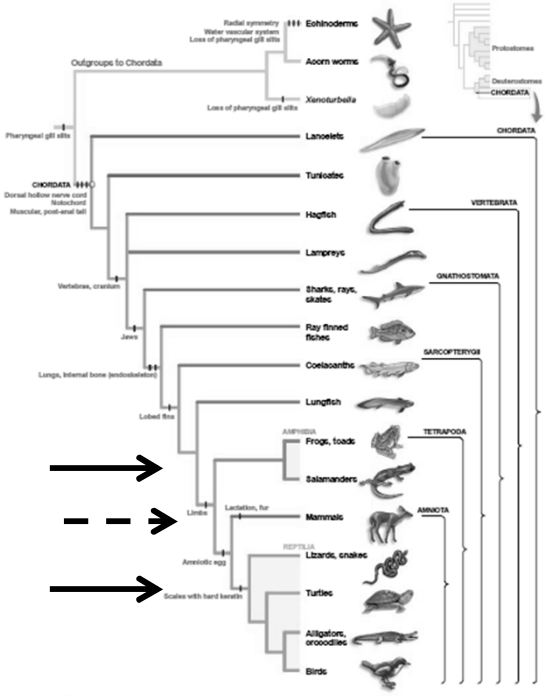
Gli Anfibi e l'origine dei Rettili



Anfibi attuali

Circa 4000 specie

Il ciclo vitale comprende uno stadio larvale solitamente acquatico ed uno adulto semiacquatico o terrestre

Quasi tutti gli anfibi devono tornare all' acqua per la deposizione delle uova.

La maggior parte degli adulti ha pelle umida che contribuisce allo scambio respiratorio supplendo ad un sistema polmonare inefficiente

Gli anfibi sono ectotermi, come i pesci cioè dipendono dalla temperatura dell'ambiente, se questa scende divengono inattivi

Gli anfibi attuali sono suddivisi in Anuri, Urodeli e Gimnofioni

Anuri

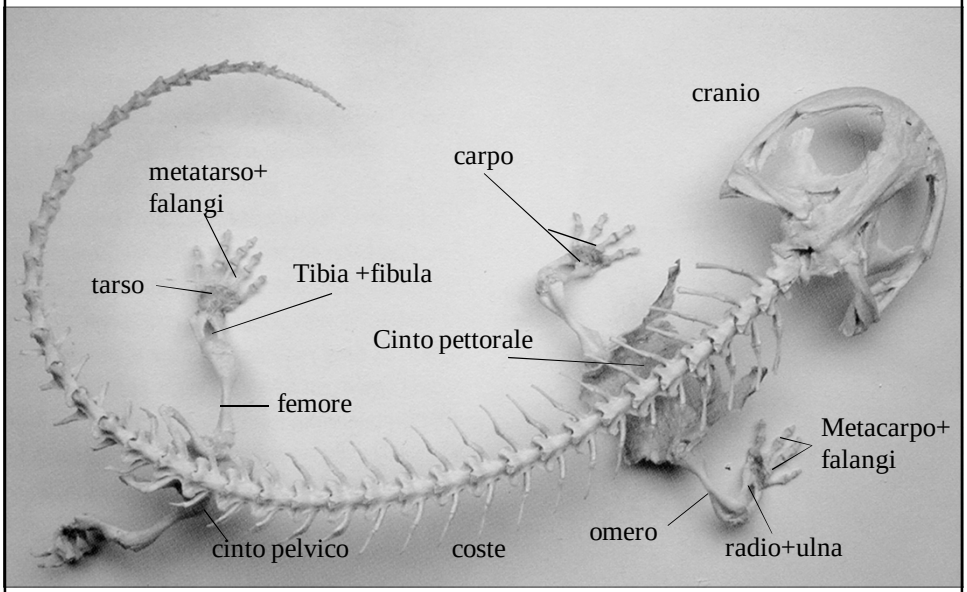
Urodeli

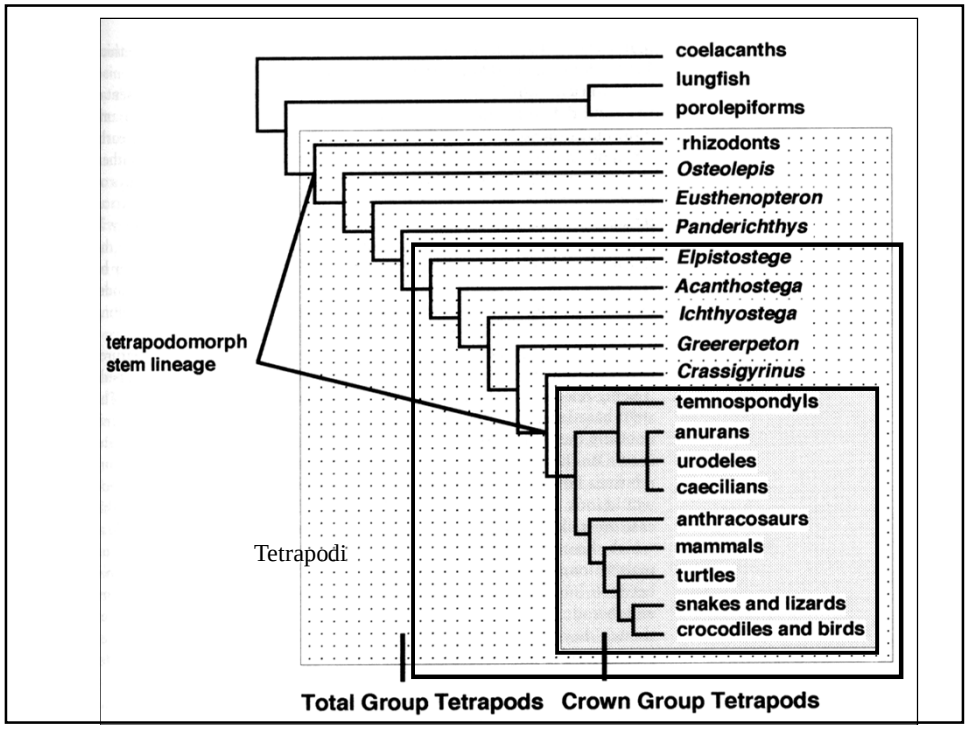
Gimnofioni

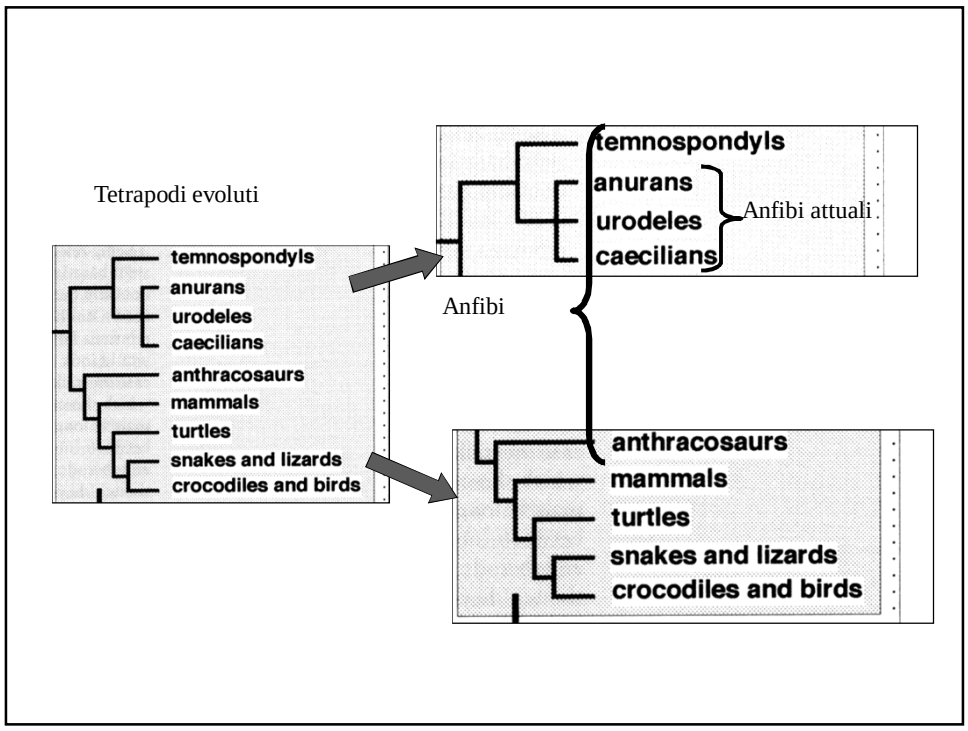
Rispetto ai pesci ossei gli Anfibi si distinguono per

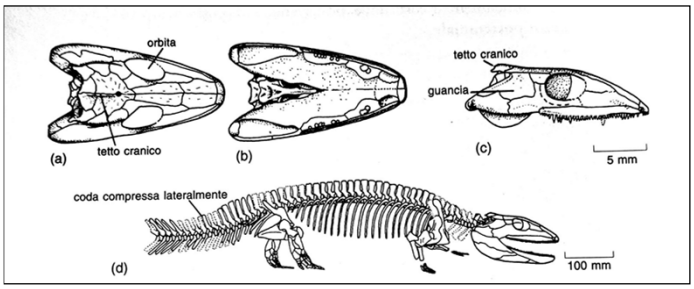
•Arti e cinti adattati alla locomozione terrestre
•Lingua usata sia per catturare la preda ed ingerirla, sia come organo di senso
•Palpebre per proteggere l'occhio dall'essiccamento
•Orecchi adattati a percepire le onde sonore nel mezzo aereo
•Laringe adattata a vocalizzare

Urodeli



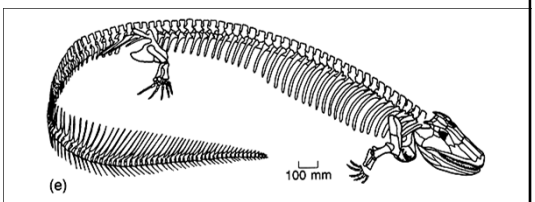

coelacanths
lungfish
porolepiforms
rhizodonts
Osteolepis
Eusthenopteron
Panderichthys
Elpistostege
Acanthostega
Ichthyostega
Greererpeton
Crassigyrinus
tetrapodomorph
stem lineage
temnospondyls
anurans
urodeles
caecilians
anthracosaurs
mammals
turtles
snakes and lizards
crocodiles and birds
Tetrapodi
Total Group Tetrapods
Crown Group Tetrapods


Tetrapodi evoluti
temnospondyls
anurans
urodeles
caecilians
anthracosaurs
mammals
turtles
snakes and lizards
crocodiles and birds
Anfibi attuali
Anfibi



Proterogyrinus

Carbonifero-Permiano
Alcuni terrestri, altri più acquatici
Mobilità elementi del cranio
Proterogyrinus più terrestre (arti sviluppati)
ma mantiene coda appiattita.
Pholiderpeton più acquatico

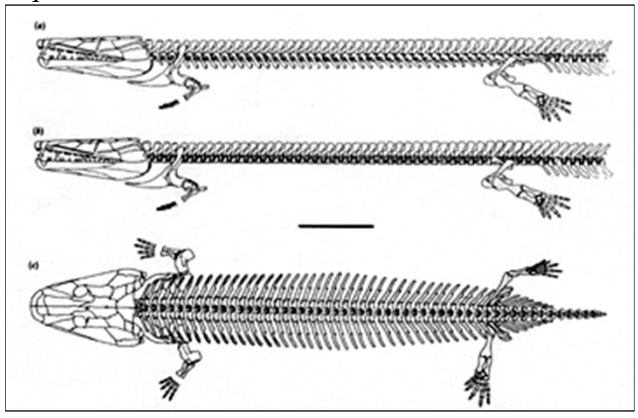


Pholiderpeton

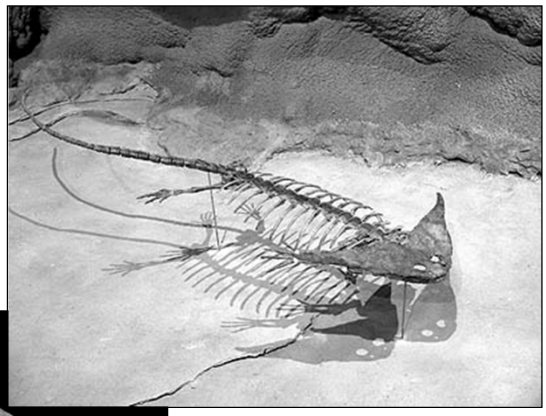
Colosteidi

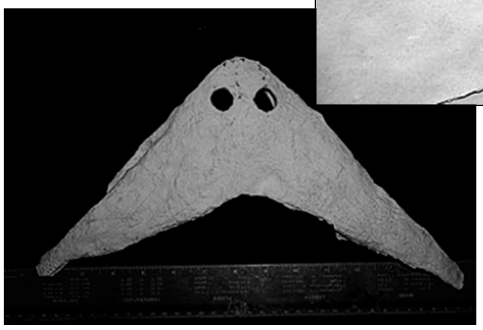
Occhi in alto, testa piatta, no incisura timpanica, canali della linea laterale ben sviluppati.

Legati ambiente acquatico

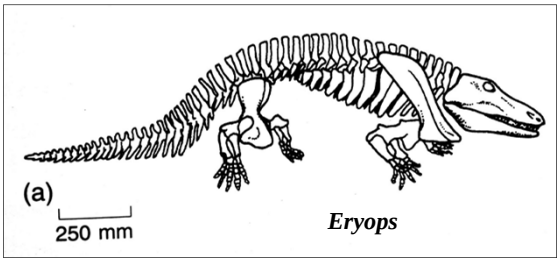


Nectridea,
Carbonifero
Coda piatta con spine neurali ed emali sviluppate, simmetriche (nuoto)

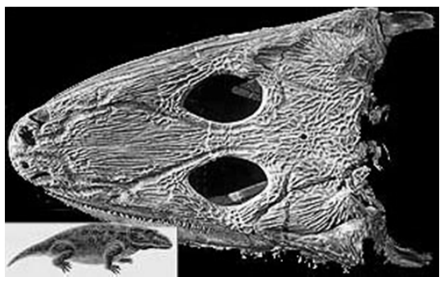




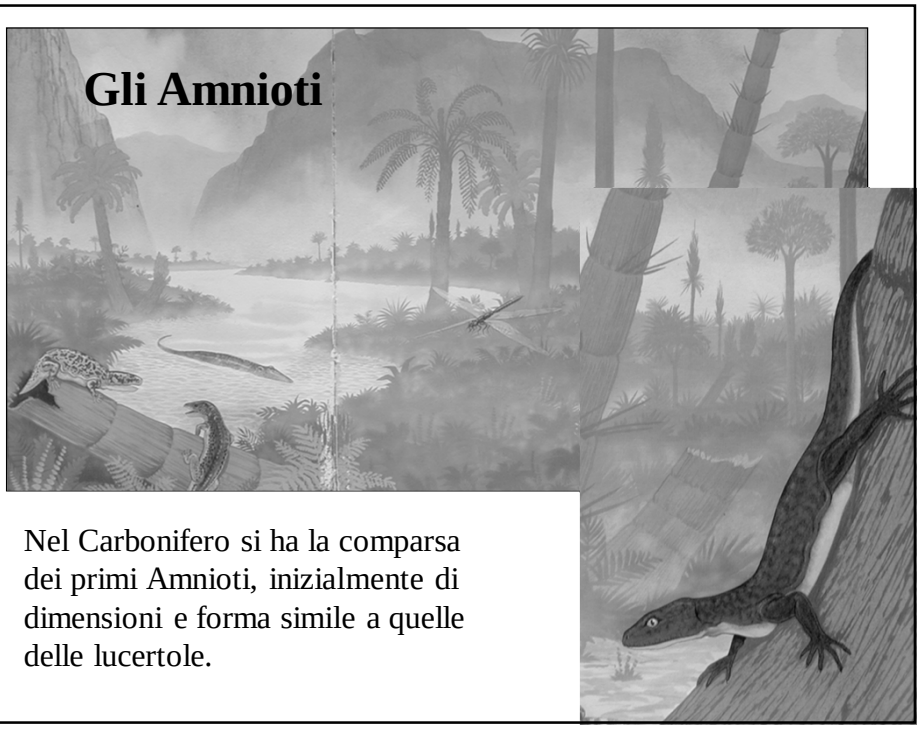
"Corna" tabulari



Temnospondili
Permiano-Cretacico
Arti robusti, scheletro massiccio
Predatori semiacquatici
Nel Triassico forme gigantesche



Gli Amnioti



Nel Carbonifero si ha la comparsa dei primi Amnioti, inizialmente di dimensioni e forma simile a quelle delle lucertole.

ANFIBI — UOVA E FORME LARVALI CHE DIPENDONO DALL'ACQUA NELLA MAGGIOR PARTE DEI CASI; UOVA PRIVE DI INVOLUCRI PROTETTIVI

AMNIOTI

AMNIOTA → RETTILI, UCCELLI, MAMMIFERI → RIPRODUZIONE

ALTRI **TETRAPODI**

MEMBRANE EXTRAEMBRIONALI

AMNIOS

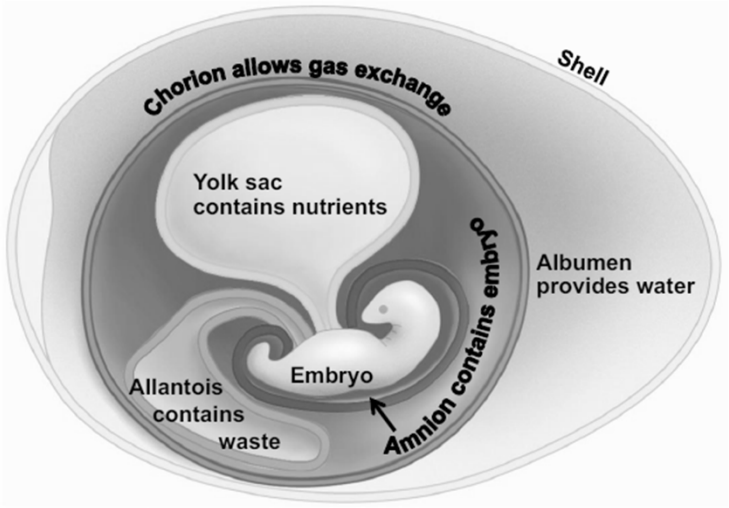
CHORION

ALLANTOIDE

M. EXTRAEMBRIONALI →

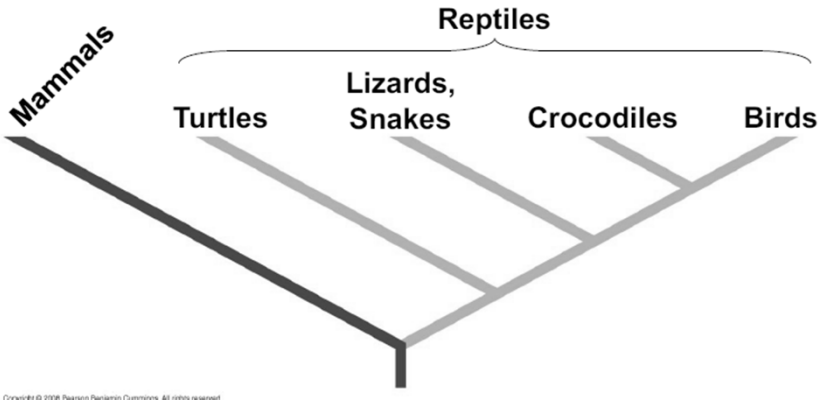
- TRATTENGONO ACQUA
- SCAMBIANO GAS
- SOSTEGNO
- PROTEZIONE

CONSENTONO DI RAGGIUNGERE UNO STADIO DI SVILUPPO PIU'AVANZATO PRIMA DEL PARTO O DELLA SCHIUSA



Chi sono i Rettili?

I Rettili possono esistere come gruppo monofiletico solo se escludiamo gli antenati dei mammiferi e consideriamo gli Uccelli un gruppo di Rettili



Quindi il termine Rettile è riferibile a

Tartarughe
Coccodrilli
Lepidosauri
} Rettili non Aviani
Uccelli

Caratteri dei Rettili

1) Uovo amniotico
2) Isolamento cutaneo dato da strutture di cheratina (squame o penne)
3) Fecondazione interna
4) Ectotermia (molti rettili) Omeotermia endotermica (dinosauri e uccelli)

AMNIOTI PRIMITIVI

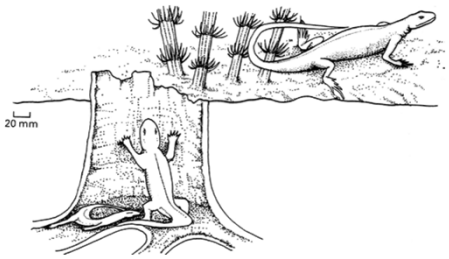
CARBONIFERO SUPERIORE Dominato da TEMNOSPONDILI e ANTRACOSAURI

Sono già presenti i primi AMNIOTI

I più antichi conosciuti: ***Palaeothyris*** e ***Hylonomus***

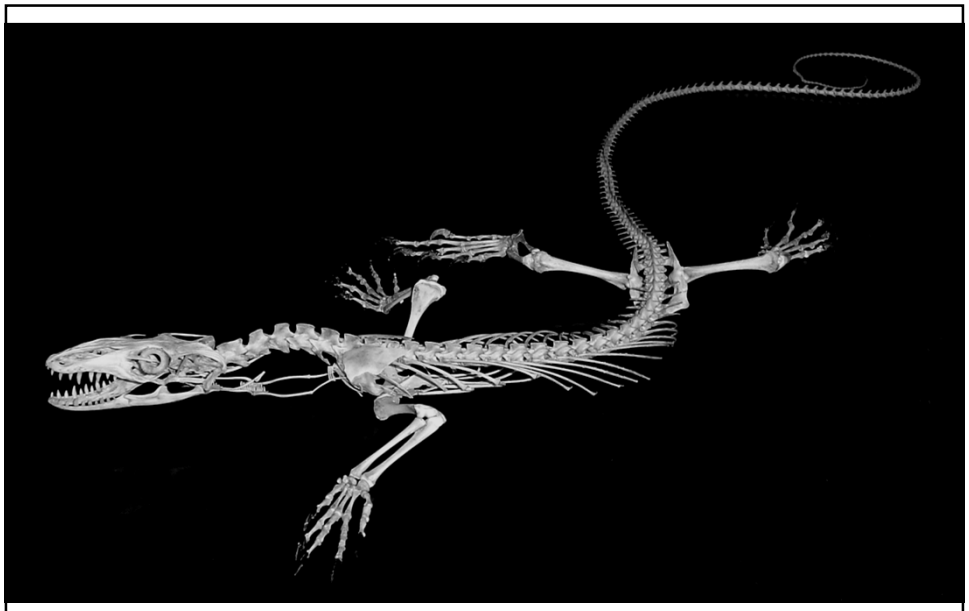
Caratteristiche

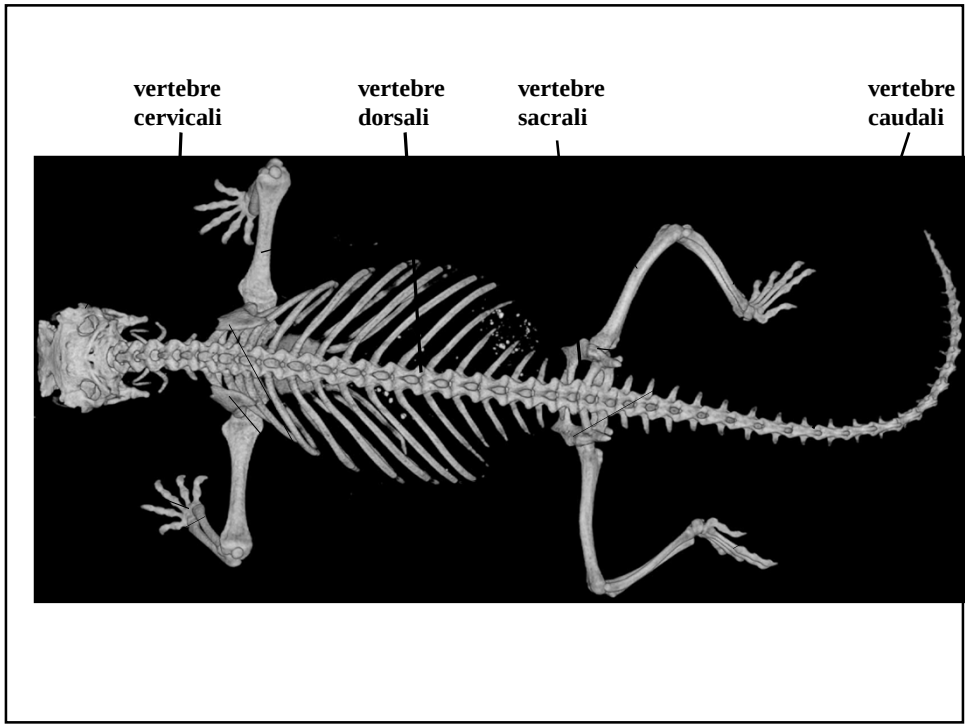
- Corpo agile
- Lunghi circa 20 cm
- Testa piccola rispetto al corpo
- Mancano zanne ma vi sono molti piccoli denti (si cibavano di Invertebrati)

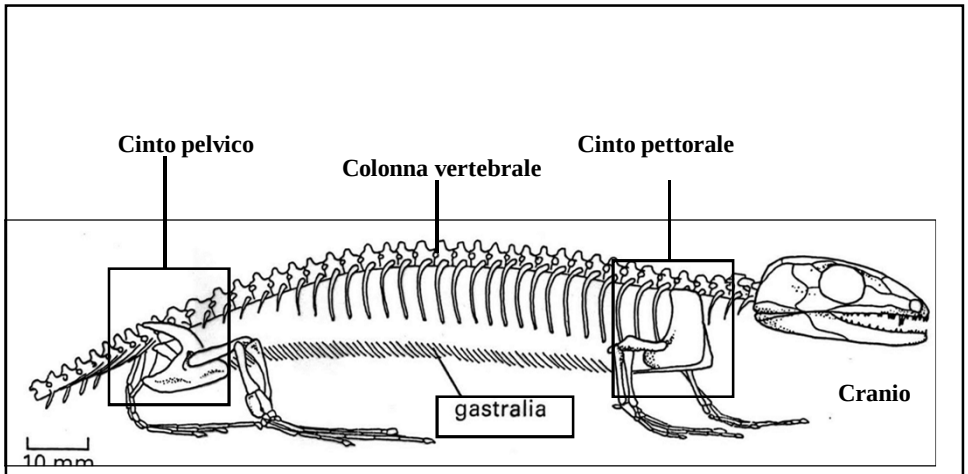


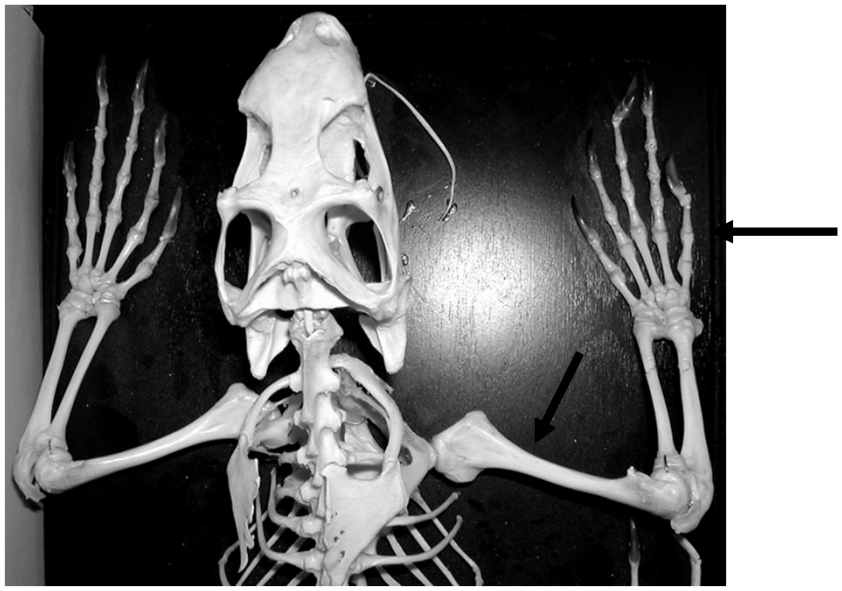
Nel **Permiano** i continenti si riunirono in un unico supercontinente detto Pangea, causando un inaridimento del clima che favorì lo sviluppo dei Rettili i quali si diffusero in tutto il supercontinente.

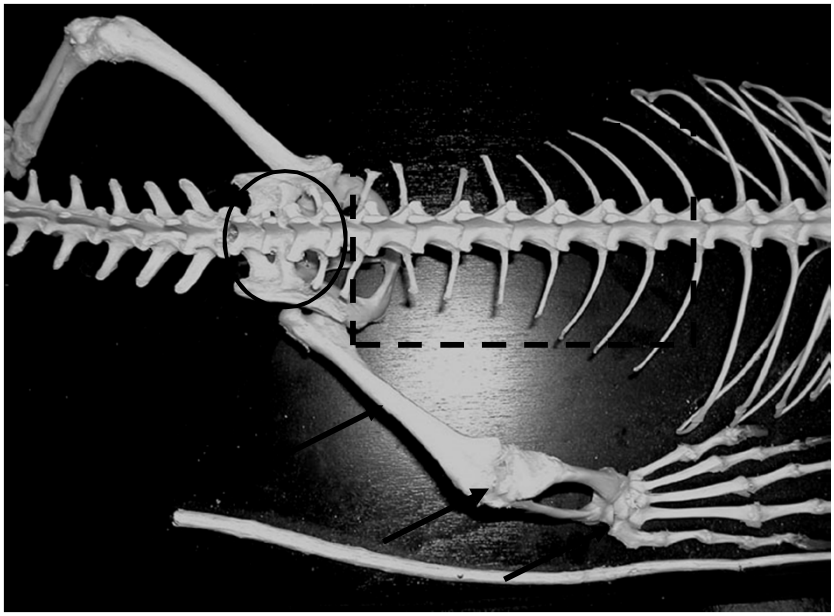
Oltre il 90% delle forme viventi scompariranno alla fine del Permiano, un evento che segnò il passaggio all'era successiva, il Mesozoico.

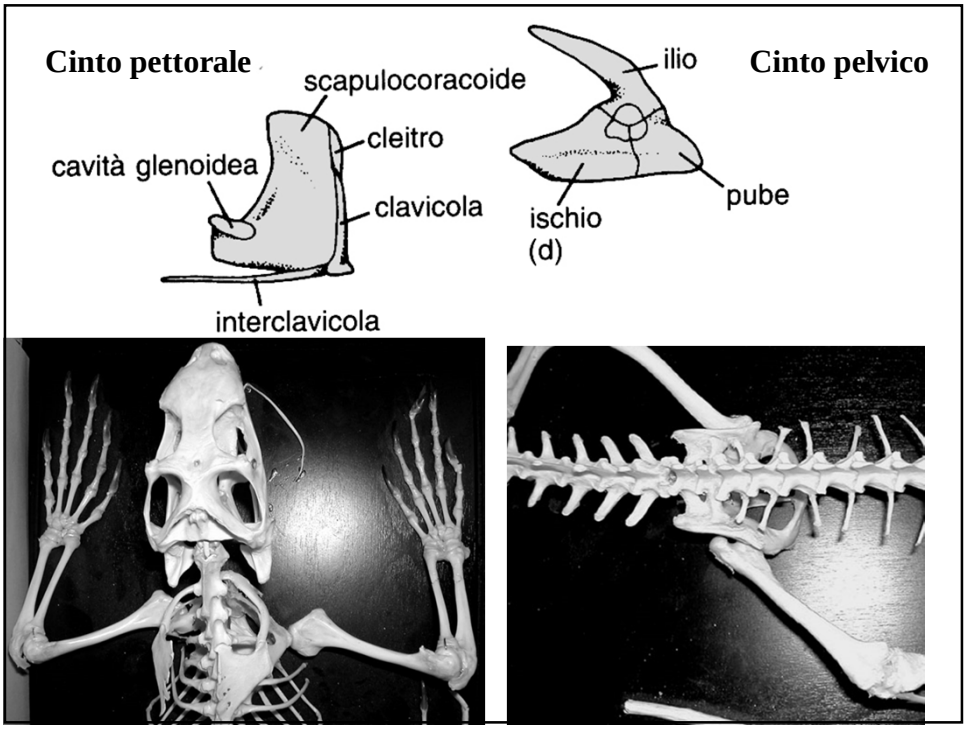


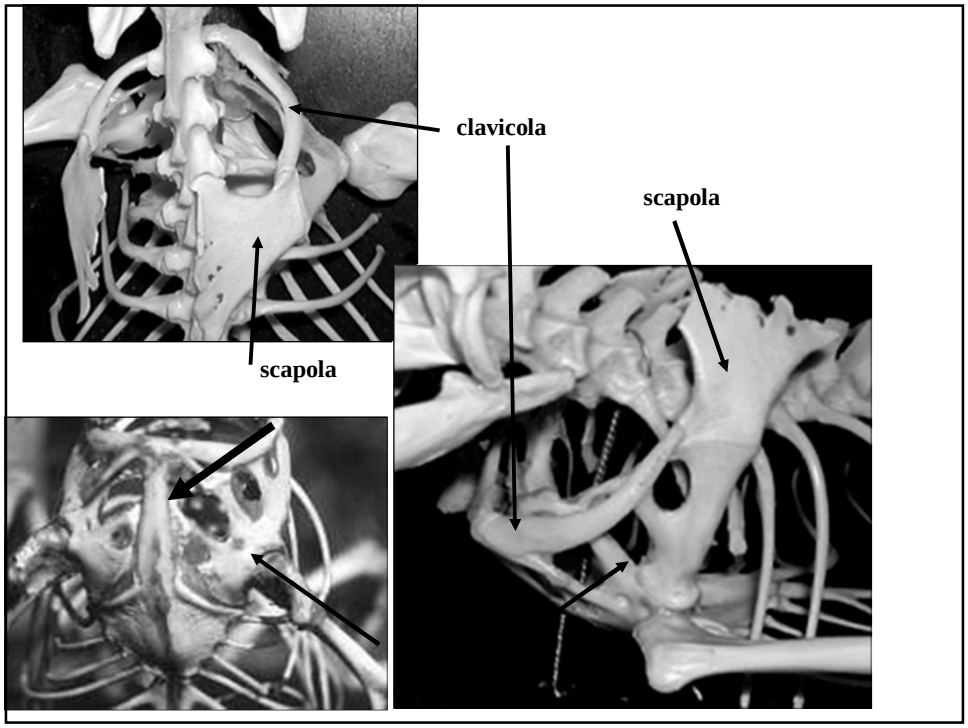

vertebre cervicali
vertebre dorsali
vertebre sacrali
vertebre caudali

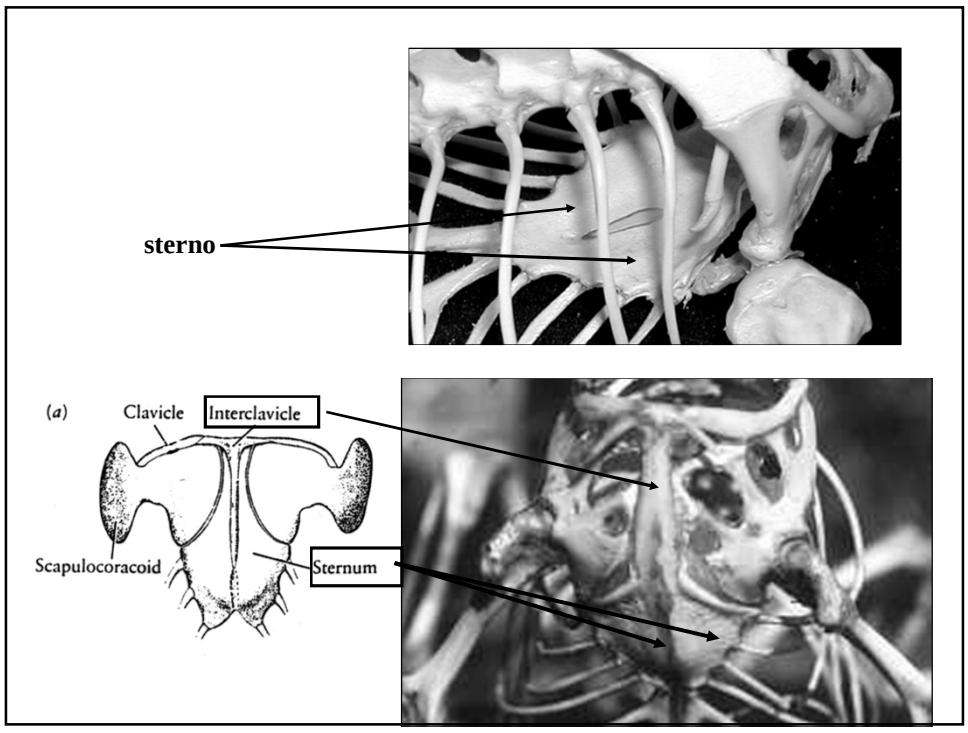

Cinto pelvico
Colonna vertebrale
Cinto pettorale
gastralia
Cranio
10 mm

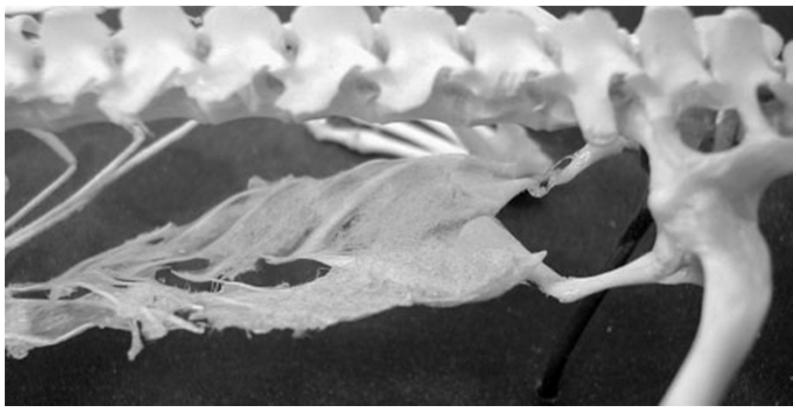




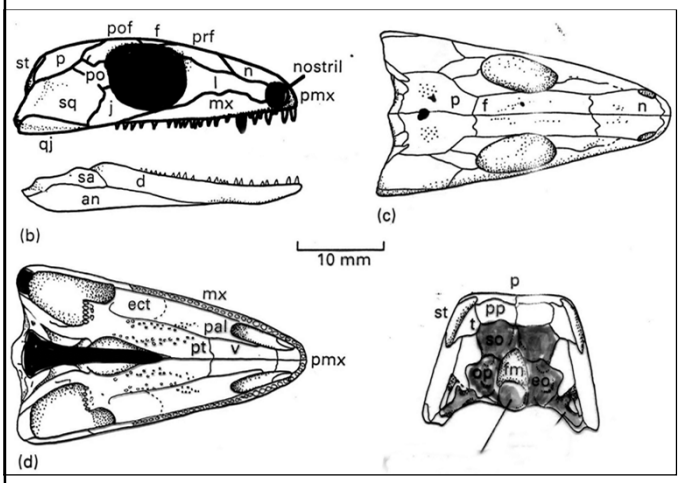

Cinto pettorale
scapulocoracoide
cleitro
cavità glenoidea
clavicola
interclavicola
ilio
Cinto pelvico
pube
ischio
(d)


clavicola
scapola
scapola

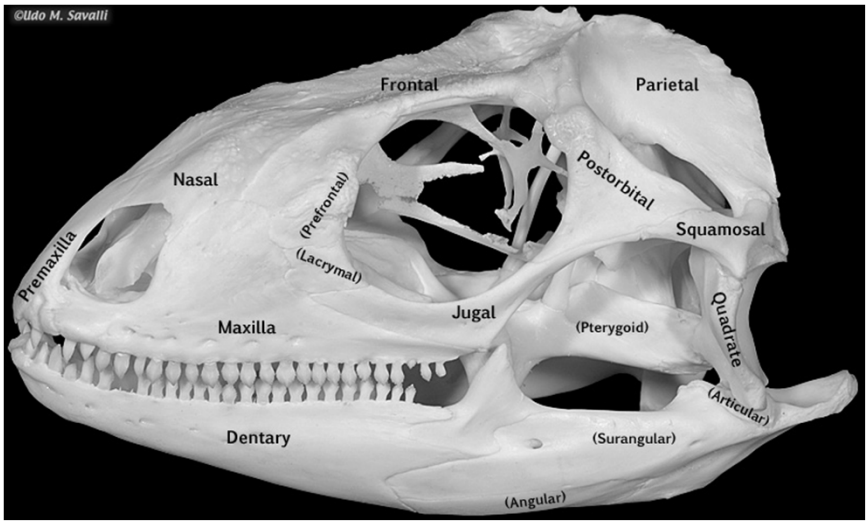

sterno
(a)
Clavicle
Interclavicle
Scapulocoracoid
Sternum



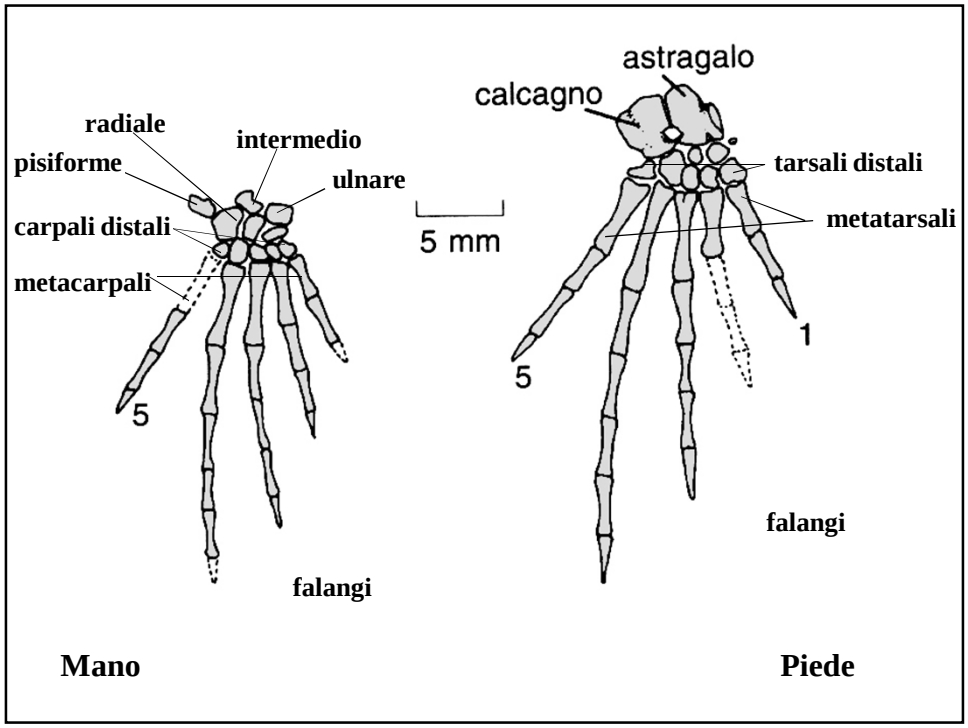
Gastralia di alligatore

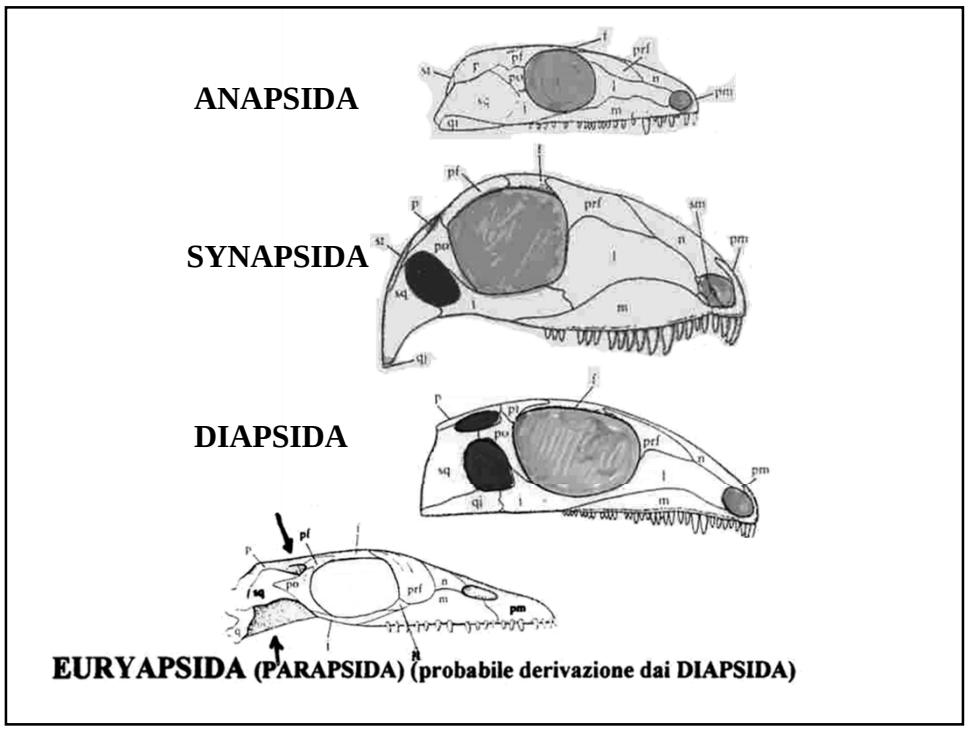


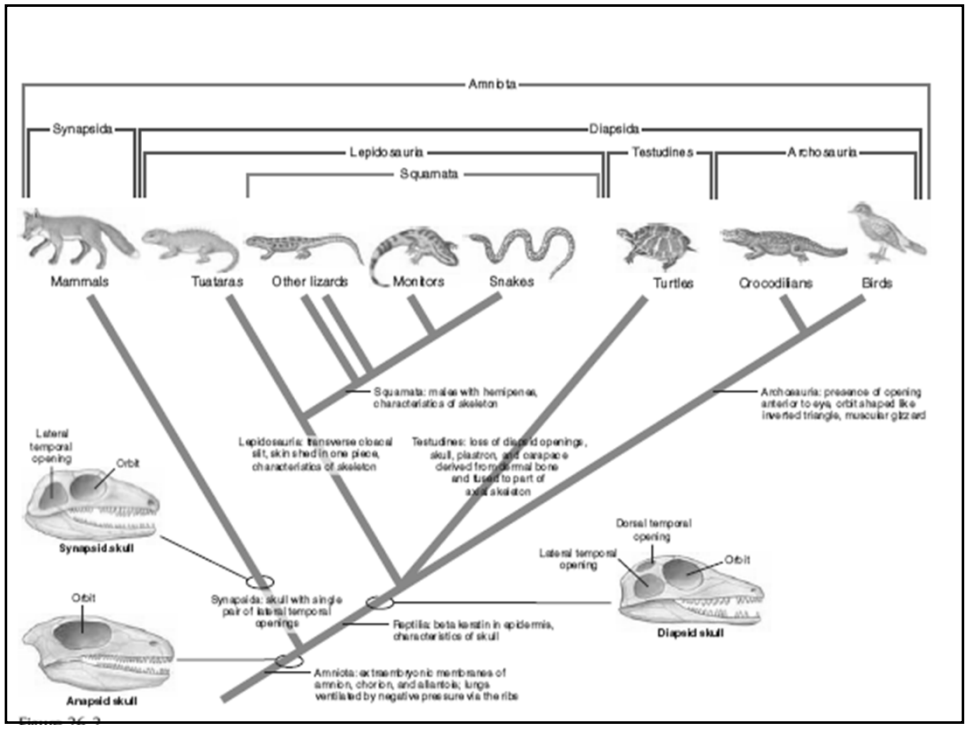
pm, premascellare
m, mascellare
n, nasale
l, lacrimale
prf, prefrontale
f, frontale
j, jugale
po, postorbitale
pof postorbitofrontale
p, parietale
pp, postparietale
st sopratemporale
sq, squamoso
t, tabulare
q, quadrato
qj quadratojugale
ect, ectopterigoide
pt, pterigoide
pal, palatino
v, vomere

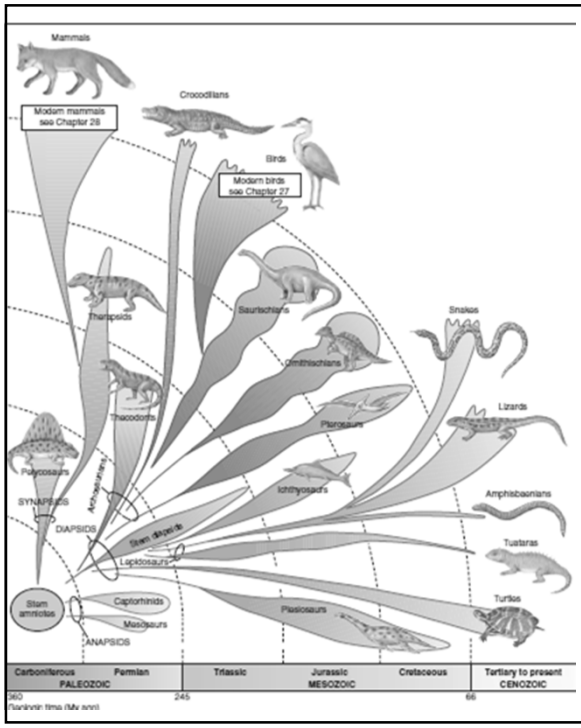


Denti diversi secondo alimentazione, anche **eterodonzia** ma sempre denti ad una radice.


radiale
intermedio
pisiforme
ulnare
carpali distali
metacarpali
5
falangi
5 mm
astragalo
calcagno
tarsali distali
metatarsali
1
5
falangi
Mano
Piede


ANAPSIDA
SYNAPSIDA
DIAPSIDA
EURYAPSIDA (PARAPSIDA) (probabile derivazione dai DIAPSIDA)





RIASSUMENDO

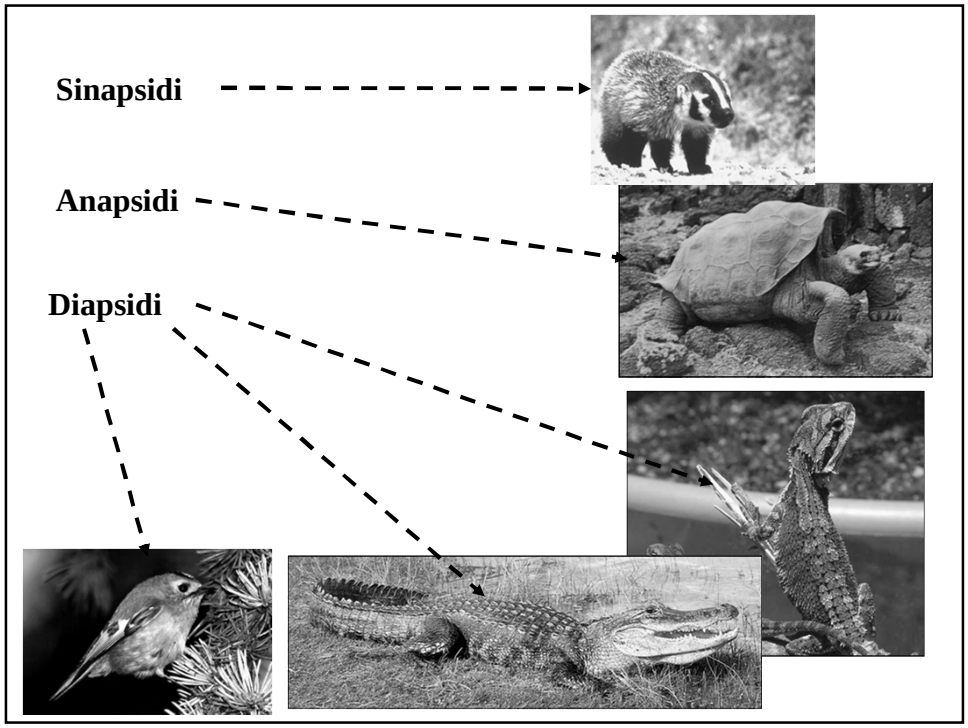
Gli **Amnioti** comprendono rettili non aviani, uccelli e mammiferi

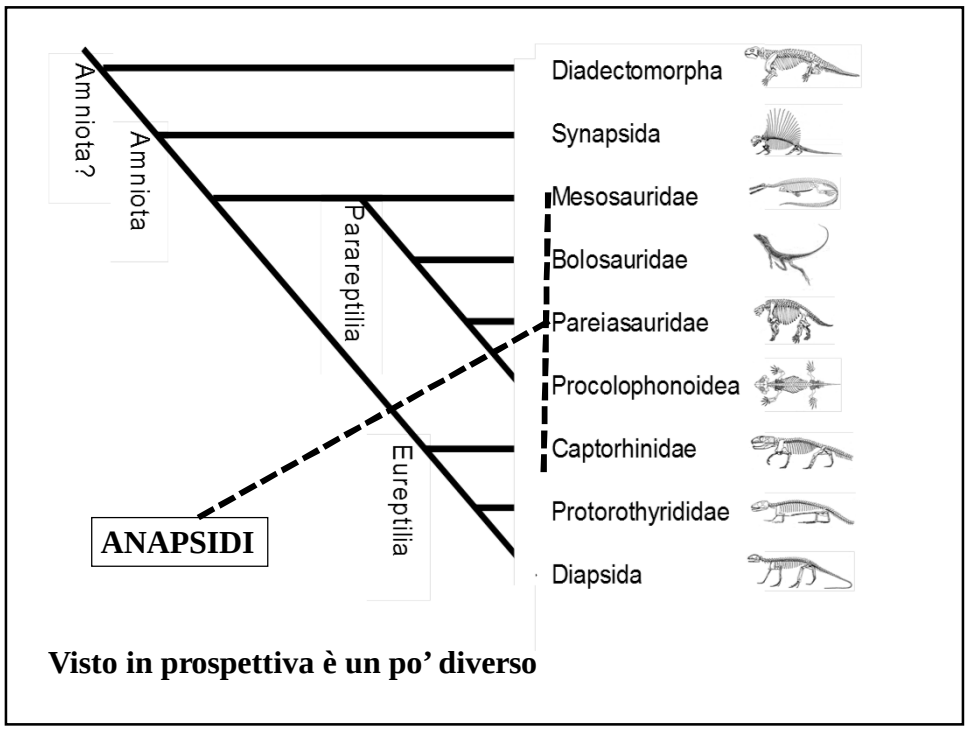
Originatisi tutti da forme simili a lucertole, dal cranio **anapside** come quello dei tetrapodi primitivi

La prima linea di Amnioti a divergere fu quella **sinapside** che porterà ai mammiferi.

Tutti gli altri amnioti (uccelli compresi) hanno un cranio **diapside**.

Le tartarughe mantengono il cranio **anapside**.



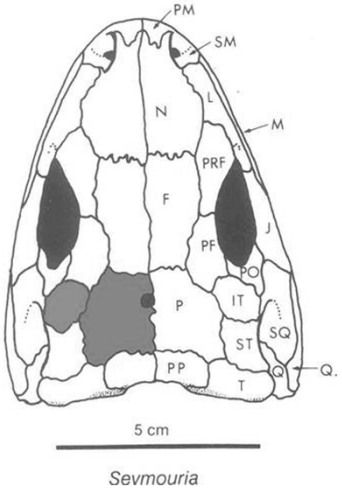


Visto in prospettiva è un po' diverso

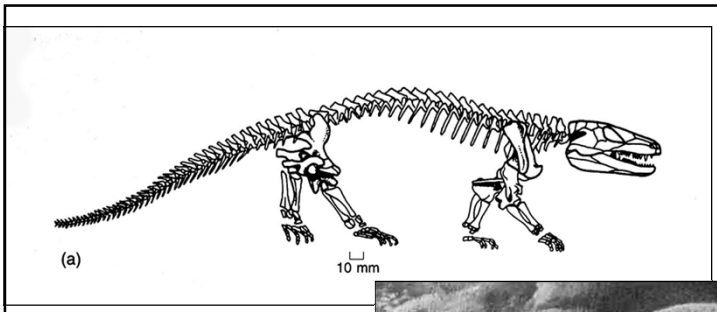
Verso i Rettili

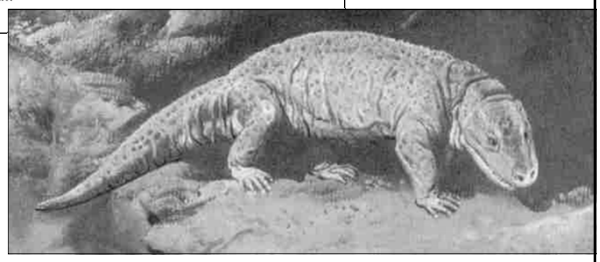
Seymouriamorpha

Rettiliomorfi
Permiano
Zampe robuste (poteva tenere il corpo sollevato da terra)

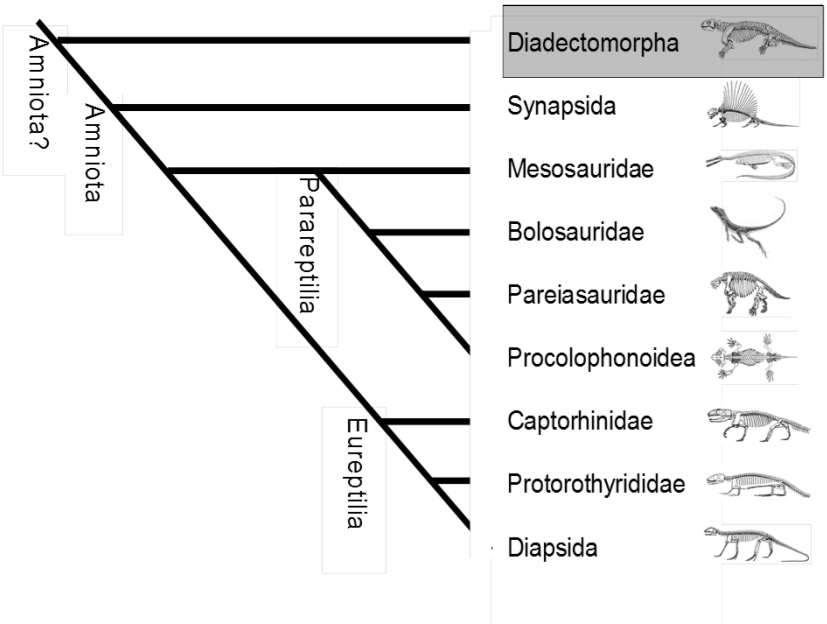


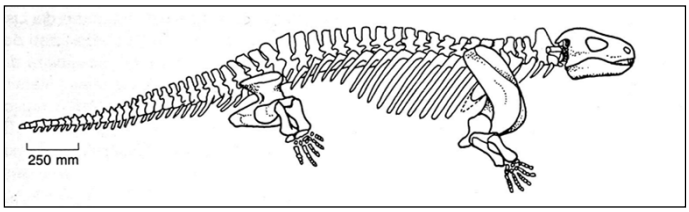
I Seymouriamorfi sono ancora anfibi:
Mantengono nel cranio l'osso intertemporale (manca negli Amnioti)





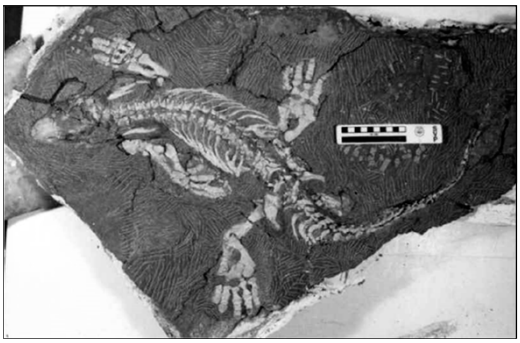
Seymouriamorpha

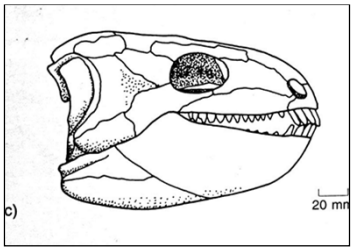


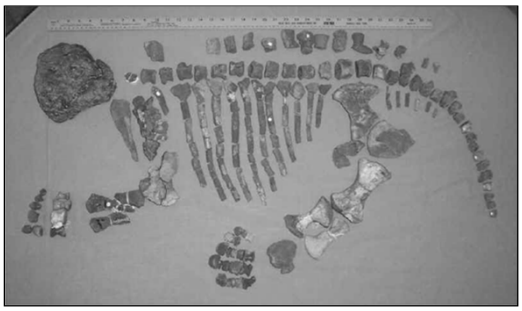


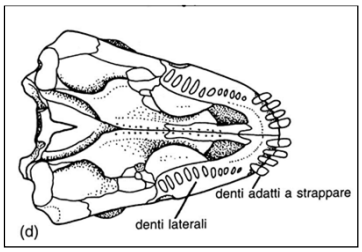
Diadectomorfi

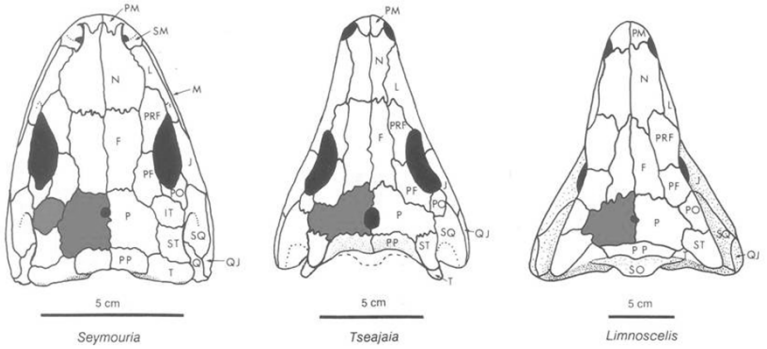
Rettiliomorfi
Carb. Sup-Permiano Inf.
Cinti robusti,
Zampe tozze
Coste ampie
Denti a piolo anteriori e trituranti posteriori
Tra i primi tetrapodi terrestri ad aver adottato una dieta vegetariana.

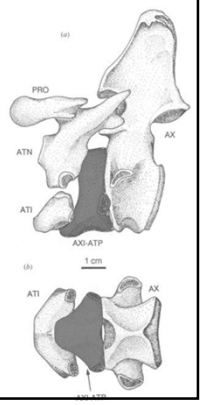








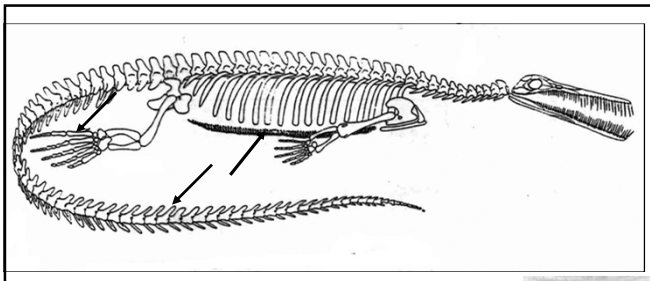




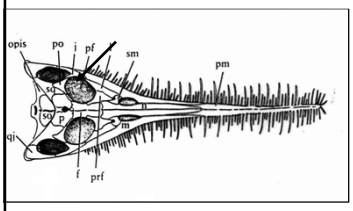
Diadectomorpha:
•Manca l'osso intertemporale
•Le prime due vertebre cervicali sono modificate
•Altamente adattati alla vita terrestre

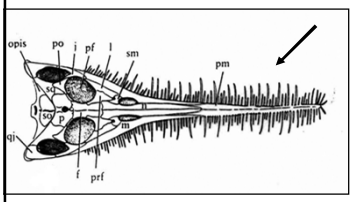
PARAREPTILIA comprendono:

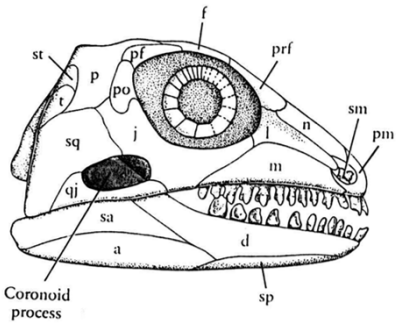
- Mesosauria
- Bolosauridae
- Procolophonia
- Paraiesauria

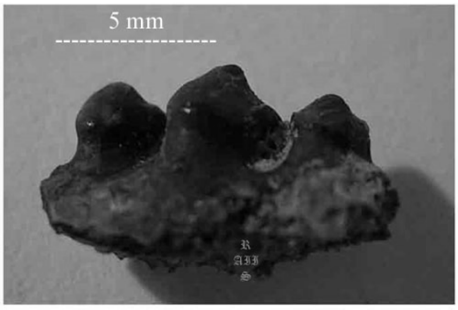


Mesosauria







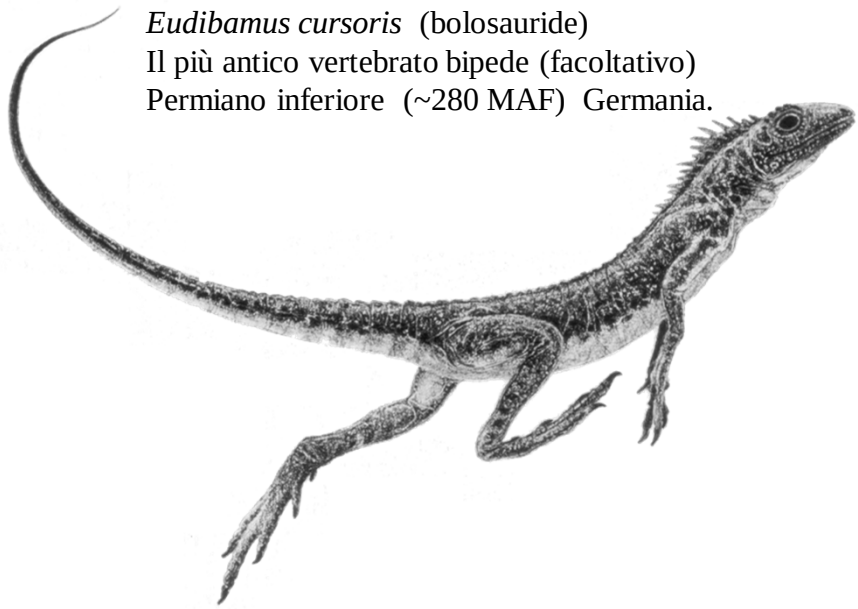


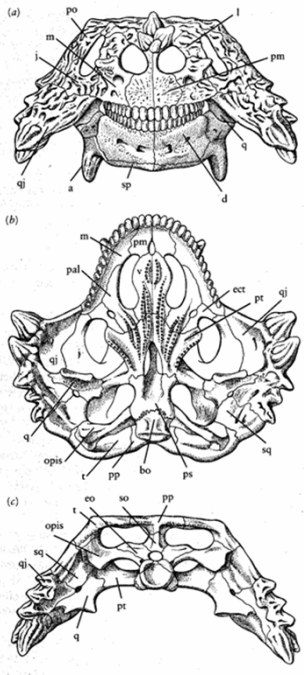
Bolosauridi, Cranio robusto,

denti con corona complessa

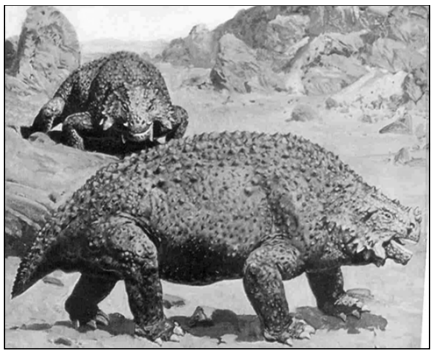
(onnivori/ erbivori)

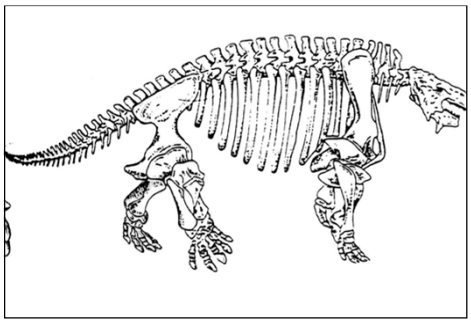
Eudibamus cursoris (bolosauride)
Il più antico vertebrato bipede (facoltativo)
Permiano inferiore (~280 MAF) Germania.



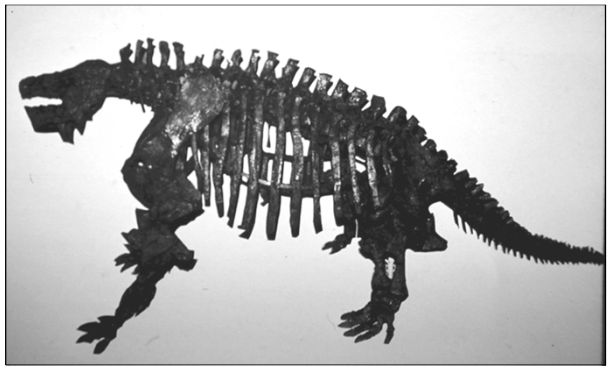


Parieasauri
Grandi erbivori con crani tozzi e tubercolati

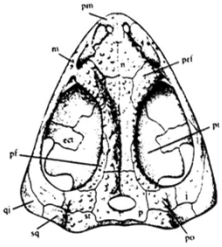


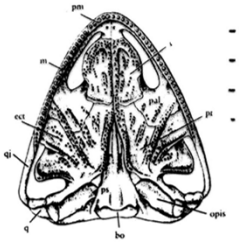


Corpo tenuto sollevato dal terreno, ma postura primitiva per cui necessari enormi muscoli



PROCOLOPHONIDAE (Permiano Superiore – Triassico)

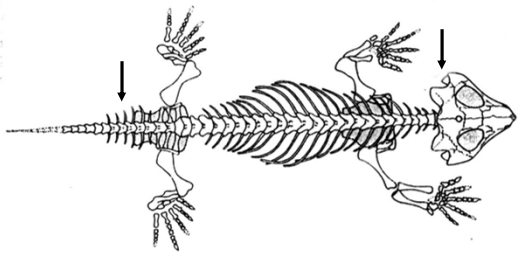


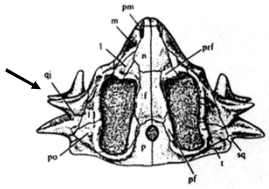


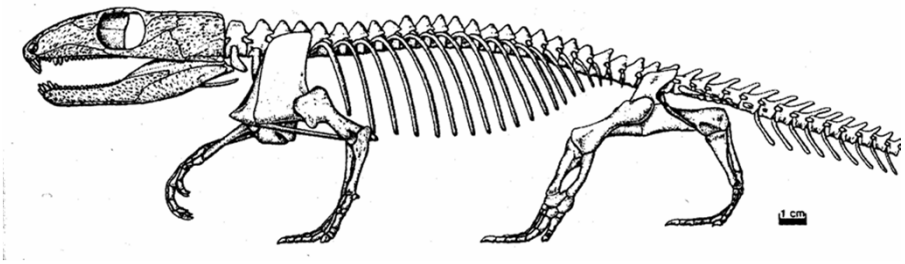
- **moltissimi denti**
- **3 unità distinte nel cinto pettorale**
- **3 vertebre sacrali**

coste caudali non fuse ai centri

forme triassiche con cranio ispessito

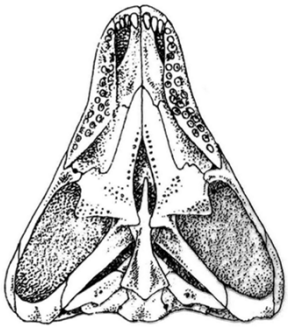




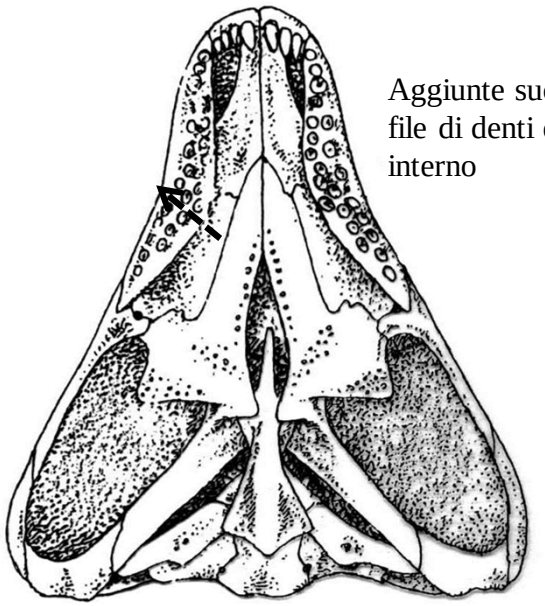


Captorhinidi: *Eocaptorhinus*
Gruppo anapside da cui avrebbero avuto origine I Diapsidi

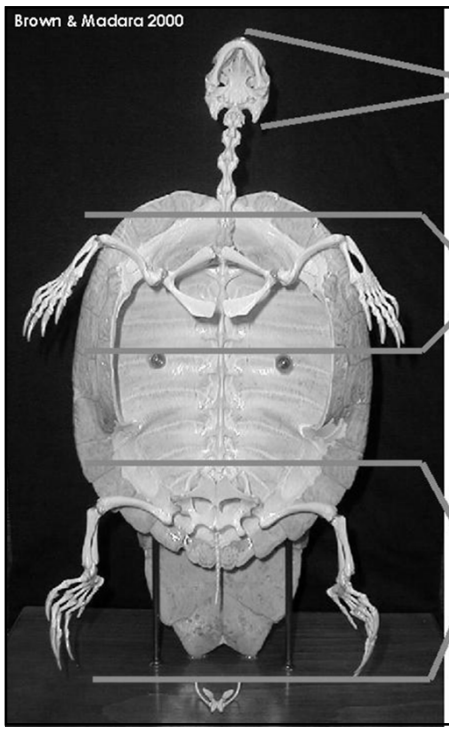
Captorhinidi



40 cm lunghezza circa
Cranio allargato posteriormente
File multiple di denti
Aggiunte successive di file di denti dal lato interno
Cibo coriaceo (vegetali fibrosi o invertebrati con gusci o carapace



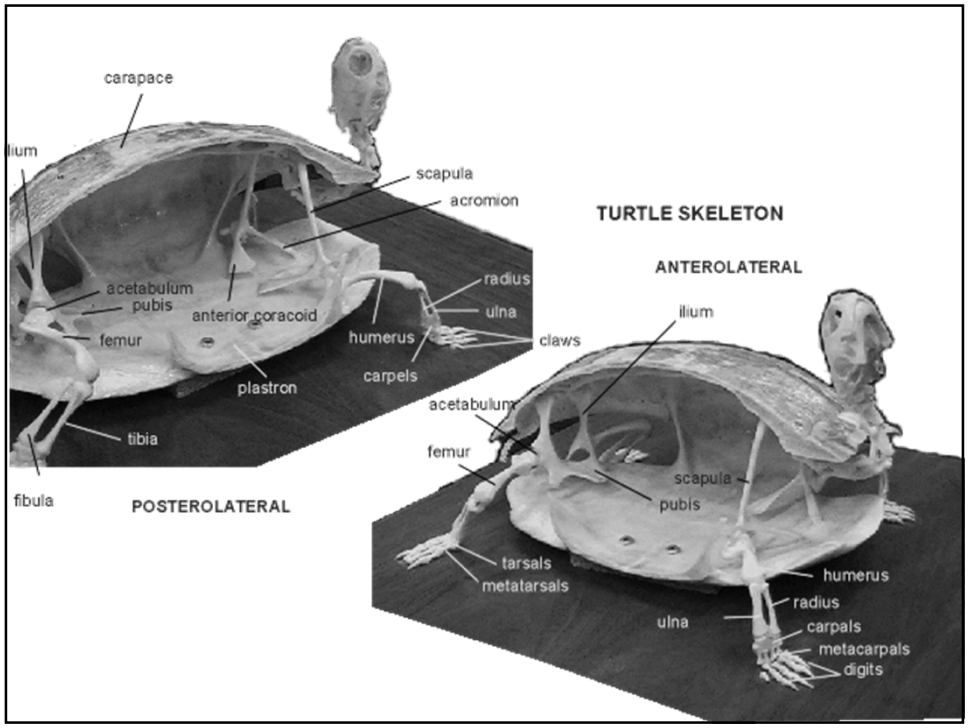
Aggiunte successive di file di denti dal lato interno

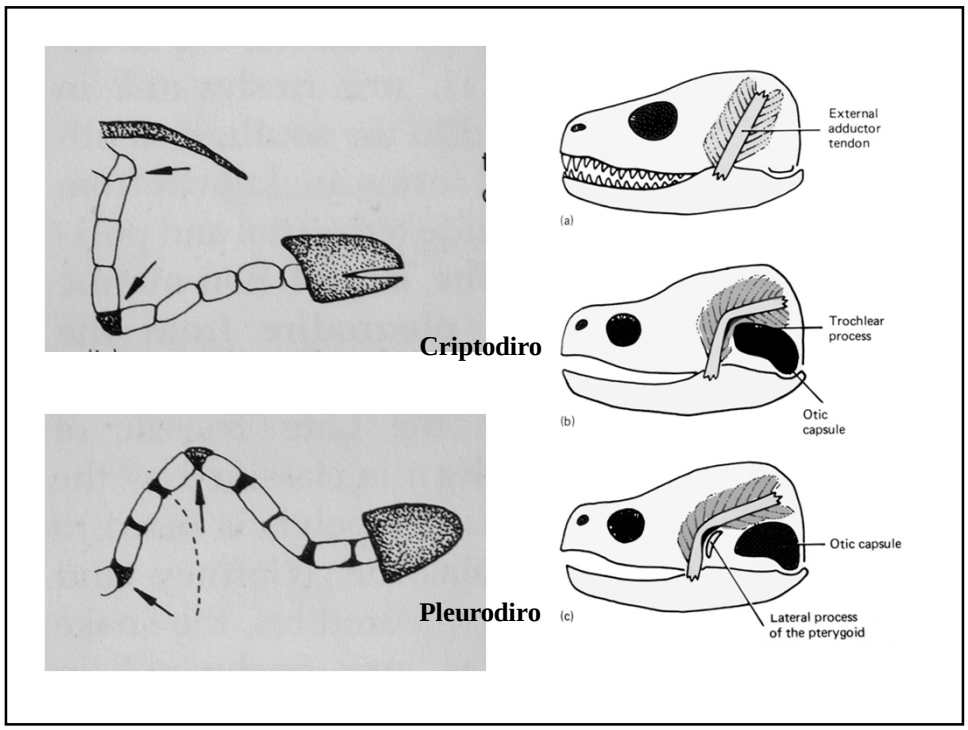


Cranio e mandibola

Cinto pettorale ed arti anteriori

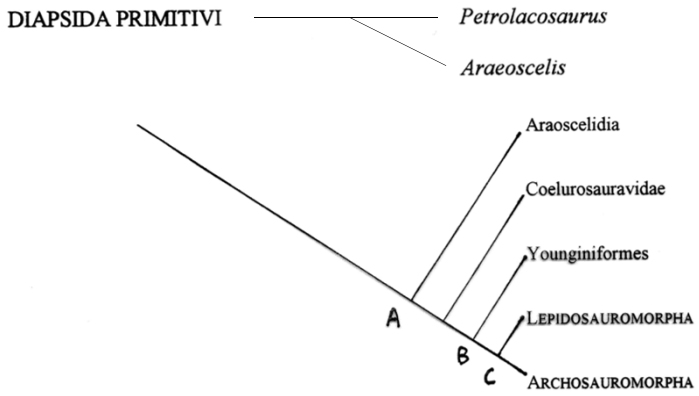
Cinto pelvico ed arti posteriori


carapace
ilium
scapula
acromion
TURTLE SKELETON
ANTEROLATERAL
acetabulum
pubis
femur
anterior coracoid
humerus
radius
ulna
claws
carpels
plastron
tibia
fibula
POSTEROLATERAL
ilium
acetabulum
femur
scapula
pubis
tarsals
metatarsals
humerus
radius
ulna
carpals
metacarpals
digits

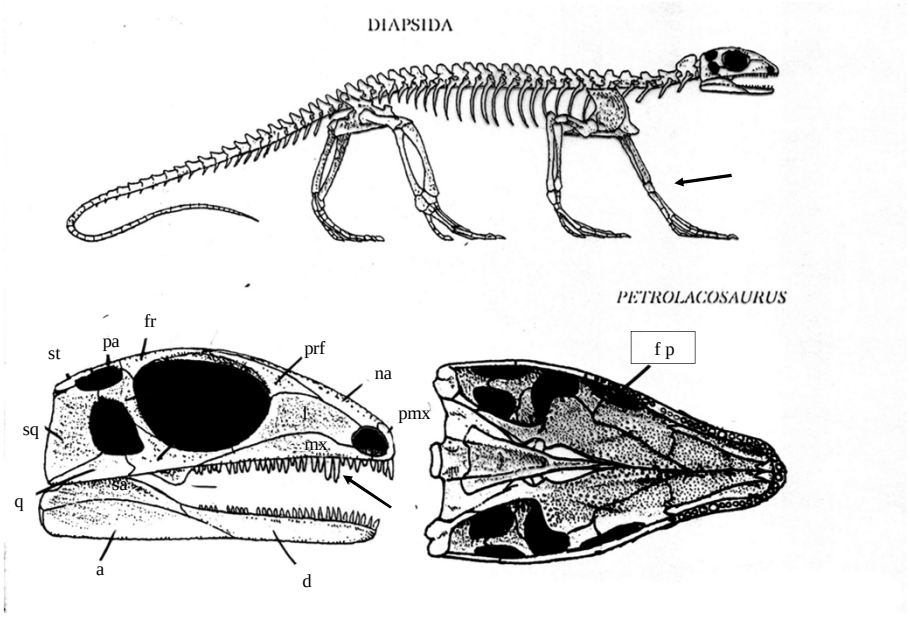

Criptodiro
Pleurodiro
External adductor tendon
(a)
Trochlear process
Otic capsule
(b)
Otic capsule
Lateral process of the pterygoid
(c)

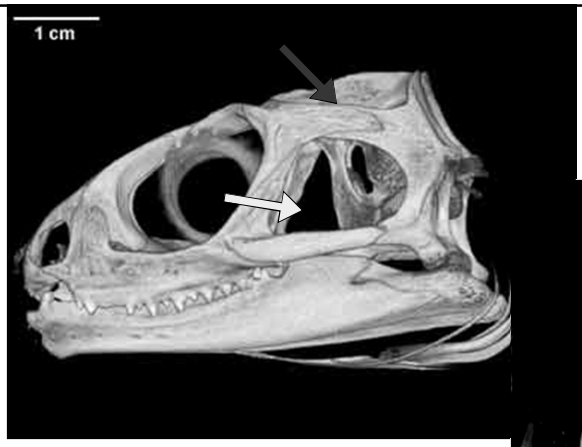
DIAPSIDA

TUTTI I RETTILI OGGI VIVENTI A PARTE LE TARTARUGHE SONO DIAPSIDI



A = DIAPSIDA B = NEODIAPSIDA C = [SAURIA]

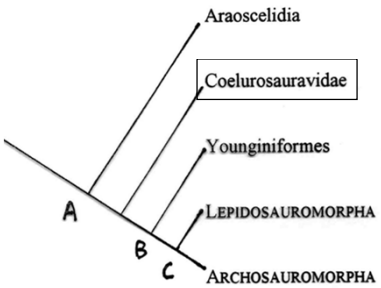




Finestre temporali

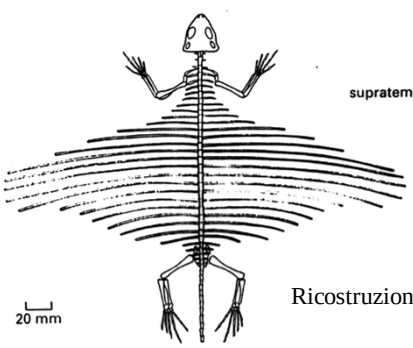
f.t. superiore

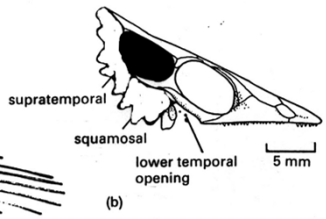
f.t. inferiore



Permiano

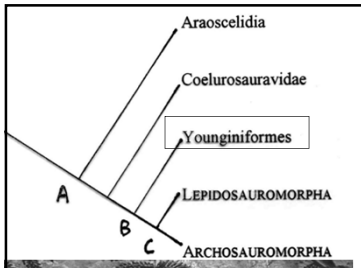
Coelurosauravidi

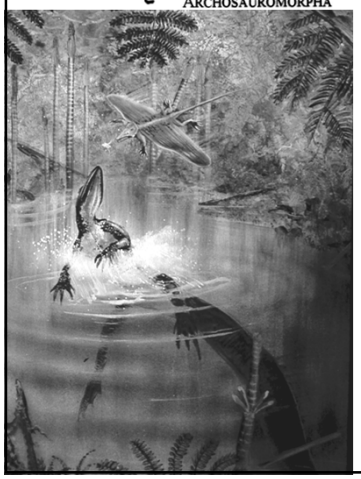


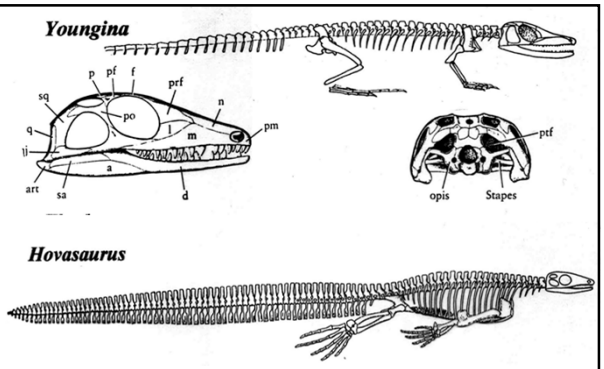


Ricostruzione erronea

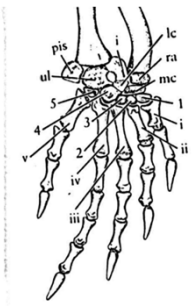
Non corrispondono per numero ed inserzione alle coste

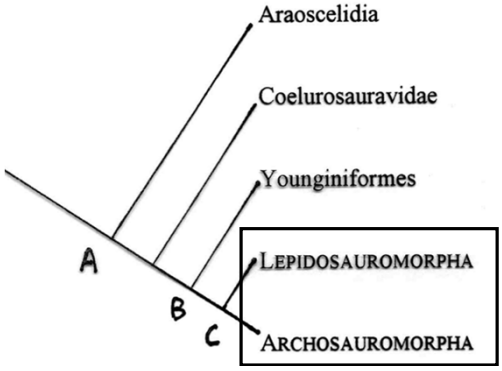






Younginiformes
Permiano





CROWN GROUP

LEPIDOSAUROMORPHA = Lucertole, serpenti, *Sphenodon*, (gruppi affini estinti) Euryapsida,

ARCHOSAUROMORPHA = Alcuni gruppi permotriassici e gli **ARCHOSAURIA**

ARCHOSAURIA = Coccodrilli, gruppi affini estinti, Dinosauri, Pterosauri.