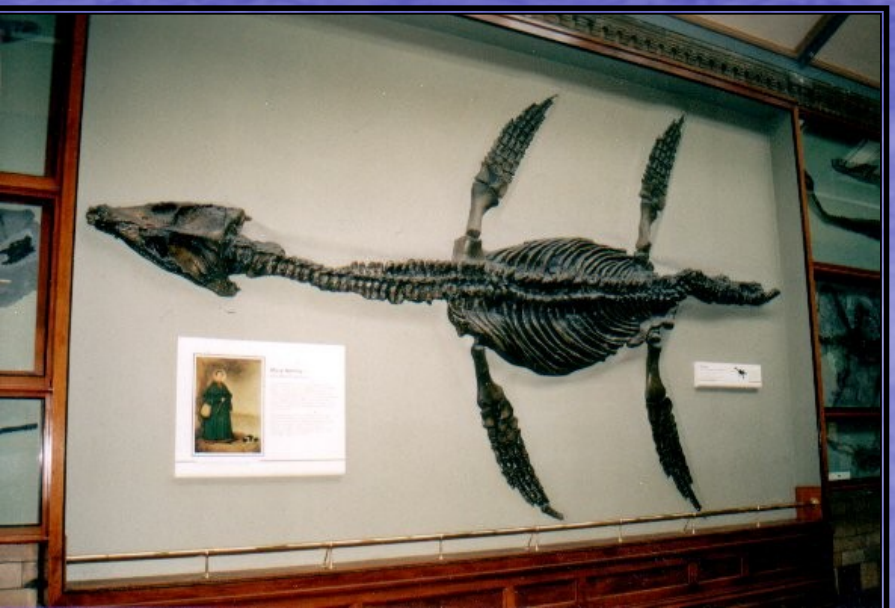
Rhomaleosauridae

- Earliest of the giant sauropterygian predators (as big as many large ichthyosaurs)
- Longer neck than conventional pliosaurs, with a crocodile-like head
- Dominant in early to middle Jurassic



Rhomaleosauridae

- Note how with ~28 cervical vertebrae, rhomaleosaur necks are not much different from plesiosaurs'
- What might this suggest about their phylogeny and behavior?



Next Week…

- More Pliosaurs
- Demise of Sauropterygia
- Mosasaurs
- The end of the Cretaceous