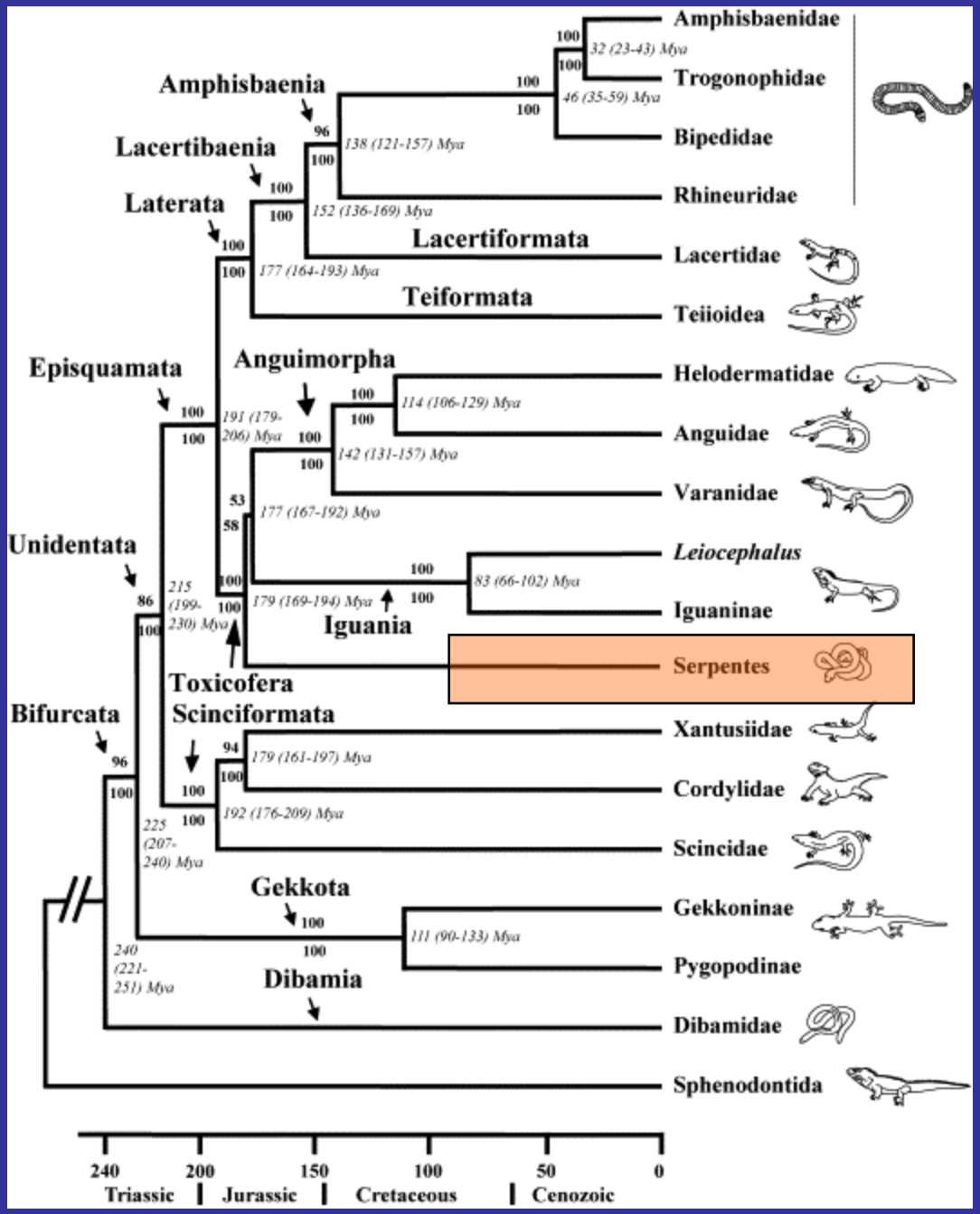
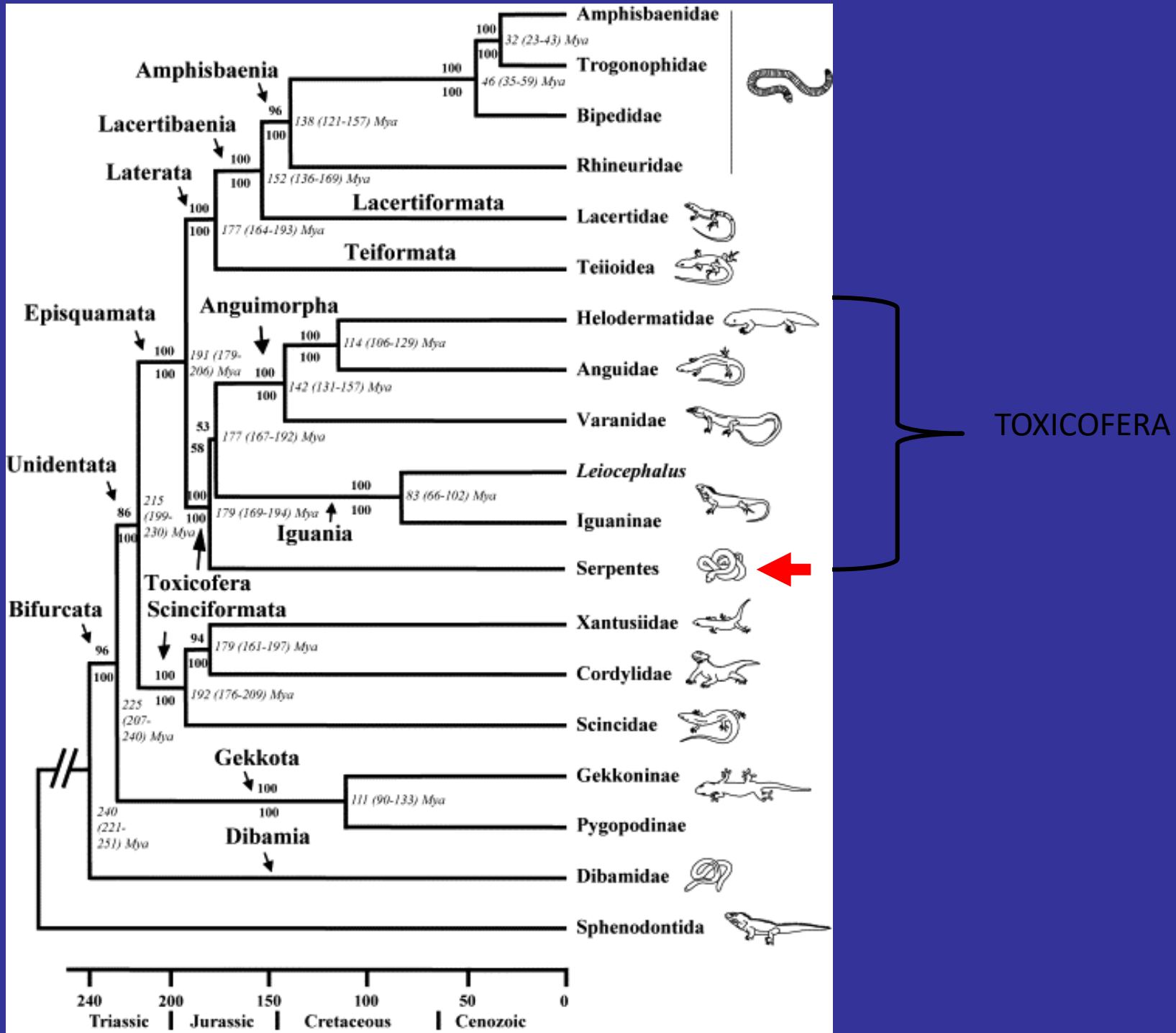

Amphisbaenidae
32 (23-43) Mya
Trogonophidae
46 (35-59) Mya
Bipedidae
Rhineuridae
Amphisbaenia
Lacertibaenia
Laterata
138 (121-157) Mya
152 (136-169) Mya
Lacertiformata
Lacertidae
177 (164-193) Mya
Teiformata
Teiioidea
Episquamata
Anguimorpha
Helodermatidae
114 (106-129) Mya
Anguidae
191 (179-206) Mya
142 (131-157) Mya
Varanidae
177 (167-192) Mya
Unidentata
Leiocephalus
83 (66-102) Mya
Iguaninae
215 (199-230) Mya
179 (169-194) Mya
Iguania
Serpentes
Toxicofera
Bifurcata
Scinciformata
Xantusiidae
179 (161-197) Mya
Cordylidae
192 (176-209) Mya
225 (207-240) Mya
Scincidae
Gekkota
Gekkoninae
111 (90-133) Mya
Pygopodinae
240 (221-251) Mya
Dibamia
Dibamidae
Sphenodontida
240
200
150
100
50
0
Triassic
Jurassic
Cretaceous
Cenozoic


Amphisbaenidae
Trogonophidae
Bipedidae
Rhineuridae
Lacertidae
Teiioidea
Helodermatidae
Anguidae
Varanidae
Leiocephalus
Iguaninae
Serpentes
Xantusiidae
Cordylidae
Scincidae
Gekkoninae
Pygopodinae
Dibamidae
Sphenodontida
Amphisbaenia
Lacertibaenia
Laterata
Lacertiformata
Teiformata
Episquamata
Anguimorpha
Unidentata
Iguania
Toxicofera
Bifurcata
Scinciformata
Gekkota
Dibamia
32 (23-43) Mya
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215 (199-230) Mya
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225 (207-240) Mya
111 (90-133) Mya
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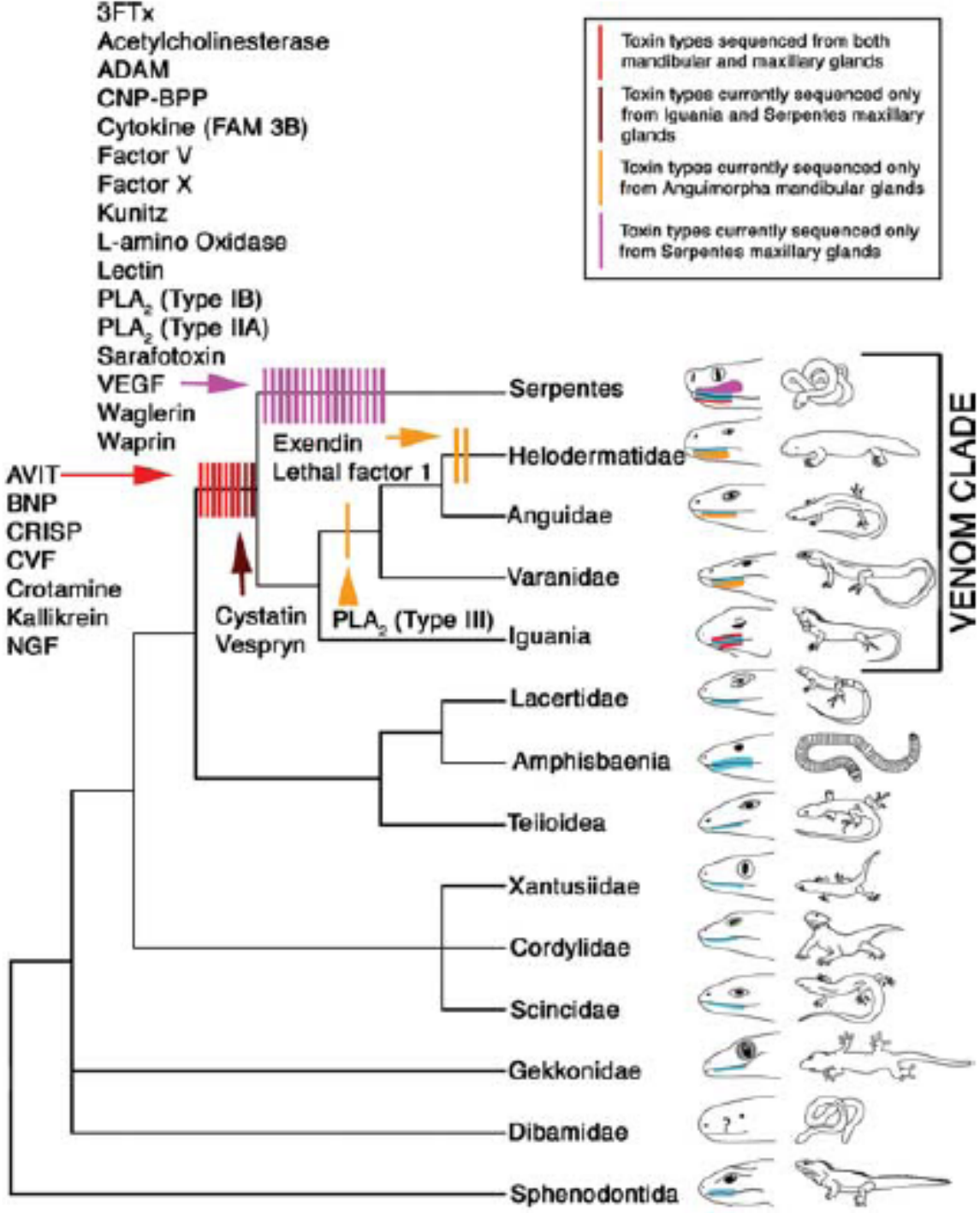
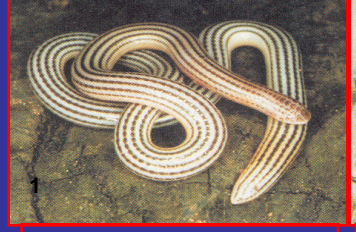
0
Triassic
Jurassic
Cretaceous
Cenozoic
TOXICOFERA


3FTx
Acetylcholinesterase
ADAM
CNP-BPP
Cytokine (FAM 3B)
Factor V
Factor X
Kunitz
L-amino Oxidase
Lectin
PLA2 (Type IB)
PLA2 (Type IIA)
Sarafotoxin
VEGF
Waglerin
Waprin
AVIT
BNP
CRISP
CVF
Crotamine
Kallikrein
NGF
Exendin
Lethal factor 1
Cystatin
Vespryn
PLA2 (Type III)
Toxin types sequenced from both mandibular and maxillary glands
Toxin types currently sequenced only from Iguania and Serpentes maxillary glands
Toxin types currently sequenced only from Anguimorpha mandibular glands
Toxin types currently sequenced only from Serpentes maxillary glands
Serpentes
Helodermatidae
Anguidae
Varanidae
Iguania
Lacertidae
Amphisbaenia
Teiioidea
Xantusiidae
Cordylidae
Scincidae
Gekkonidae
Dibamidae
Sphenodontida
VENOM CLADE

EXTANT SNAKES:
28 families
441 genera
3619 species

Fontes: Vitt (website), Pough et al. (1989)

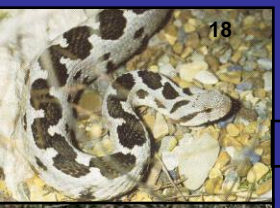


LEPTOTYPHLOPIDAE (114)

ANOMALEPIDIDAE (18)

TYPHLOPIDAE (281)
GERRHOPILIDAE
XENOTYPHLOPIDAE

CYLINDROPHIIDAE (10)



VIPERIDAE (259)

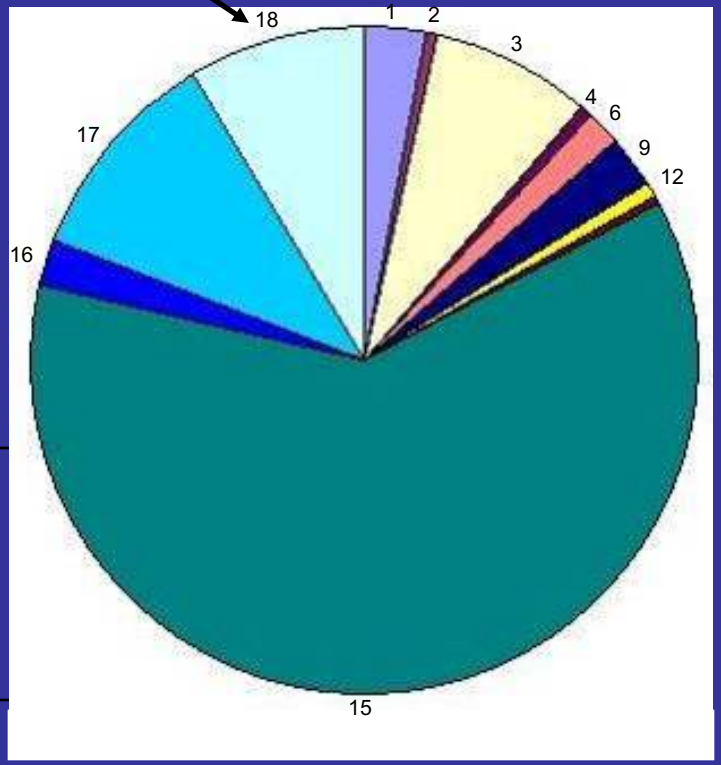
ELAPIDAE (315)

ATRACTASPIDIDAE (66)

COLUBRIDAE
DIPSADIDAE
PSEUDOXENODONTIDAE
NATRICIDAE
LAMPROPHIIDAE
HOMALOPSIDAE
XENODERMIDAE
PAREIDAE
(2409)

ACROCHORDIDAE (3)

Numbers refer to each family



ANILIIDAE (1)

UROPELTIDAE (49)

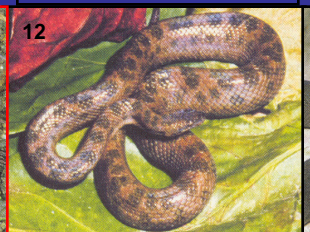
XENOPELTIDAE (2)

LOXOCEMIDAE (1)

BOIDAE (74)

XENOPHIDIIDAE (2)

TROPIDOPHIIDAE (34)



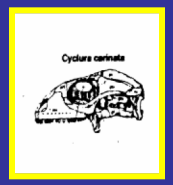
BOLYERIIDAE (2)

UNGALIOPHIIDAE (3)

= fossorial

= terrestrial/arboreal

Uma classificação hierárquica tradicional das serpentes



"LAGARTOS" | **Scolecophidia** | **Anilioidea** | **Booidea** | **Caenophidia**

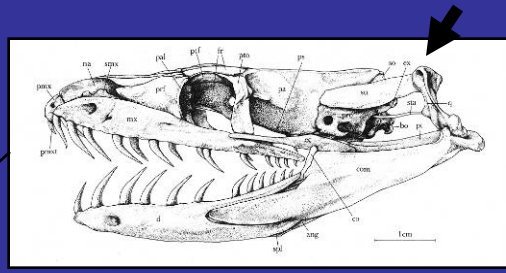
MACROSTOMATA

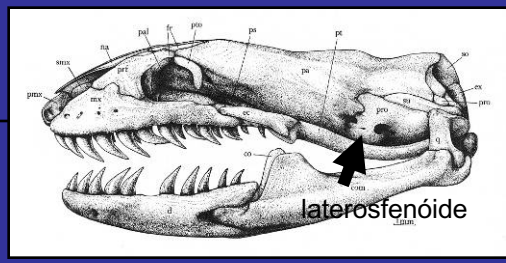
ALETHINOPHIDIA

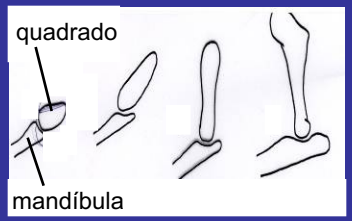
SERPENTES

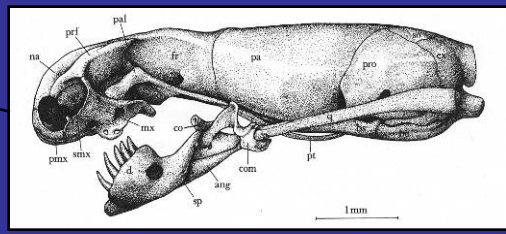
SQUAMATA

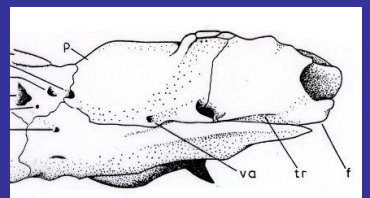
ORIGEM TERRESTRE OU MARINHA ?





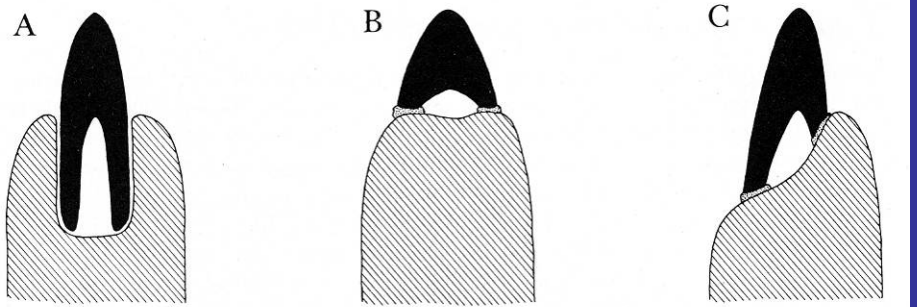


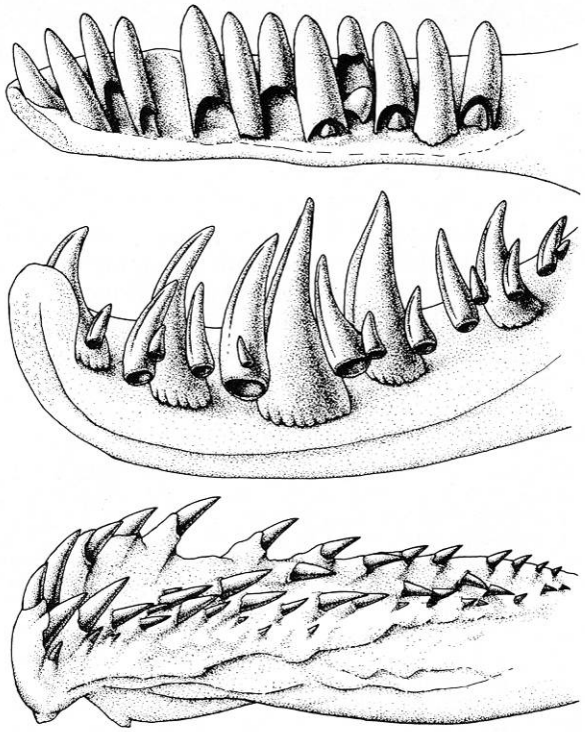


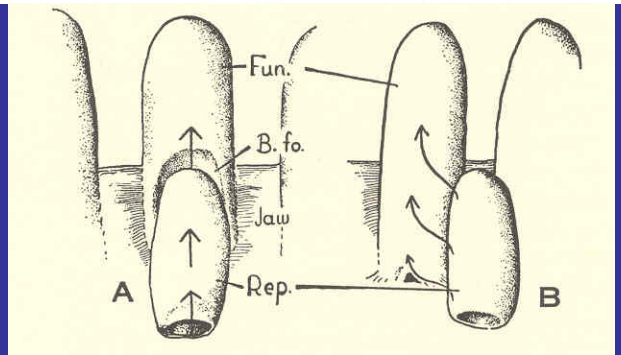


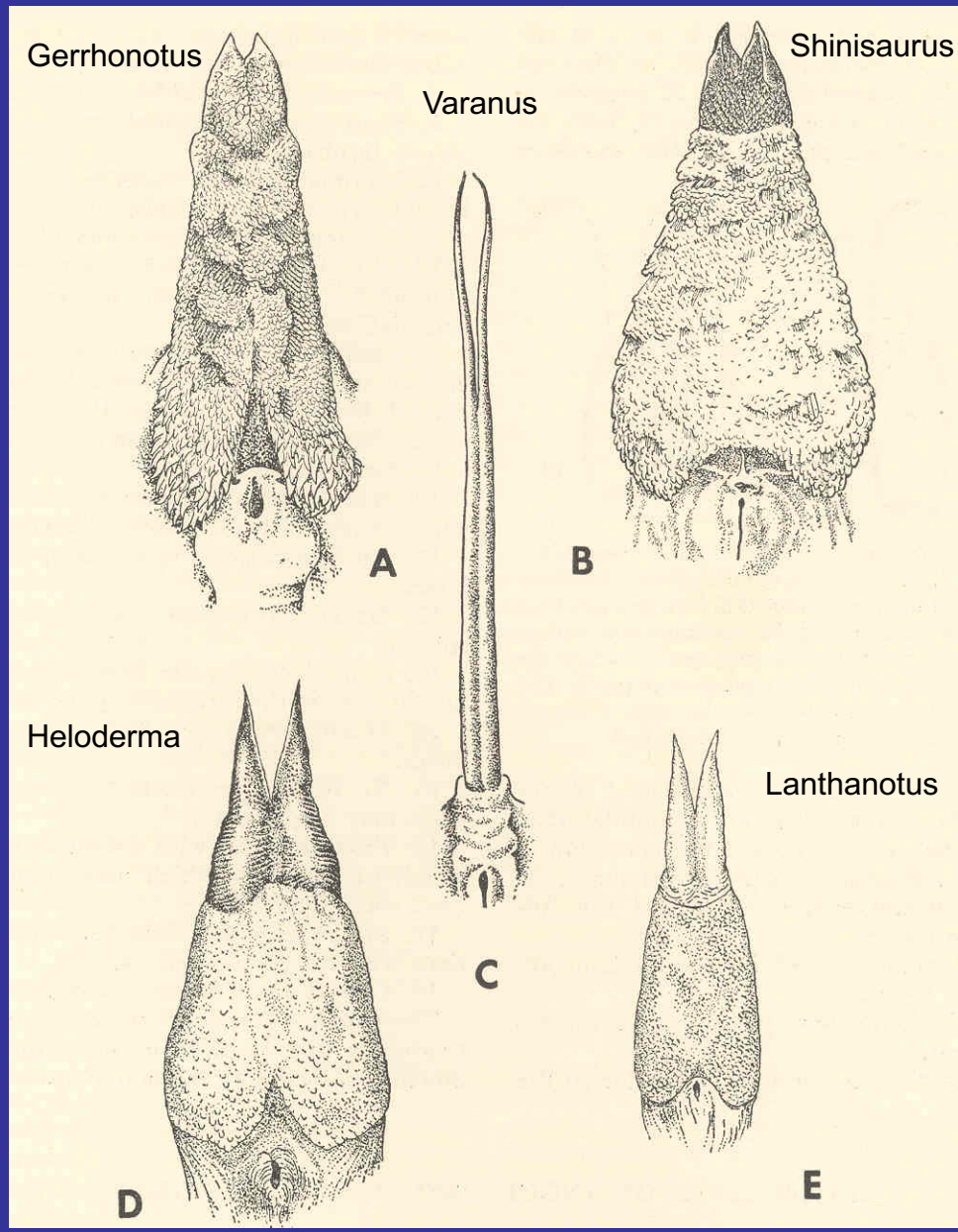
Caixa craniana fechada

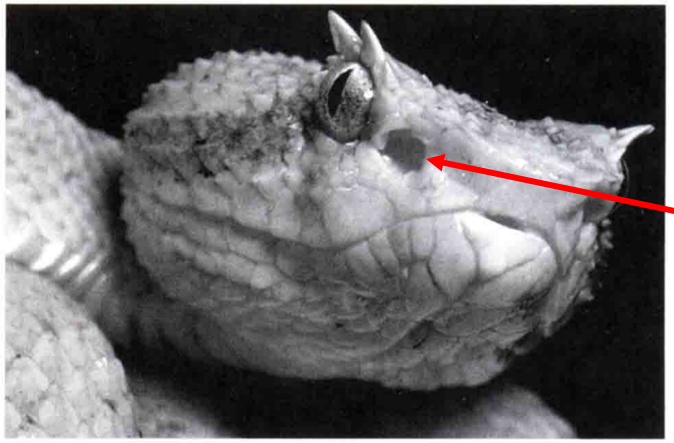
Fontes: H. Zaher (pess.), Vitt (Website), Parker e Grandison (1977)


A
B
C

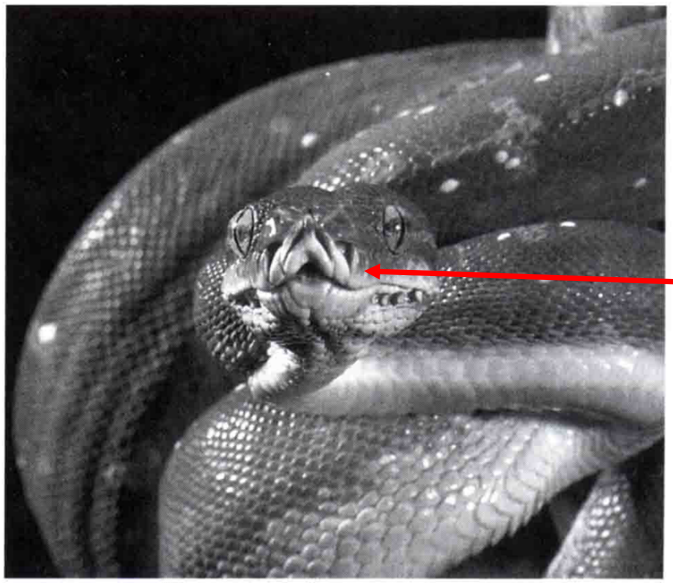



Fun.
B. fo.
Jaw
Rep.
A
B


Gerrhonotus
Varanus
Shinisaurus
A
B
Heloderma
Lanthanotus
C
D
E



(a)



(b)

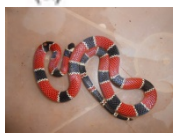
Figure 11–43 **Infrared-receptive pit organs.** (a) *Bothriechis schlegelii*, a crotaline viperid. All pit vipers have a single pair of facial pit organs located between the eye and nostril. (b) The green tree python *Morelia viridis*. Many boas and pythons have a series of pit organs on the labial scales. *(Photographs by (a) Michael & Patricia Fogden, (b) David Northcott/DRK Photo.)*

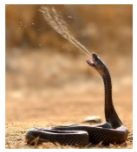
Fosseta loreal

Fossetas labiais

DENTIÇÃO

proteróglifa





solenóglifa

Figure 11–41 **Venom apparatus of elapid and viperid snakes.** (a) The common cobra, *Naja naja*, and (b) the cottonmouth, *Agkistrodon piscivorus*, lateral view. Note short fang and small venom gland of the elapid. The adductor mandibulae externus superficialis muscle compresses the venom gland of elapids, whereas the compressor glandulae muscle performs that function in viperids. *(Source: Kochva 1978.)*

opistóglifa

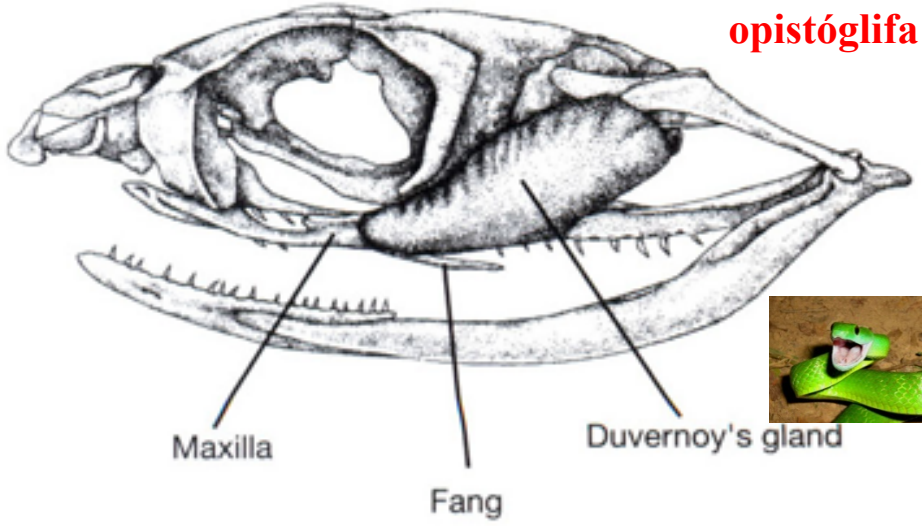


Figure 11–31 **The African boomslang, *Dispholidus typus*.** Note Duvernoy's gland and the enlarged, grooved teeth (rear fangs) at the posterior end of the maxilla. *(Source: Modified from Parker and Grandison 1977.)*

áglifa

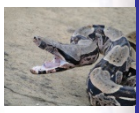
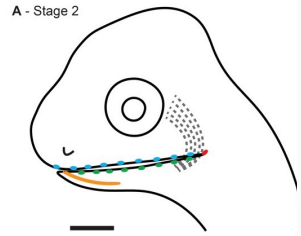
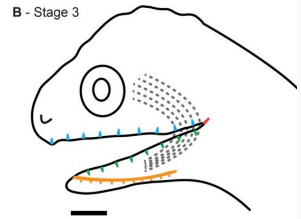
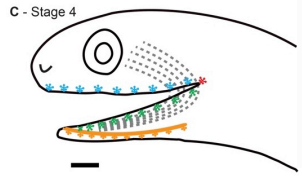


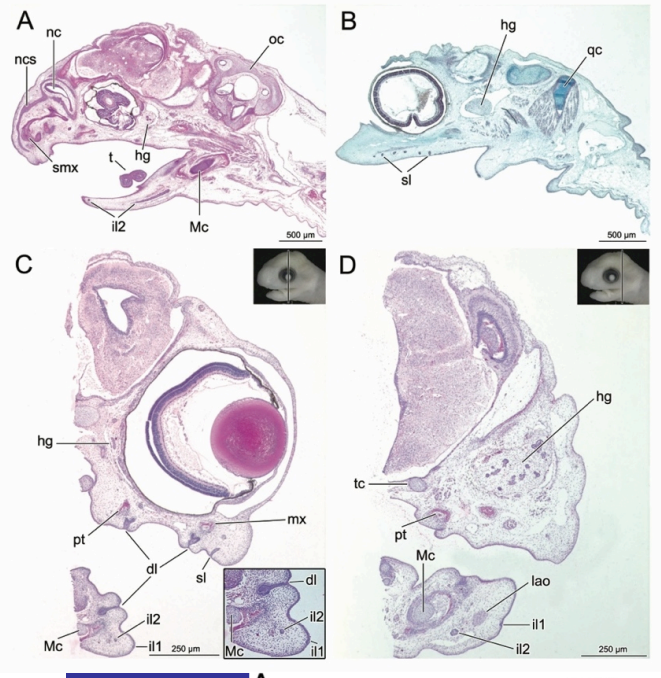
Figure 11–32 **Lateral view of the skull of *Nerodia rhombifer*, a colubrid snake.** The fully enclosed braincase results from downgrowth of the frontal (F) and parietal (P) bones. Note the location of the prokinetic articulation (PRO). *(Source: Modified from Cundall and Gans 1979.)*

DIPSADIDAE: Um novo sistema de inoculação de veneno

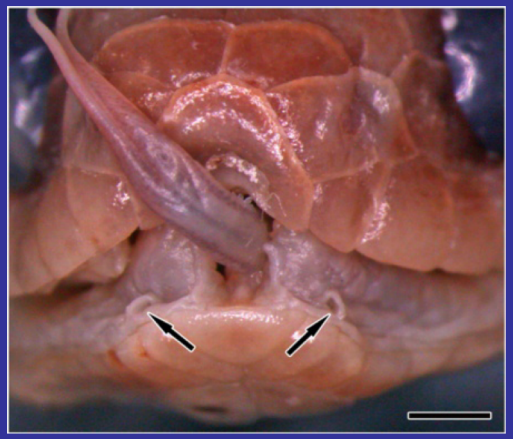


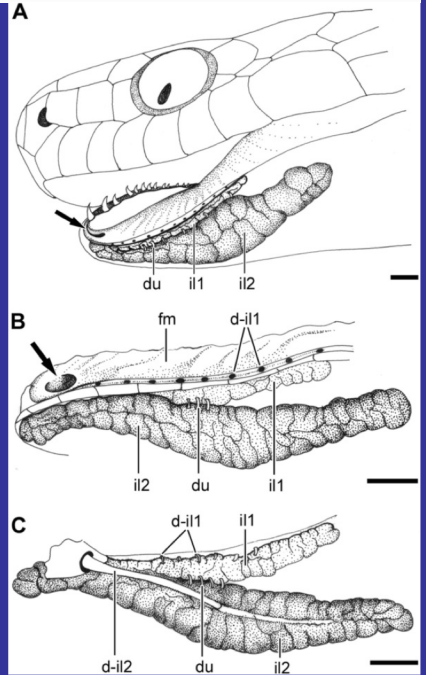


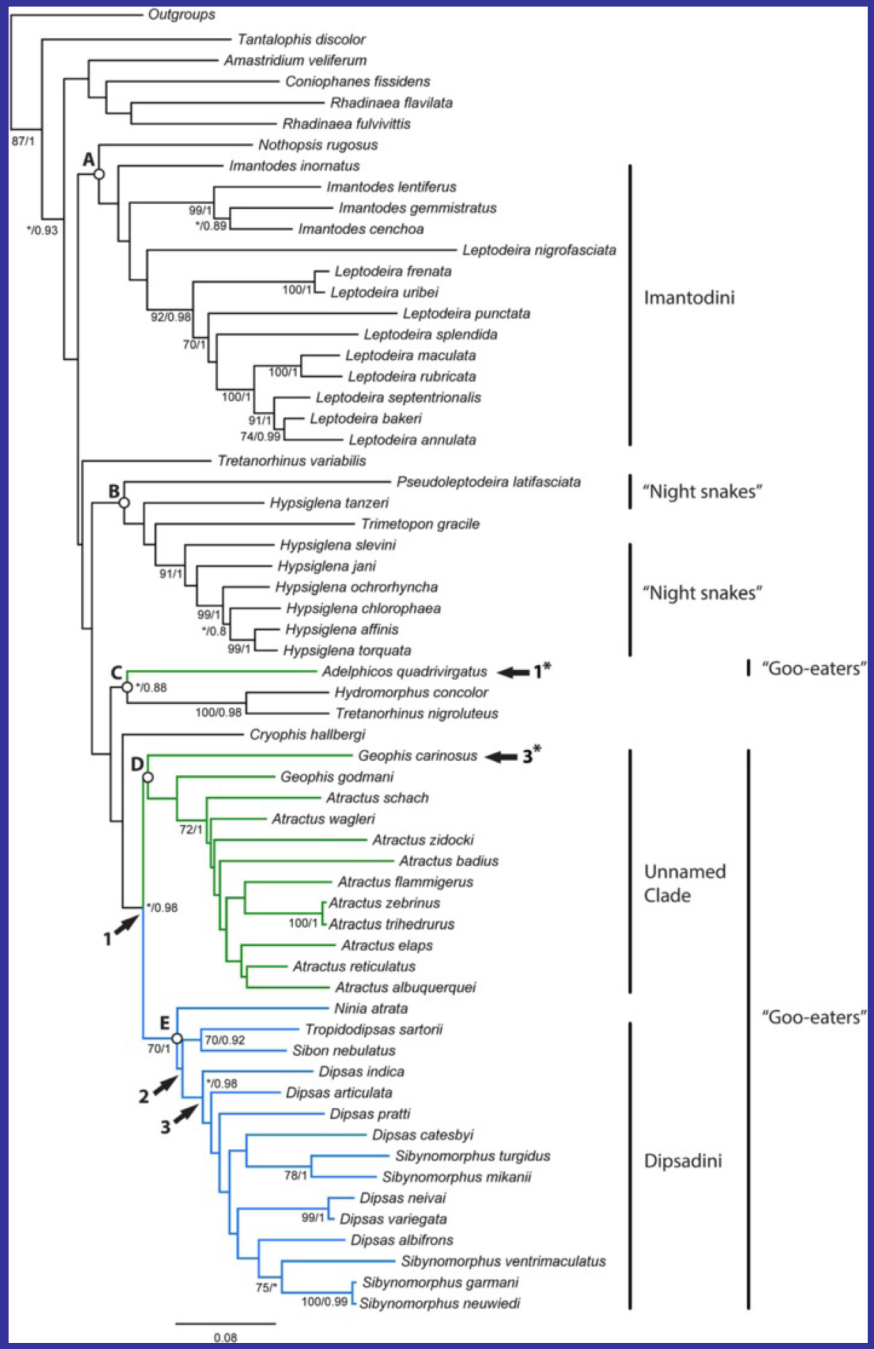




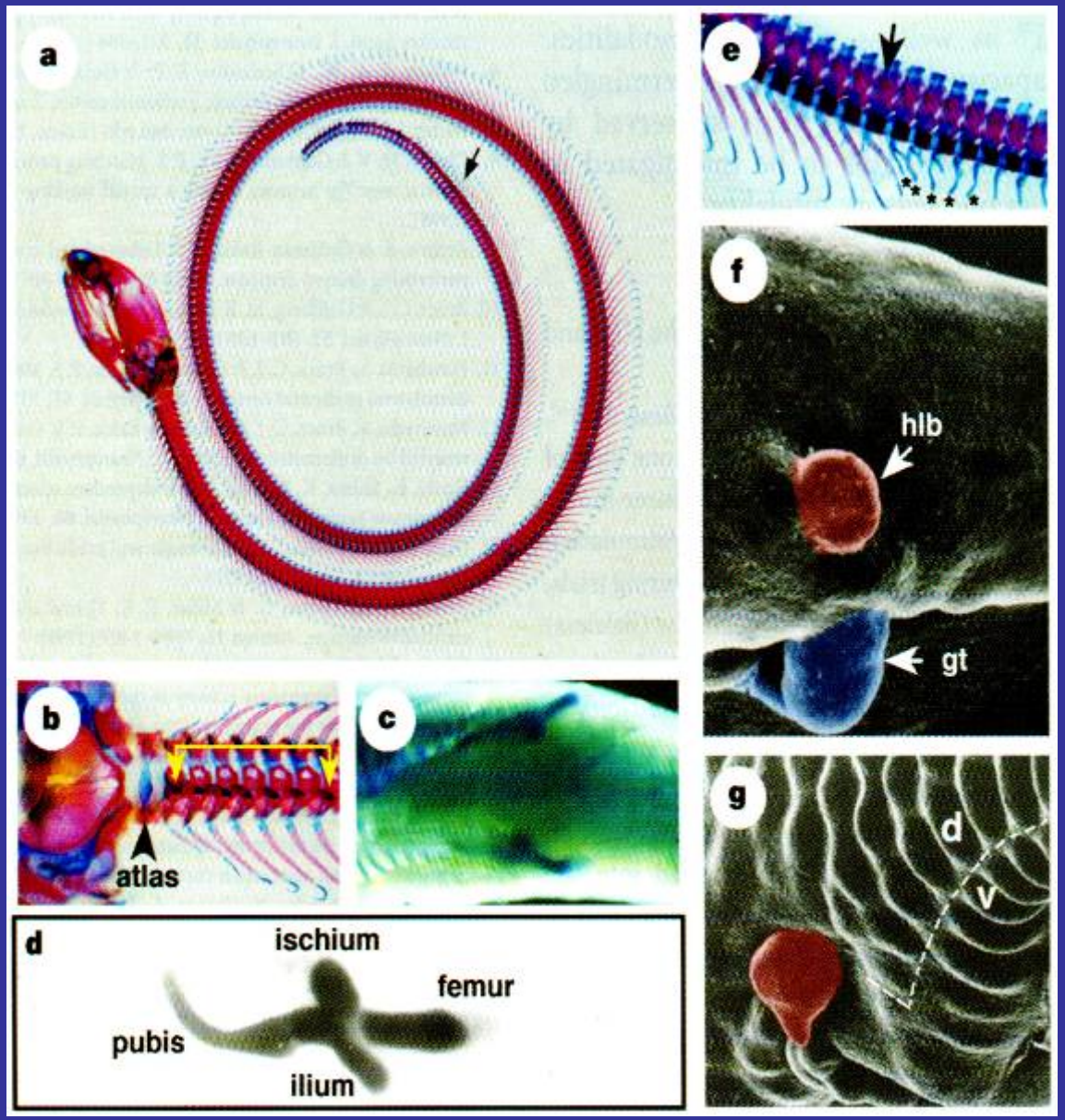
ul, glândula supralabial; Verde, glândula infralabial 1 (il1);
rmelho, glândula rictal; Laranja, glândula infralabial 2 (il2).







A perda das patas nas Serpentes



O aumento da região d
do gene Hox responsáv
formação do tórax no d
pescoço das serpentes
"desligamento" do gen
influência no pescoço e
conseqüência, na perda
escapular e das patas c

A redução à vestígios da
traseiras é uma conseqü
perda de uma estrutura
a crista apical, não tend
dramático na expressão
associados à formação
posteriores. Por esta raz
das serpentes mantêm p

“Microstomata”

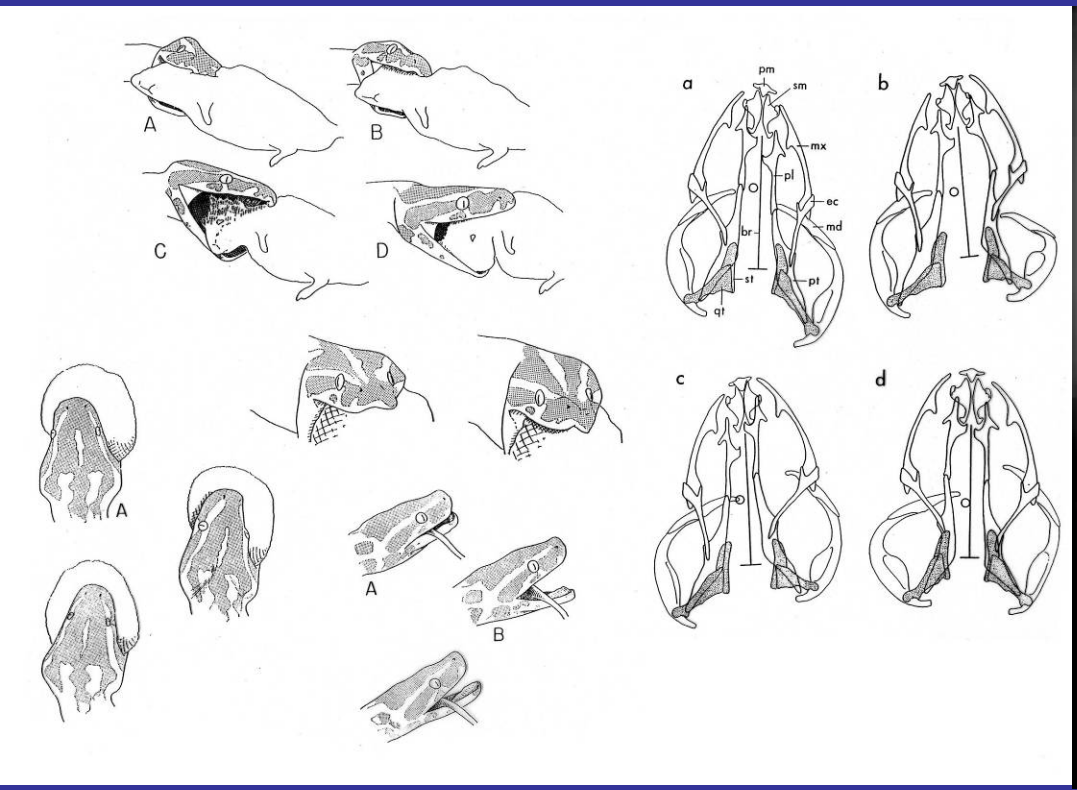
Cobra-cega da família Leptotyphlopidae (dezenas de centímetros)

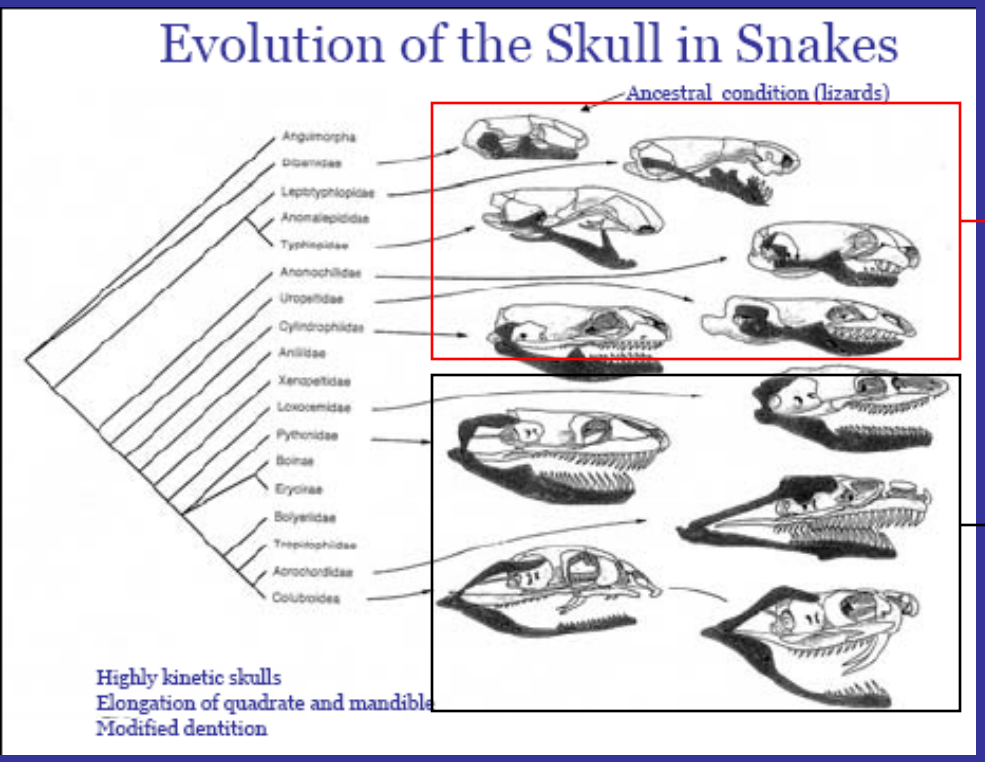
Macrostomata

Píton da família Pythonidae (5 a 10 metros)


SKULLS
UNLIMITED
INTERNATIONAL
.com

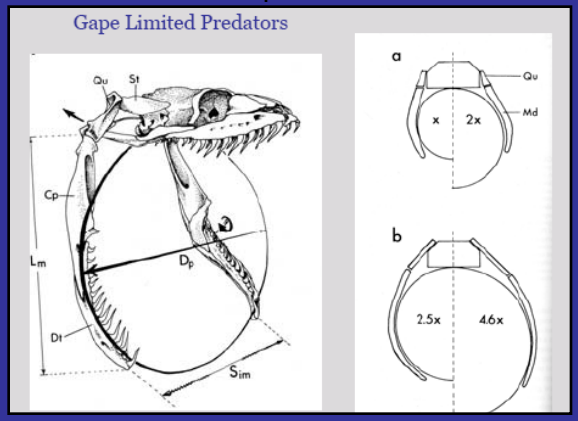
ESPECIALIZAÇÕES NA INGESTÃO DAS PRESAS
Marcha pterigoidiana
Independencia entre os complexos osseos dentígeros



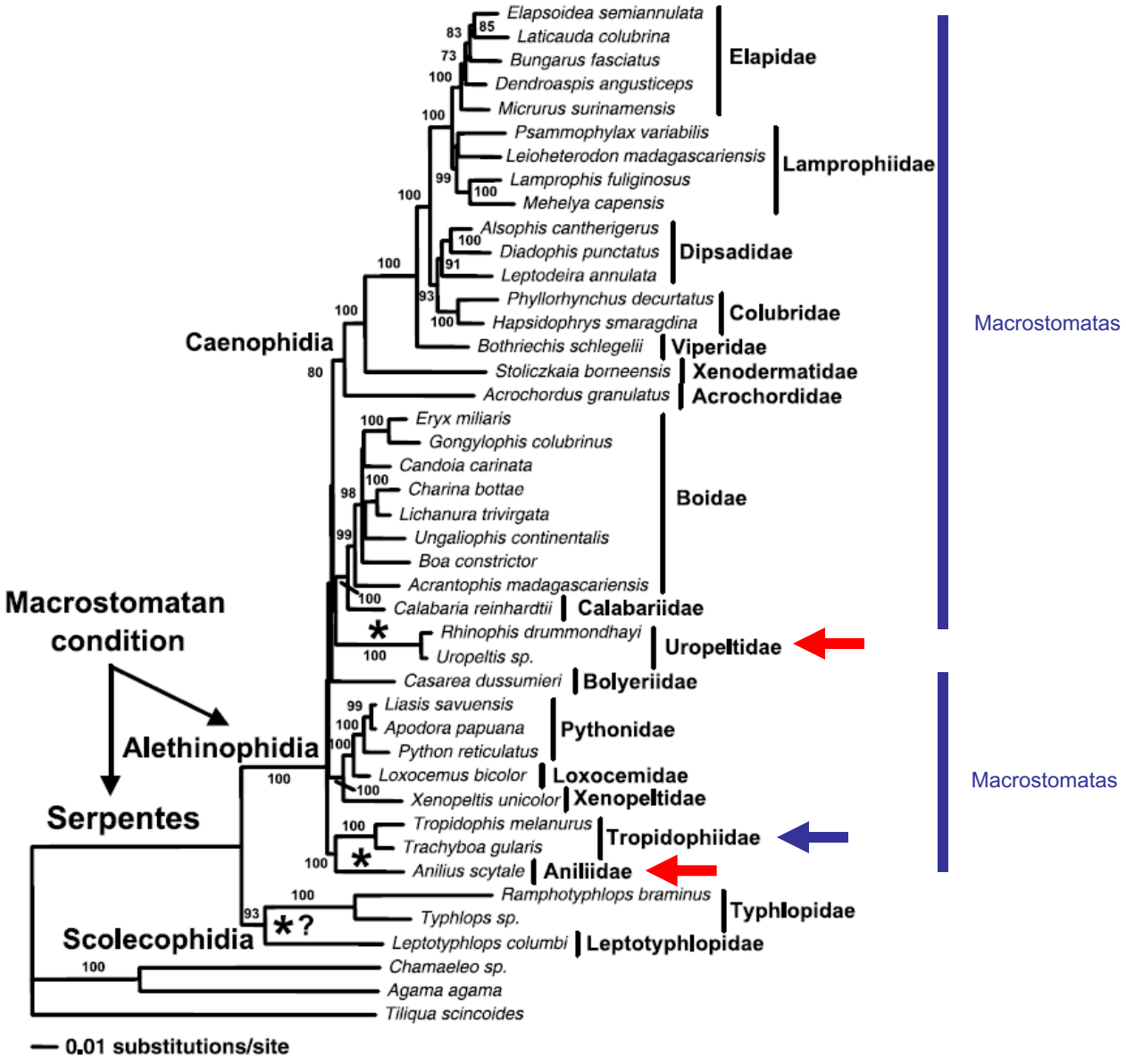


"Microstomata"

Macrostomata



Dados moleculares sustentam Macrostomatas parafiléticos



Vidal e David (2003)

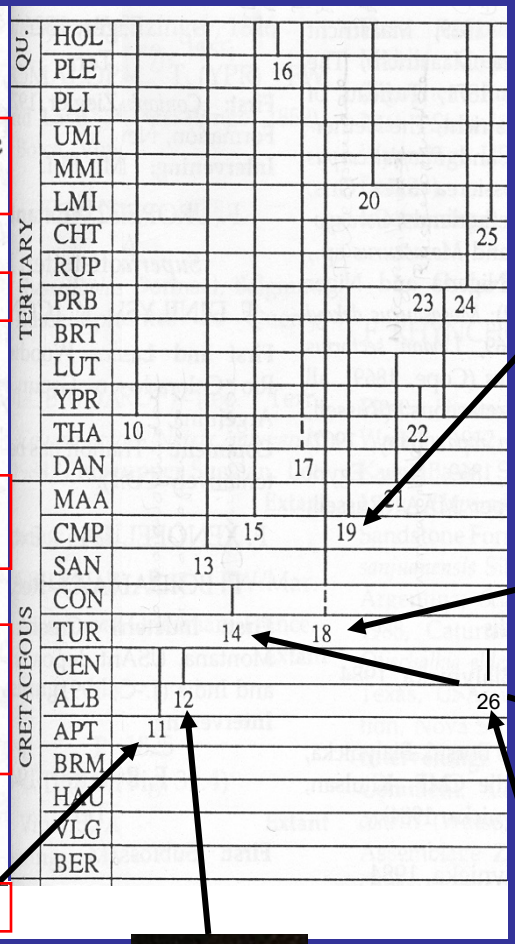
Árvore de MV obtida através da análise combinada de sequências dos genes nucleares c-mos e RAG1 (1056 bp)

Nove famílias extintas de serpentes

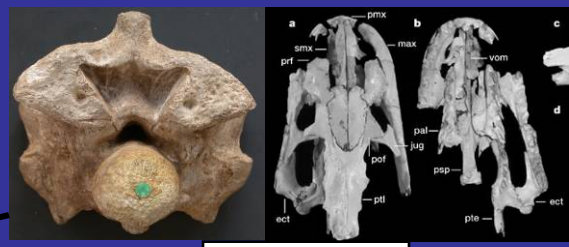
Fontes: H. Zaher (Pess.), Benton (1993), Scanlon (2006)

SERPENTES

10. Typhlopidae
11. Lapparantopheidae
12. Simoliophiidae
13. Aniliidae
14. Dinilysiidae
15. Boidae
16. Bolyeridae
17. Tropidophiidae
18. Madstoiidae
19. Palaeophiidae
20. Acrochordidae
21. Nigerophiidae
22. Anomalophiidae
23. Russellophiidae
24. Colubridae
25. Elapidae
26. Pachyophiidae



PALAEOPHIIDAE



MADTSOIIDAE

DINILYSIIDAE

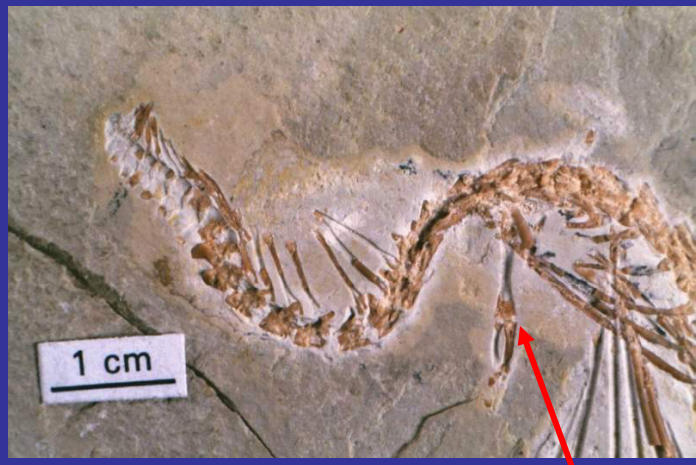
Najash rionegrina

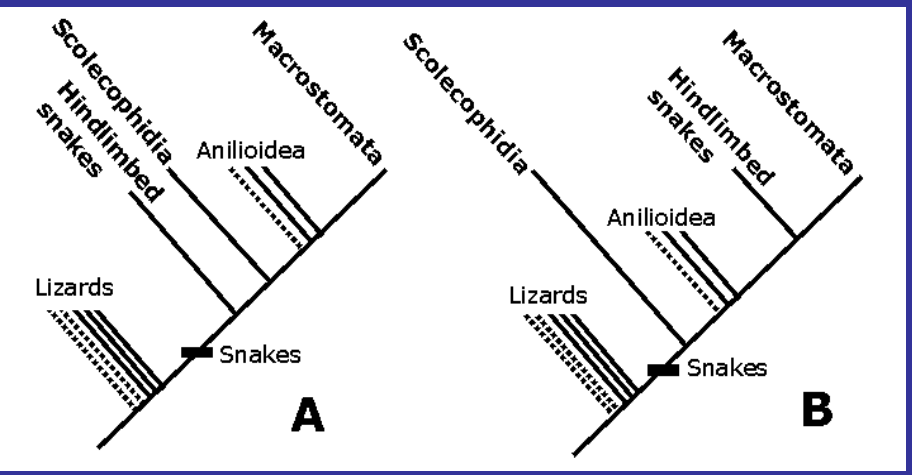
LAPPARENTOPHIIDAE

SIMOLIOPHIIDAE

PACHYOPHIIDAE

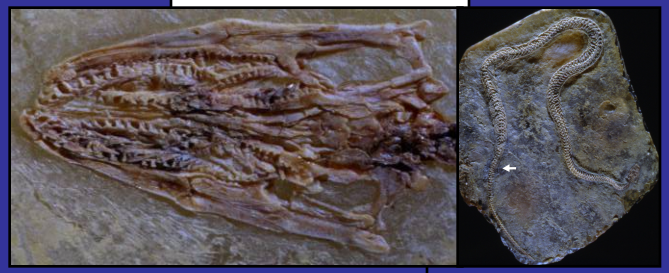
Najash rionegrina



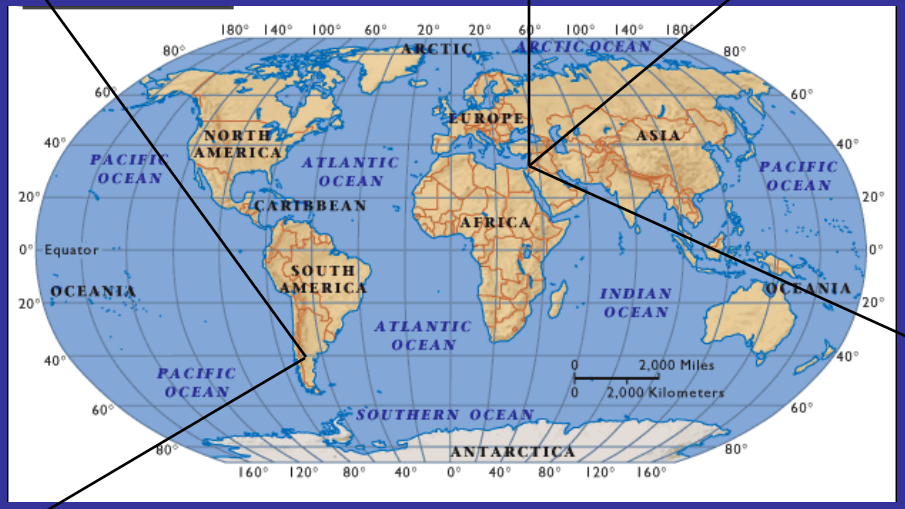


Dinilysia patagonica

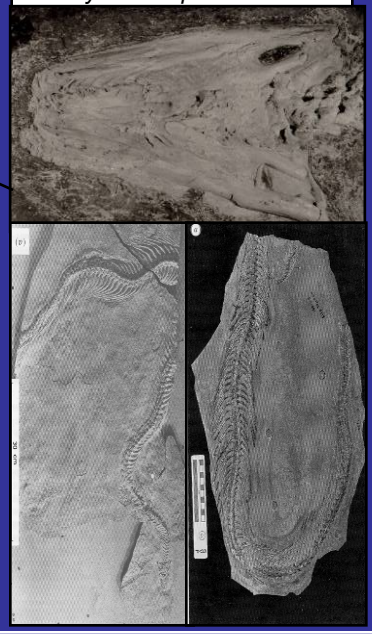
Haasiophis terrasanctus



Eupodophis descouensi



Pachyrhachis problematicus



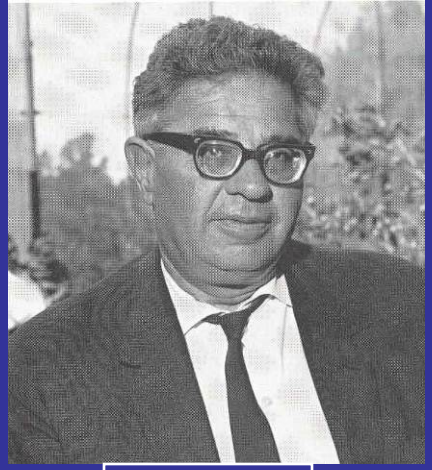
Najash rionegrina

Serpentes com patas do Cretáceo (*Dinilysia*?)

Fontes: H. Zaher (pess.), O. Rieppel (pess.)

Fontes: H. Zaher, Lee e Caldwell (1998), Adler (1989)

As cobras com patas do Cenomaniano de Ein Yabrud (Israel)



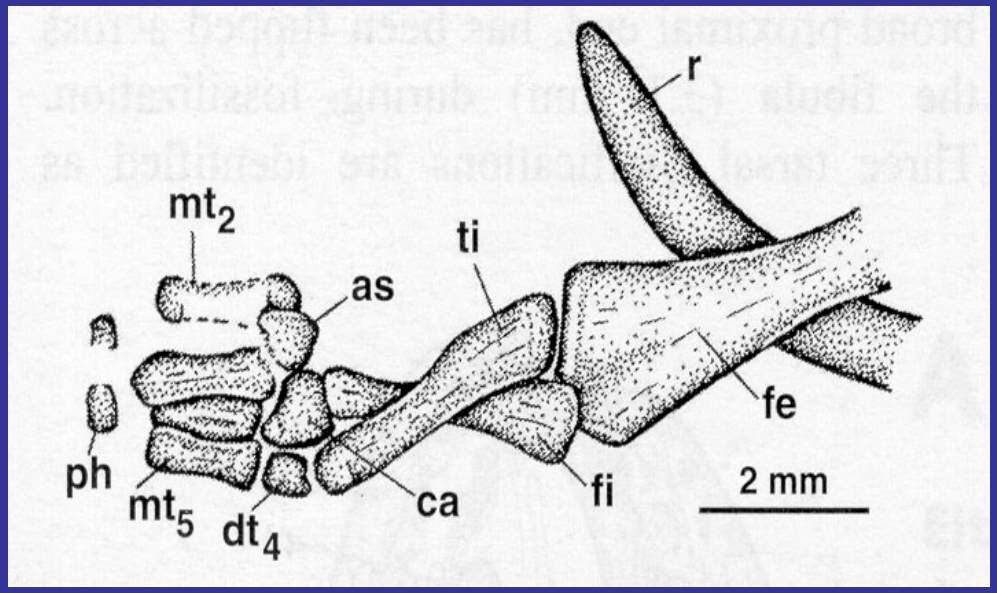
GEORG HAAS

Haasiophis terrasanctus

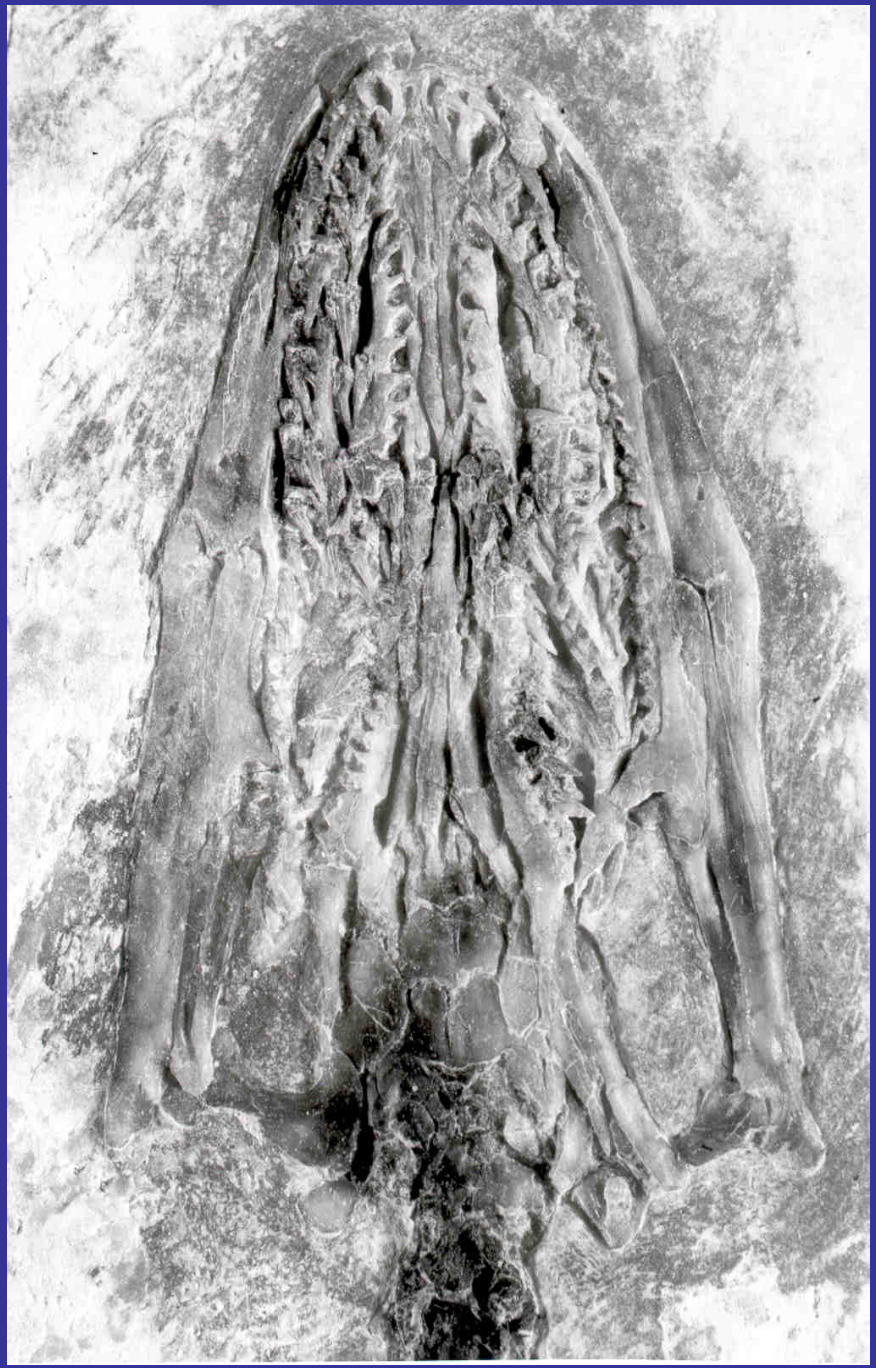
Pachyrhachis problematicus

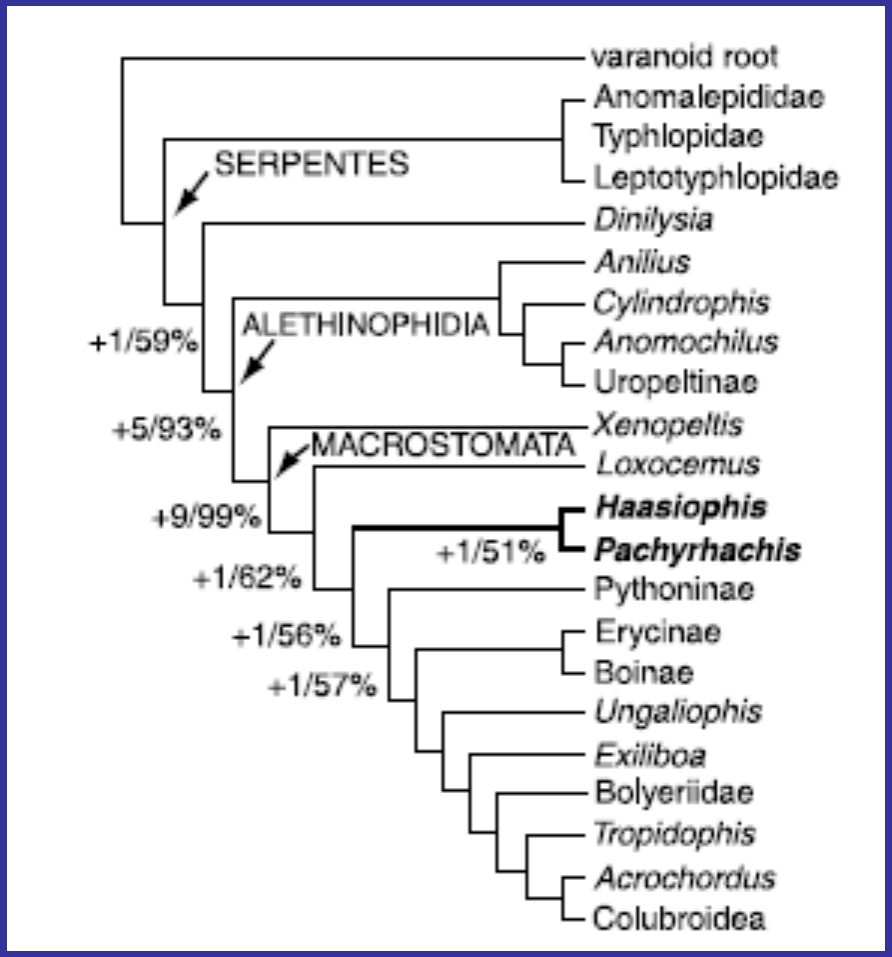
Estesius colberti

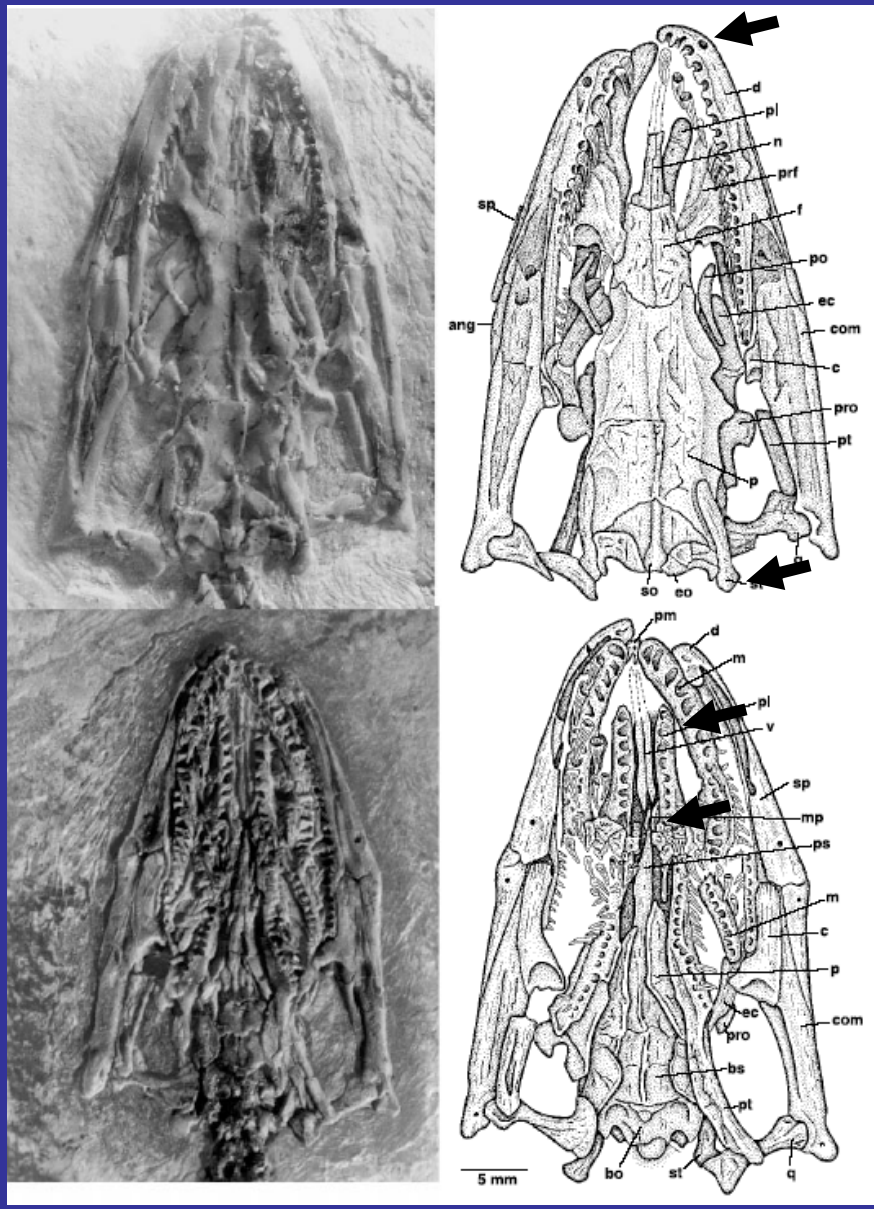
HAASIOPHIS TERRASANCTUS



- r - costela
- fe - femur
- ti - tíbia
- fi - fíbula
- as - astragalus
- ca - calcâneo
- dt4 - quarto tarsal
- mt - metatarsais
- ph - fragmentos de falanges

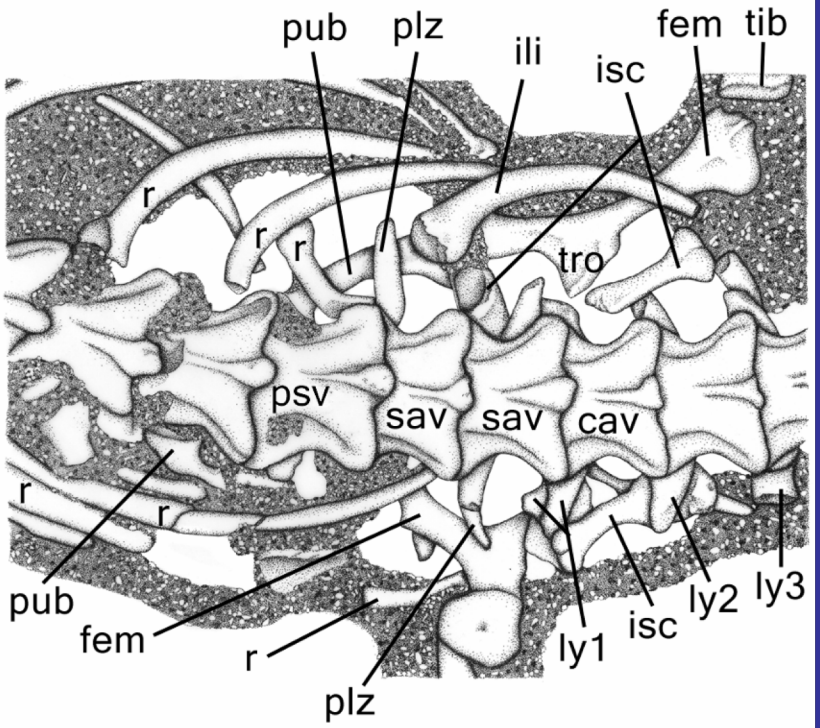



varanoid root
Anomalepididae
Typhlopidae
Leptotyphlopidae
SERPENTES
Dinilysia
Anilius
Cylindrophis
ALETHINOPHIDIA
+1/59%
Anomochilus
Uropeltinae
+5/93%
Xenopeltis
MACROSTOMATA
Loxocemus
+9/99%
Haasiophis
+1/51%
Pachyrhachis
+1/62%
Pythoninae
+1/56%
Erycinae
Boinae
+1/57%
Ungaliophis
Exiliboa
Bolyeriidae
Tropidophis
Acrochordus
Colubroidea


d
pl
n
prf
sp
f
po
ec
ang
com
c
pro
pt
p
so
eo
pm
m
v
mp
ps
bs
bo
st
q
5 mm

DINILYSIA PATAGONICA: UMA SERPENTE CRETÁCICA TERRESTRE DA ARGENTINA

Najash rionegrina: a primeira cobra com um sacro


pub
plz
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r
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tro
psv
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cav
r
r
pub
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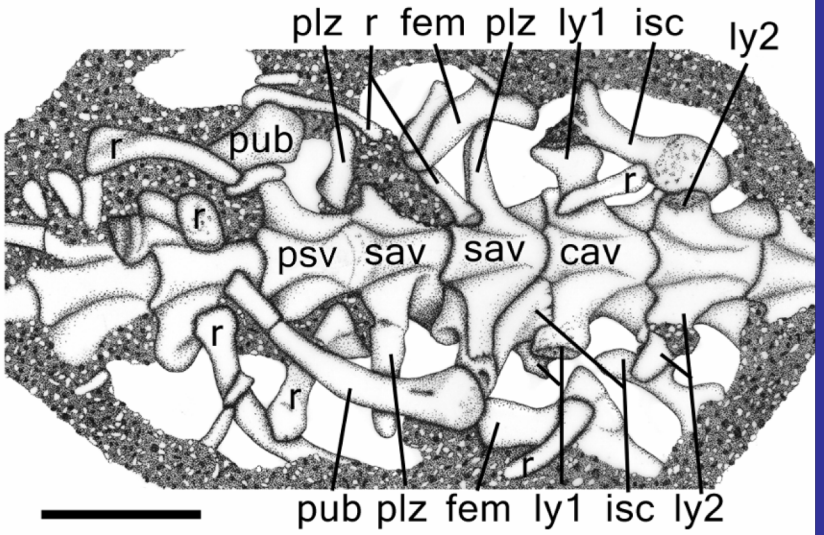
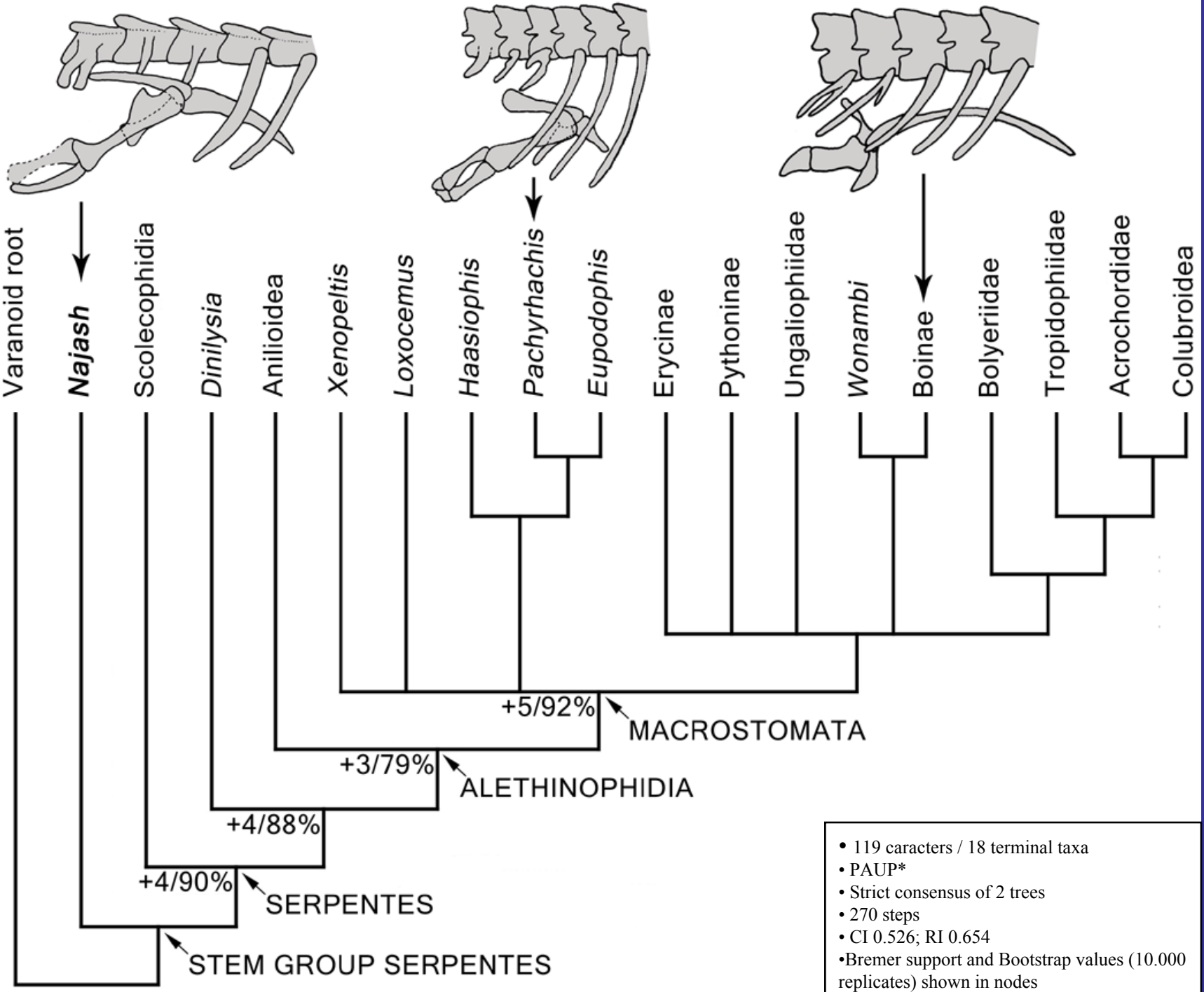
isc
ly2
ly3


plz
r
fem
plz
ly1
isc
ly2
r
pub
r
r
psv
sav
sav
cav
r
r
r
pub
plz
fem
ly1
isc
ly2


Varanoid root
Najash
Scolecophidia
Dinilysia
Anilioidea
Xenopeltis
Loxocemus
Haasiophis
Pachyrhachis
Eupodophis
Erycinae
Pythoninae
Ungaliophiidae
Wonambi
Boinae
Bolyeriidae
Tropidophiidae
Acrochordidae
Colubroidea
+5/92%
MACROSTOMATA
+3/79%
ALETHINOPHIDIA
+4/88%
+4/90%
SERPENTES
STEM GROUP SERPENTES
• 119 caracters / 18 terminal taxa
• PAUP*
• Strict consensus of 2 trees
• 270 steps
• CI 0.526; RI 0.654
•Bremer support and Bootstrap values (10.000 replicates) shown in nodes

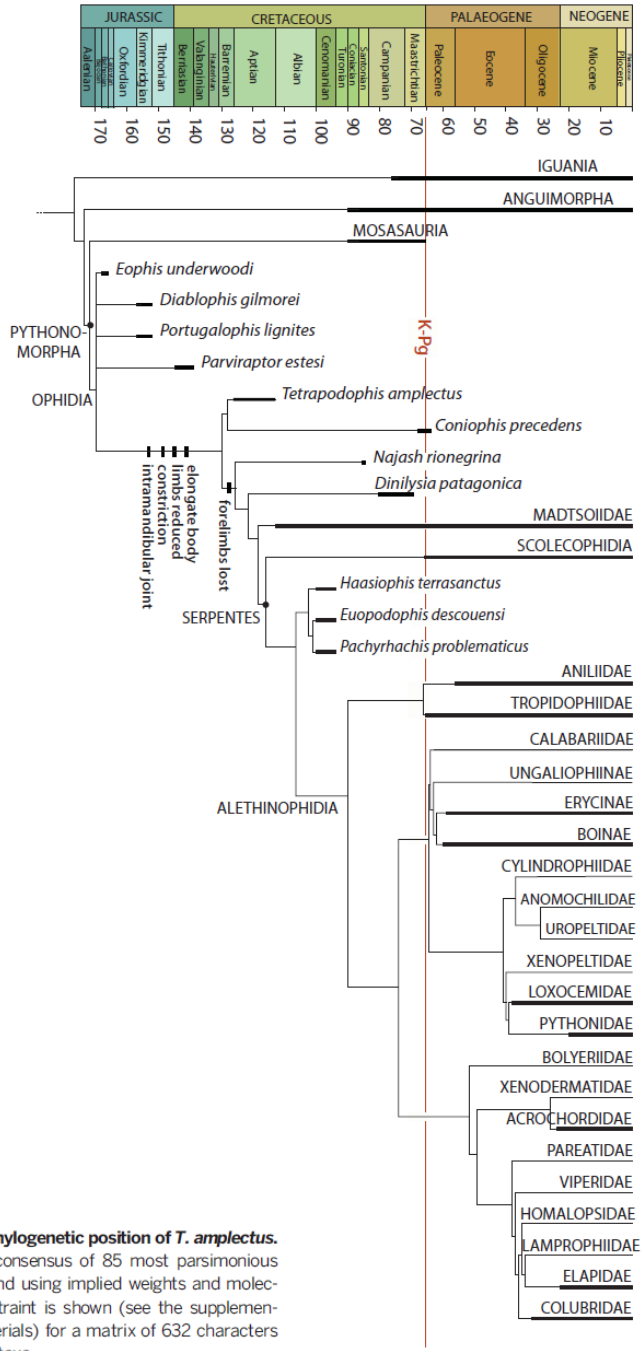
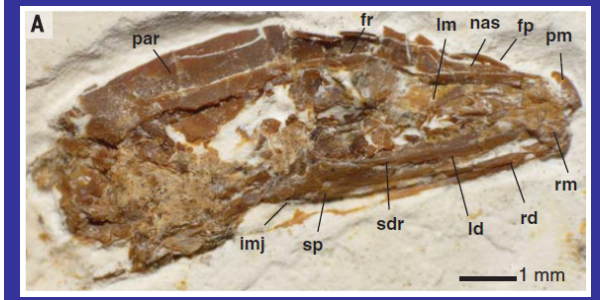


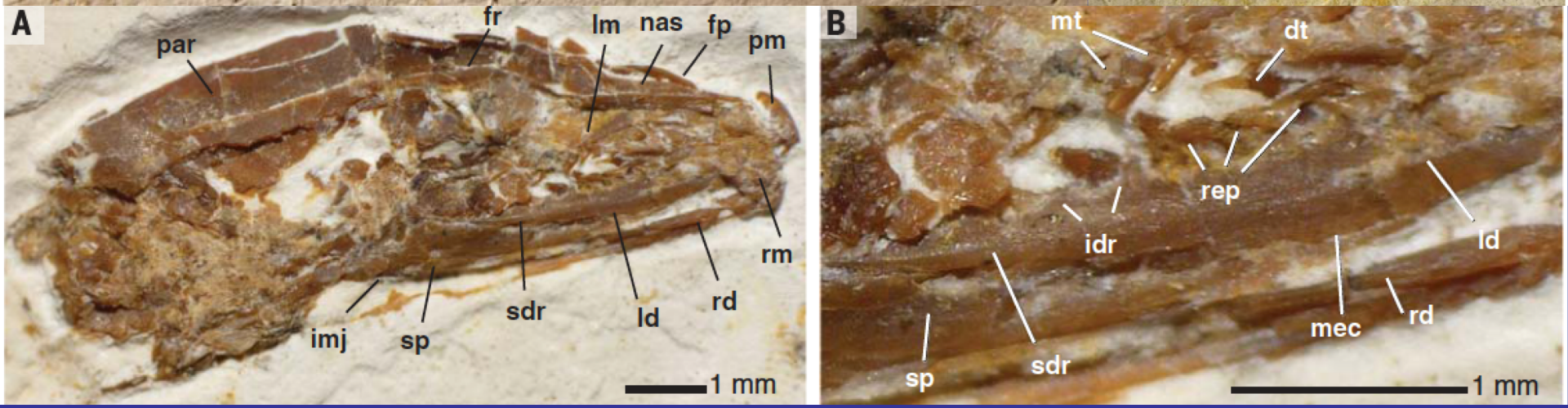
Fig. 5. Phylogenetic position of *T. amplectus*. A strict consensus of 85 most parsimonious trees found using implied weights and molecular constraint is shown (see the supplementary materials) for a matrix of 632 characters and 205 taxa.

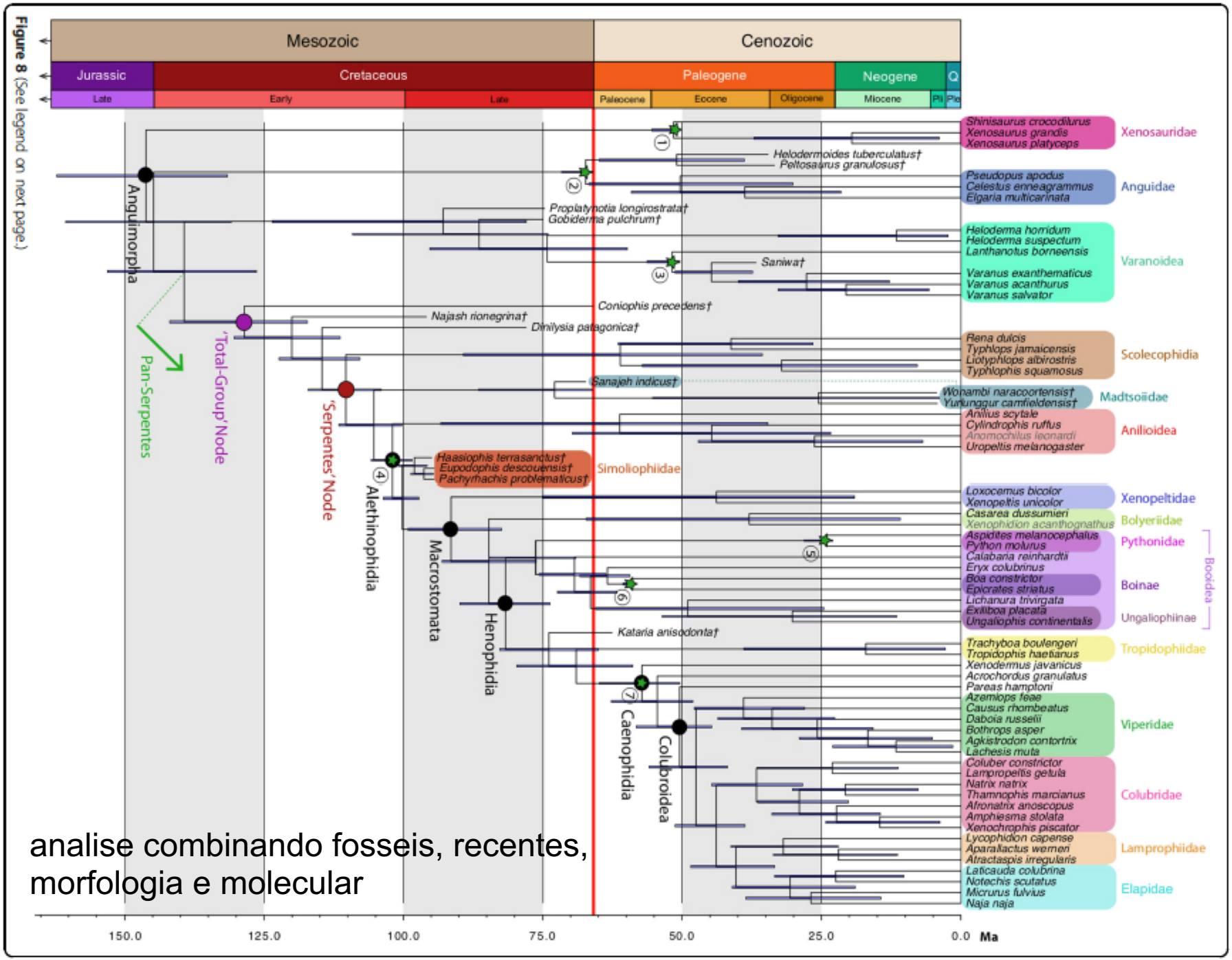
A four-legged snake from the Early Cretaceous of Gondwana

David M. Martill,[1] Helmut Tischlinger,[2] Nicholas R. Longrich[3]

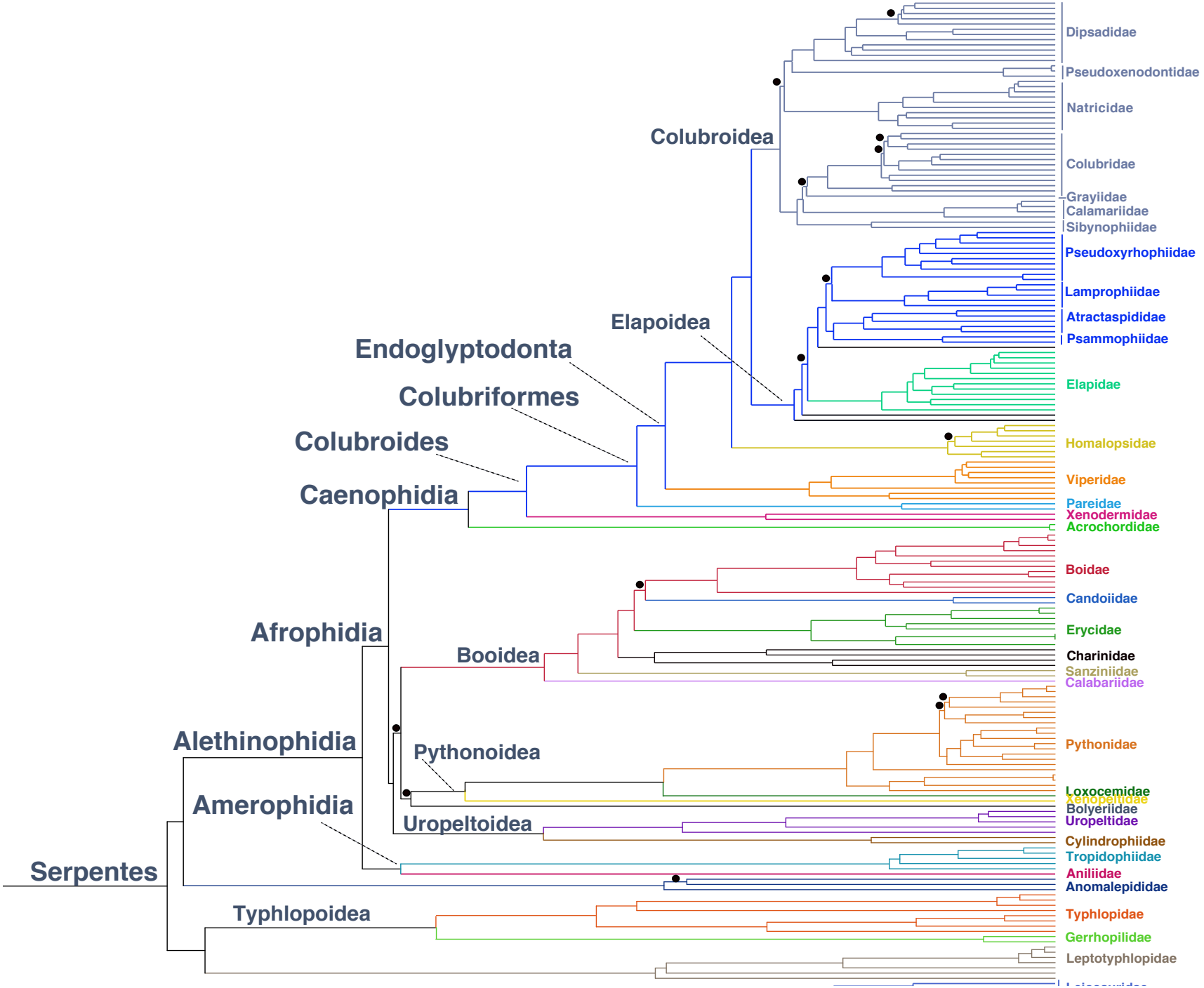


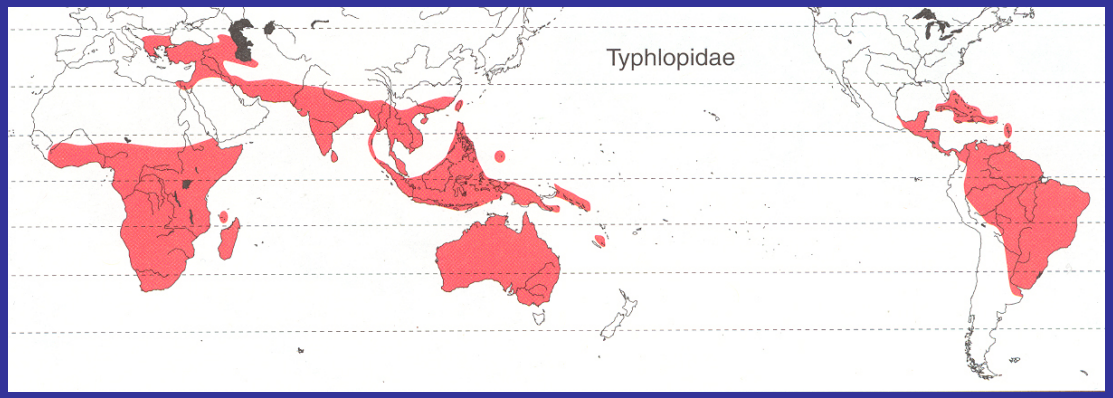

A
B
10 mm
A
nsp
poz
zgs
zga
syn
prz
1 mm
B
1mm
vs
C
vb
gc
1mm

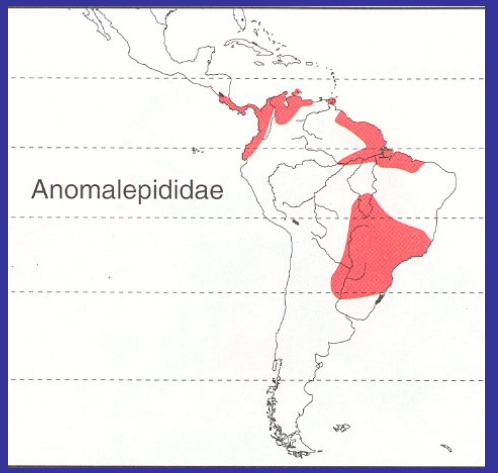

A
par
fr
lm
nas
fp
pm
rm
rd
ld
sdr
sp
imj
1 mm
B
mt
dt
rep
idr
ld
mec
rd
sdr
sp
1 mm



analise combinando fosseis, recentes, morfologia e molecular


Serpentes
Typhlopoidea
Amerophidia
Alethinophidia
Afrophidia
Caenophidia
Colubroides
Colubriformes
Endoglyptodonta
Elapoidea
Colubroidea
Booidea
Pythonoidea
Uropeltoidea
Dipsadidae
Pseudoxenodontidae
Natricidae
Colubridae
Grayiidae
Calamariidae
Sibynophiidae
Pseudoxyrhophiidae
Lamprophiidae
Atractaspididae
Psammophiidae
Elapidae
Homalopsidae
Viperidae
Pareidae
Xenodermidae
Acrochordidae
Boidae
Candoiidae
Erycidae
Charinidae
Sanziniidae
Calabariidae
Pythonidae
Loxocemidae
Xenopeltidae
Bolyeriidae
Uropeltidae
Cylindrophiidae
Tropidophiidae
Aniliidae
Anomalepididae
Typhlopidae
Gerrhopilidae
Leptotyphlopidae





SCOLECOPHIDIA

Typhlophis squamosus

Typhlops reticulatus

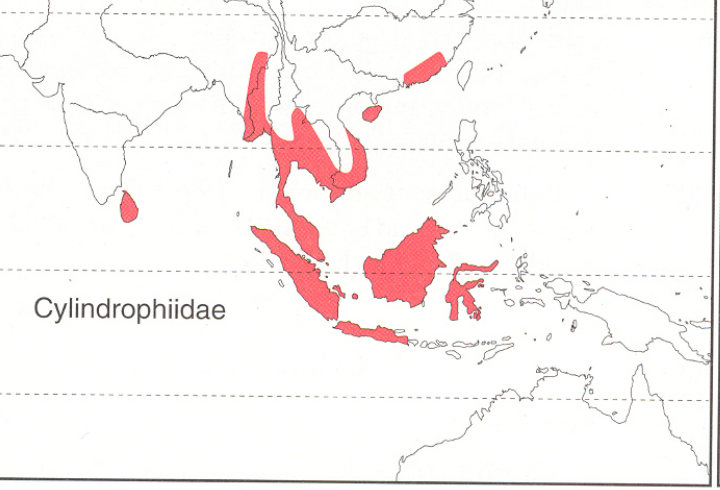
Leptotyphlops septemstriatus

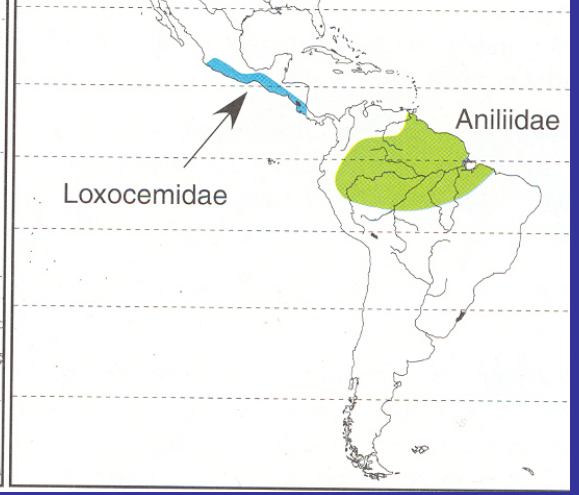
Typhlops jamaicensis

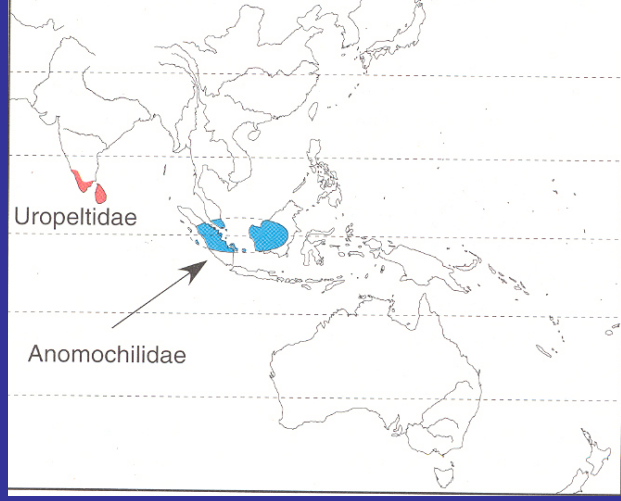
LEPTOTYPHLOPIDAE = ~ 90 espécies
Leptotyphlops
Rhinoleptus

TYPHLOPIDAE = ~210 espécies
Acutotyphlops
Cyclotyphlops
Ramphotyphlops
Rhinotyphlops
Typhlops
Xenotyphlops

ANOMALEPIDIDAE = ~ 15 espécies
Anomalepis
Helminthophis
Liotyphlops
Typhlophis

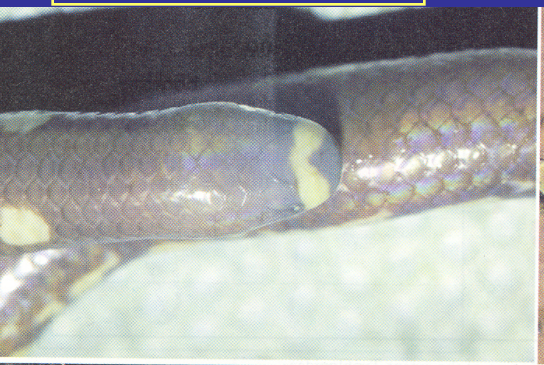






ANILIOIDEA

Anomochilus leonardi



Cylindrophis ruffus

Anilius scytale

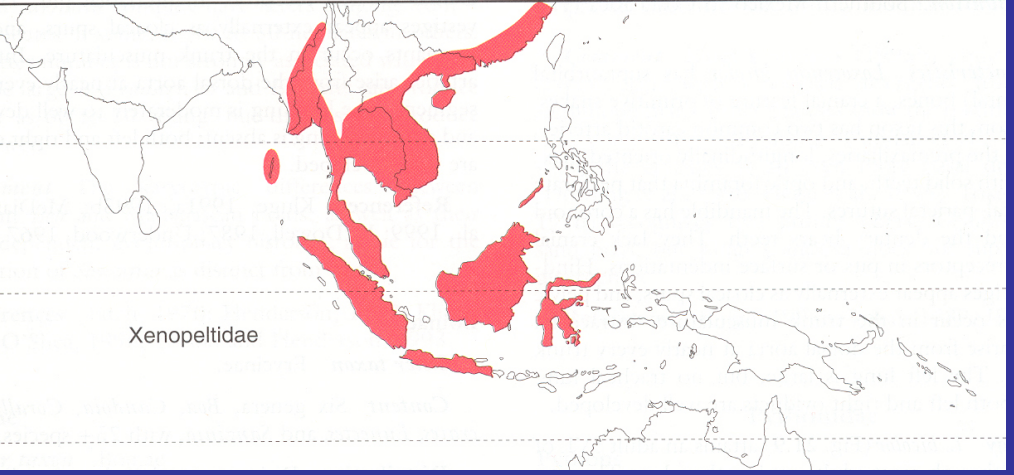
Rhinophis drummondhayi

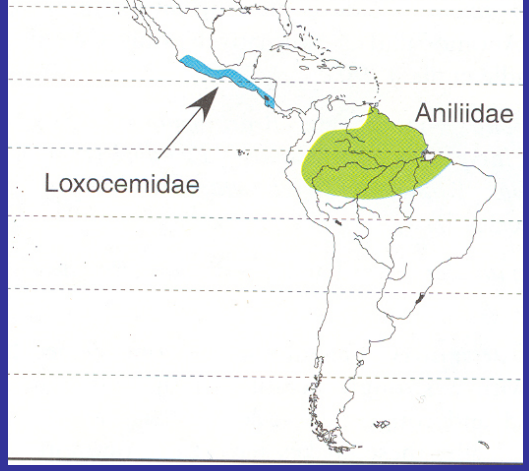
ANOMOCHILIDAE = 2 espécies
Anomochilus

CYLINDROPHIIDAE = 8 espécies
Cylindrophis

ANILIIDAE = 1 espécie
Anilius

UROPELTIDAE = ~ 45 espécies
Brachyophidium
Melanophidium
Platyplectrurus
Plectrurus
Pseudoplectrurus
Pseudotyphlops
Rhinophis
Teretrurus
Uropeltis





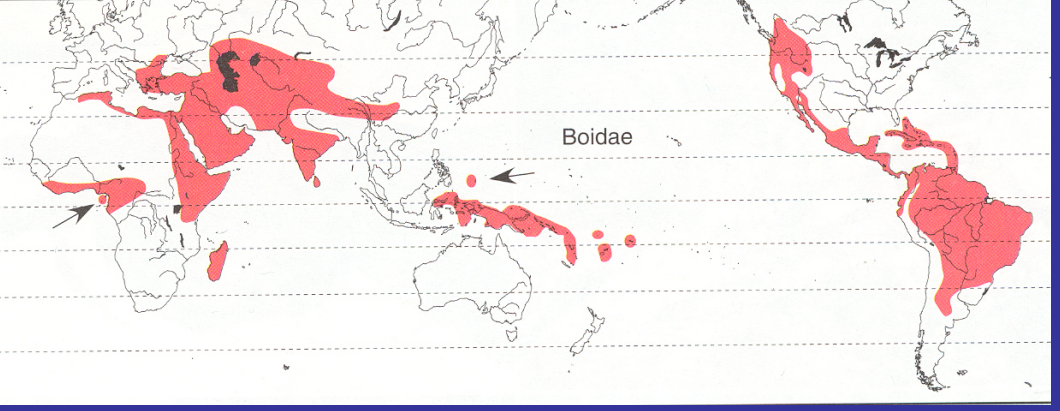
MACROSTOMATA BASAIS

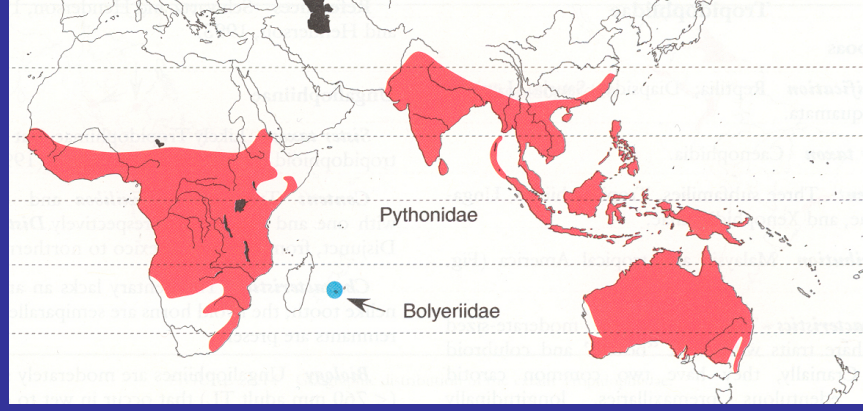
Loxocemus bicolor

Xenopeltis unicolor

LOXOCEMIDAE = 1 espécie
Loxocemus

XENOPELTIDAE = 2 espécies
Xenopeltis

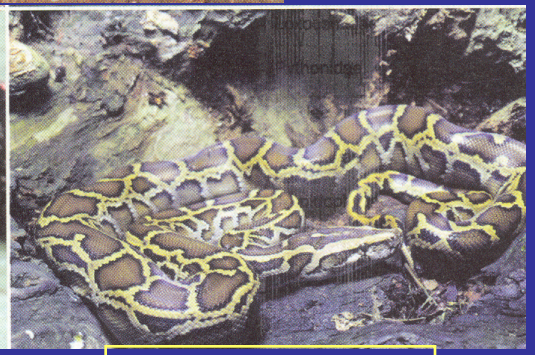




BOOIDEOS (1)

Lichanura trivirgata

Corallus hortulanus

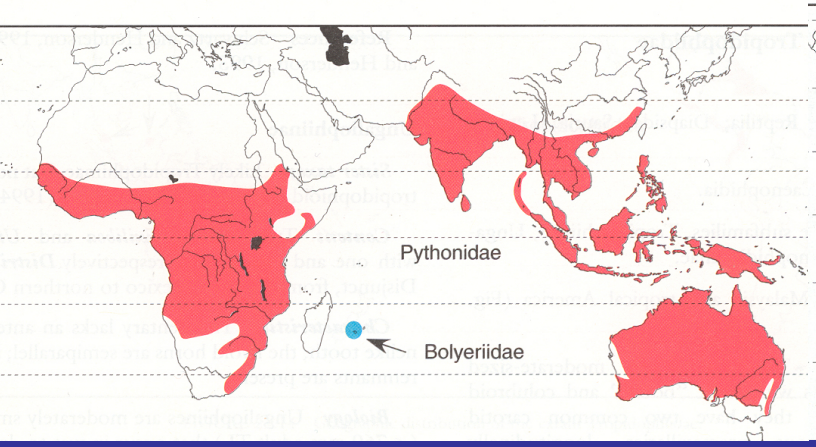


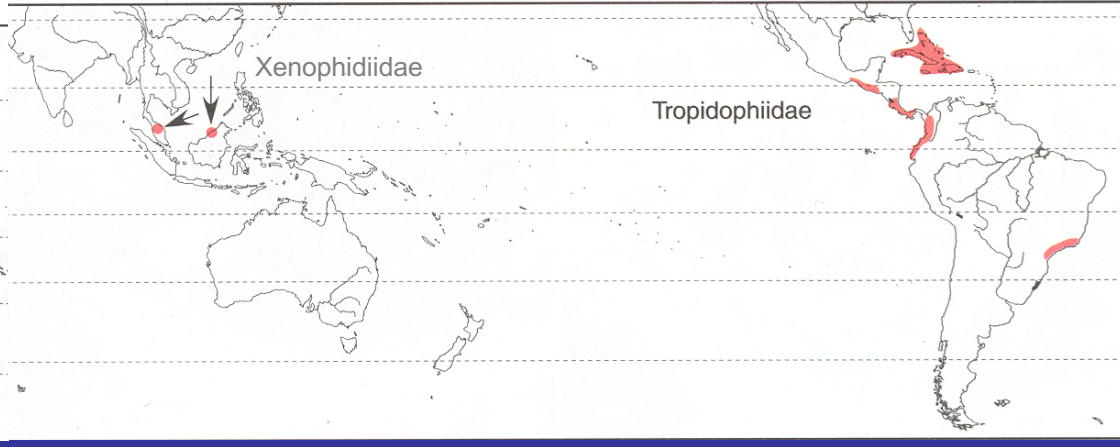
Python molurus

BOIDAE = ~ 25 espécies
Boa
Candoia
Corallus
Epicrates
Eunectes
Sanzinia

ERYCIDAE = 14 espécies
Calabaria
Charina
Lichanura
Gongylophis
Eryx

PYTHONIDAE = ~ 25 espécies
Apodora
Aspidites
Liasis
Liopython
Morelia
Python





Casarea dussumieri

Xenophidion schaeferi

Tropidophis haetianus

BOOIDEOS (2)

BOLYERIIDAE = 2 espécies
Bolyeria
Casarea

XENOPHIDIIDAE = 2 espécies
Xenophidion

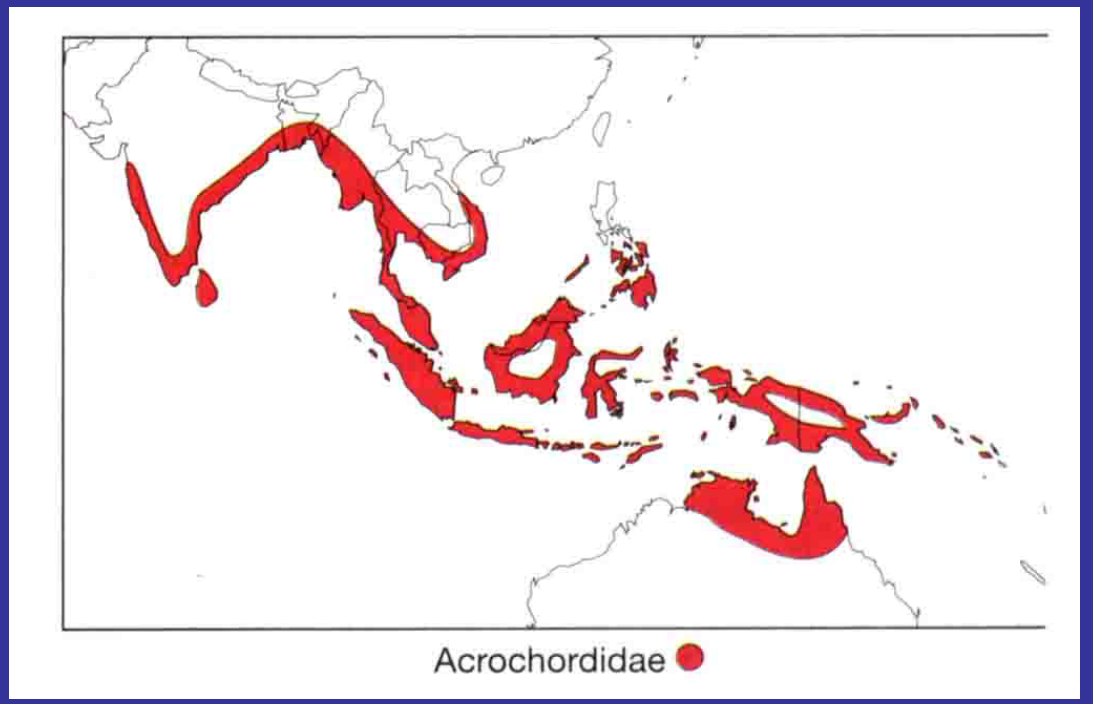
TROPIDOPHIIDAE = ~ 18 espécies
Tropidophis
Trachyboa

UNGALIOPHIIDAE = 3 espécies
Ungaliophis
Exiliboa

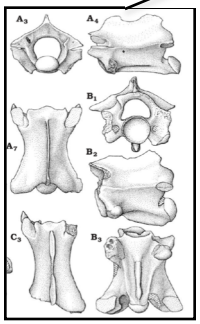
CAENOPHIDIA

ACROCHORDIDAE = 3 espécies
Acrochordus

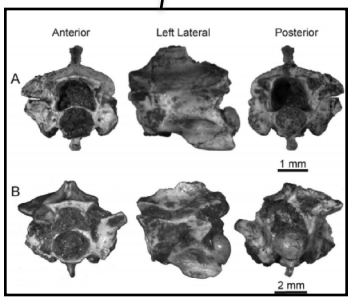
Acrochordus javanicus



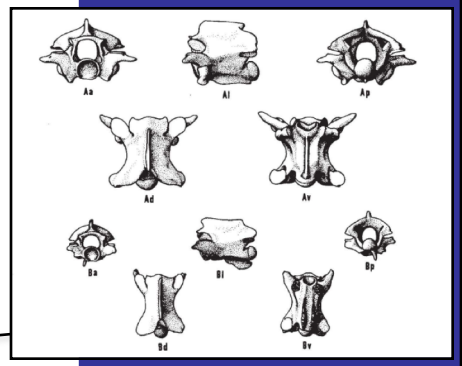
Henophidia
Russelophidae
Acrochordus 3
Acrochordus dehmi
Acrochordus granulatus
Xenodermatidae
Pan-Caenophidia 1
Colubroides
Procerophis
Pareatidae
Crotalinae
"Vipera aspis complex"
Other Viperinae
Viperinae 4
Homalopsidae
"Coluber" cadurci
Micrelaps
Lamprophiidae
Calliophis
Micrurus+Maticora
Ophiophagus+Dendroaspis
Aspidelaps+Walterinnesia
Hemachatus
Elapidae
Naja romani
Naja 6
Naja
Elapsoidea
Bungarus flaviceps
Bungarus bungaroides
Siwalik Group *Bungarus*
Bungarus fasciatus+Bungarus ceylonicus
Elapoidea+Colubridae 5
"derived" *Bungarus* 8
Laticauda
Oxyuraninae
Incongruelaps iteratus
Oxyuraninae 7
Pseudoxenodontinae+Calamariinae
Natricinae
Thermophis
Nothopsis+Pseudoboa
Farancia+Diadophis
Paleoheterodon tiheni UNSM 46504
Heterodon+Contia
Heterodon+Farancia 9
Sibynophiinae
Grayiinae
Ahaetulla+Dendrelaphis
Dasypeltis+Boiga
Scaphiophis+Oligodon
Coelognathus+Lytorhynchus
Oxybelis+Sympholis
Lycodon+Gonyosoma
Archelaphe
Euprepiophis
Oreocryptophis
Orthriophis
Rhinechis+Zamensis
Elaphe
Coronella+Oocatochus
Senticolis
Rhinocheilus+Bogertophis
Pituophis
Pantherophis+Pituophis 10
UNSM 125457
Pantherophis



Procerophis sahni
Lower Eocene (54 MYA)
Gujarat, India

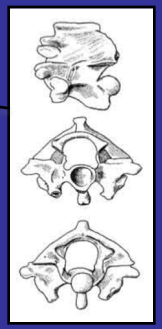


Elapid morphotypes 1 e 2
Upper Oligocene (24.95 MYA)
Nsungwe, Tanzânia

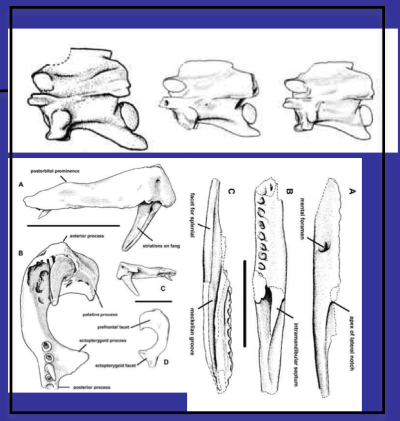


Coluber cadurci
Lower Oligocene (30.9 MYA)
Quercy, France

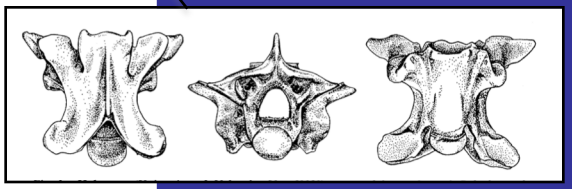
Naja romani
Lower Miocene (16.7 MYA)
Vieux-Collonges, France



***Laticauda* sp.**
Upper Oligocene/Lower Miocene (24 MYA)
Riversleigh, Australia



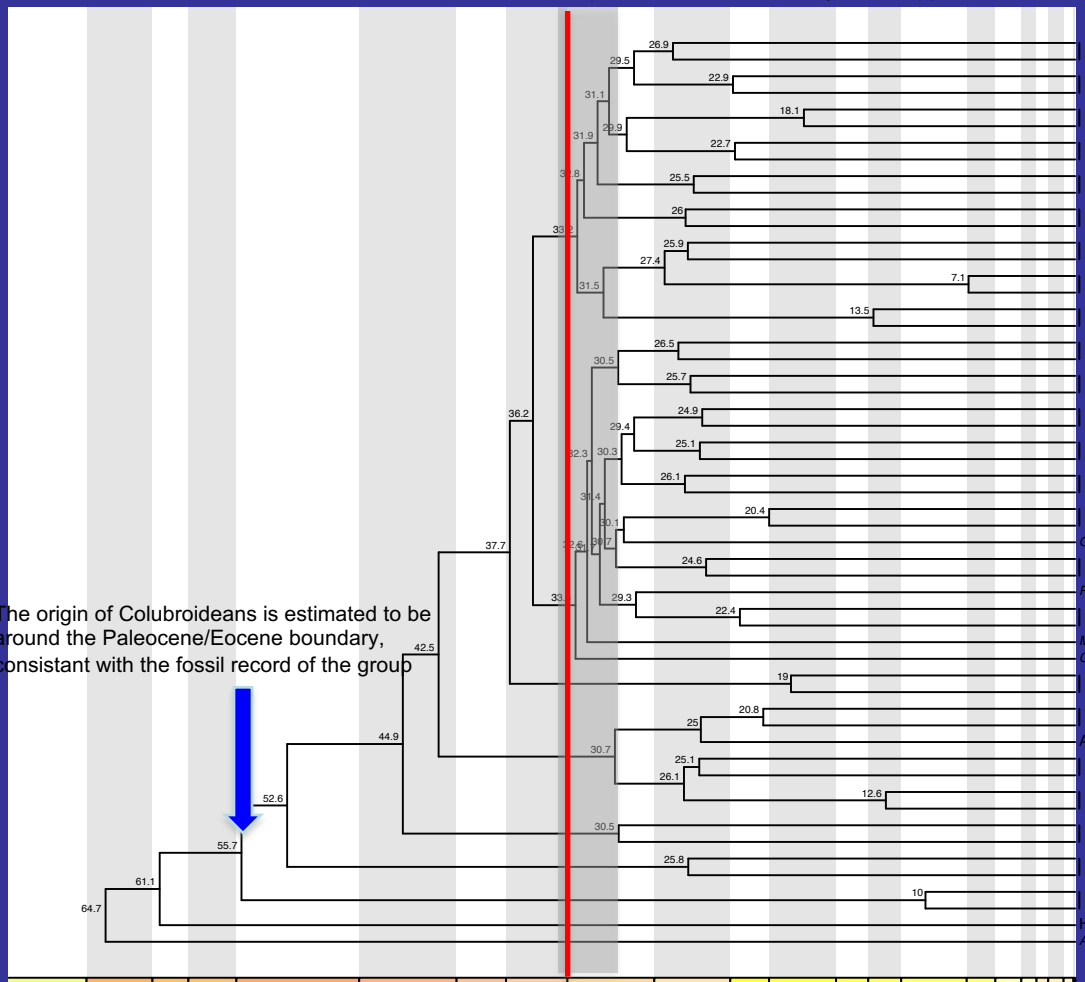
Incongruelaps iteratus
Upper Miocene (10 MYA)
Riversliegh, Australia



Paleoheterodon tiheni
Upper Miocene(12.5 MYA)
Brown County, Nebraska, U.S.A.

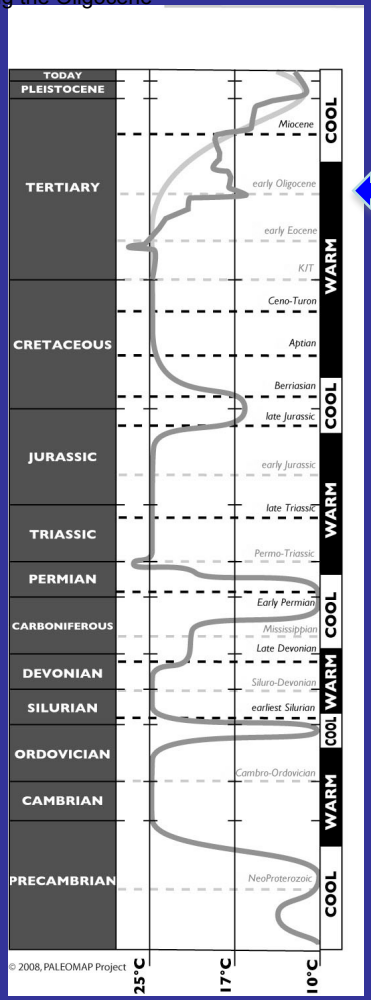
Summary of the time calibrated tree using TreePL and fossils

Extinction event at the end of the Eocene, the “Grande Coupure” was charaterized by the disappearance of a large number of squamate lineages



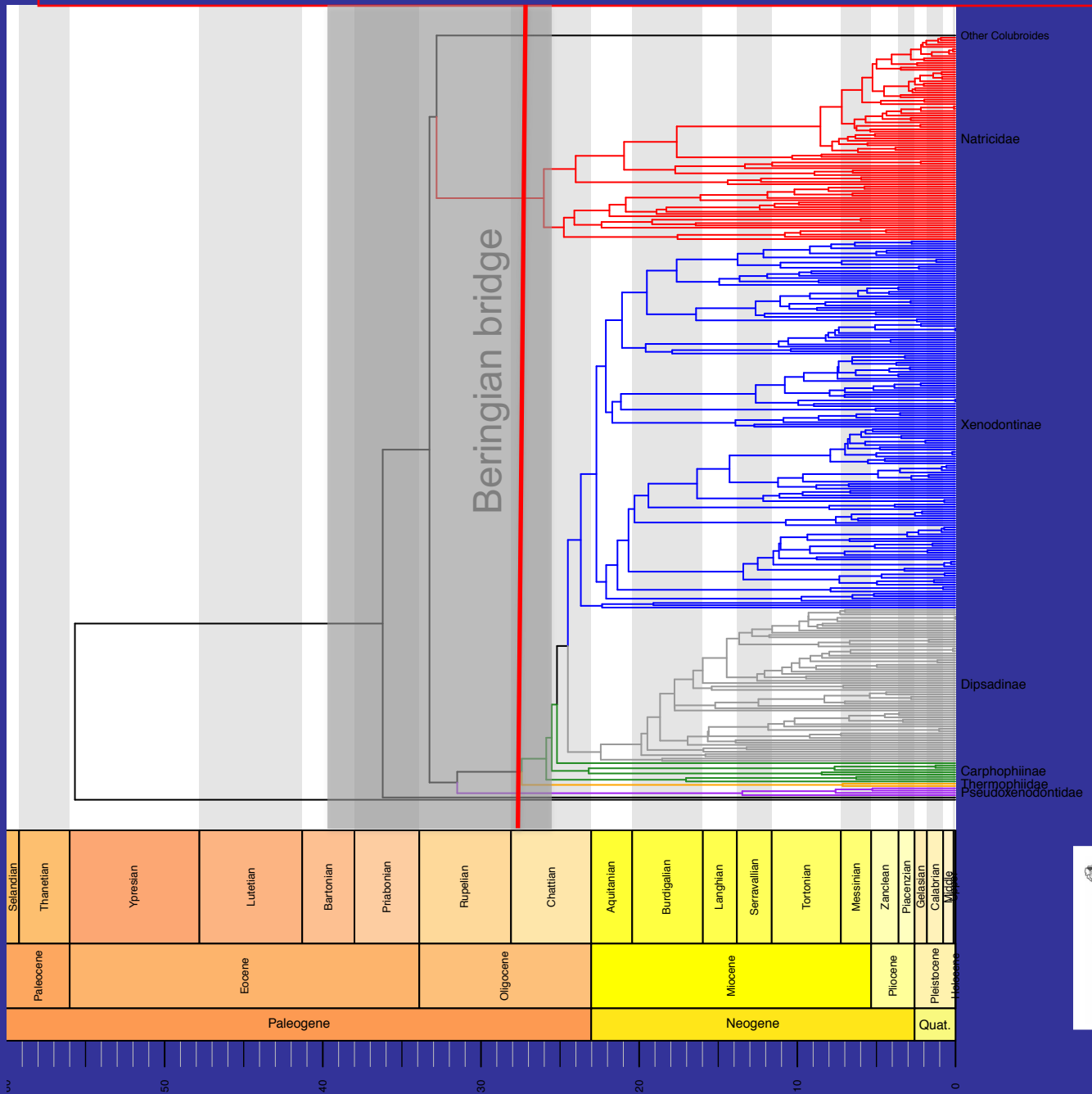
The origin of Colubroideans is estimated to be around the Paleocene/Eocene boundary, consistant with the fossil record of the group

Faunal turnover at the Eocene-Oligocene transition with the origin and diversification of new colubroidean lineages during the Oligocene



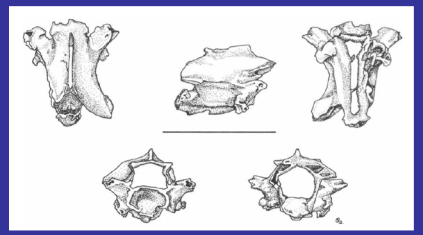
Dipsadidae originated in Asia and dispersed into North America and South America

- Fossils suggest an earlier dispersion into North America, in the Eocene. Well established in NA during the Oligocene. Asian origin not documented in the fossil record



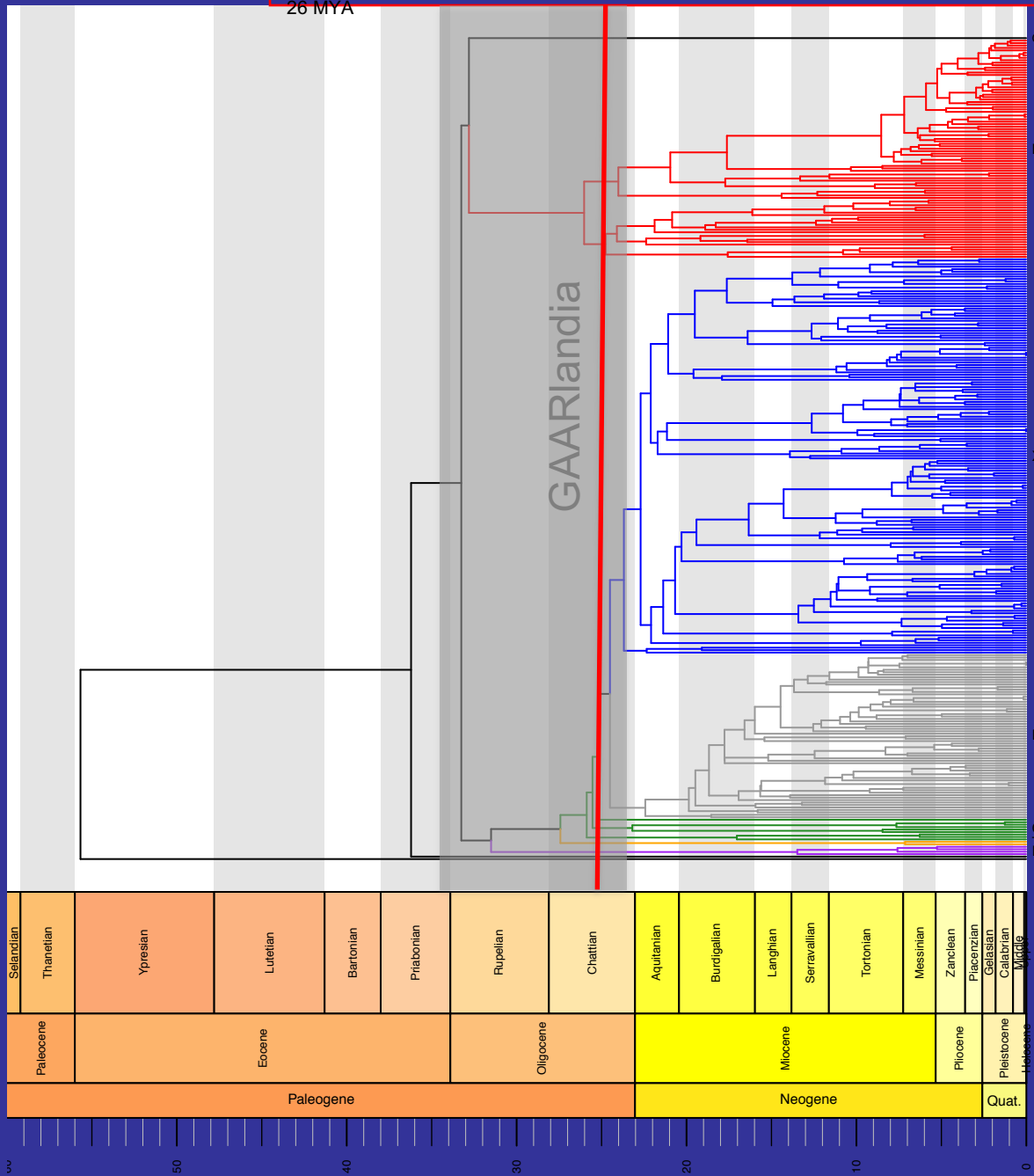
Oligocene (25 MYA) of NW North America (Blakey, 2014)

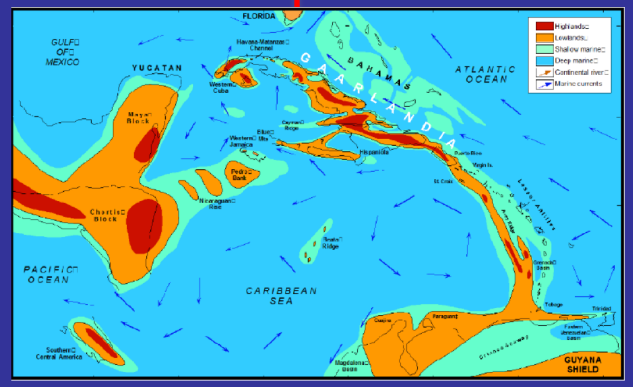
Eocene (40 MYA) of NW North America (Blakey, 2014)



Texasophis galbearthi
Lower Oligocene (32 MYA) of Colorado

Dipsadidade originated in North America in the Oligocene (27.4 MYA) and dispersed rapidly into South America through GAArlandia during the Late Oligocene 25-26 MYA



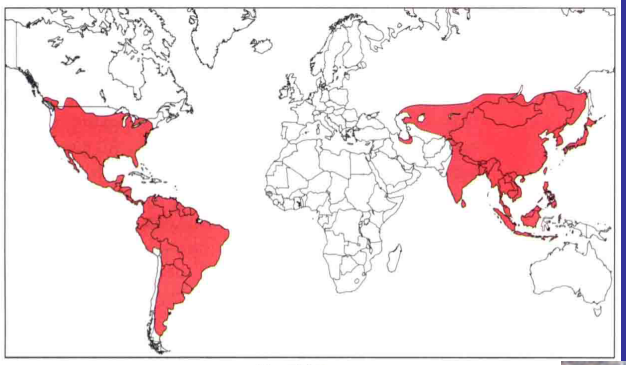


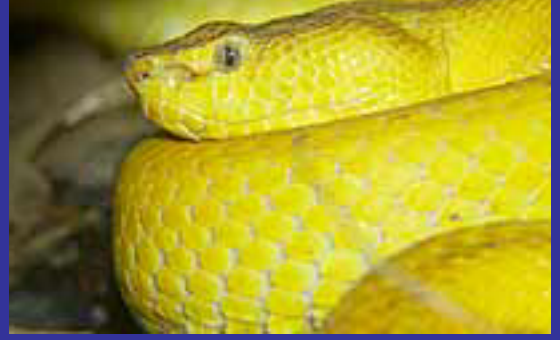
GAARlandia = “Great Antilles – Aves Ridge” Land Bridge

Late Eocene – Oligocene (35 – 25 MYA)

Tectonic uplift of the greater antilles in combination with the Aves ridge duraing the Eocene-Oligocene transition coupled with a dramatic sea-level fall formed an arc of land mass connecting Central and South America

Earliest “colubrid” record in the Early Miocene of Patagonia, Argentina, and Miocene of La Venta, Colombia


Viperidae
Crotalinae




Bothrops

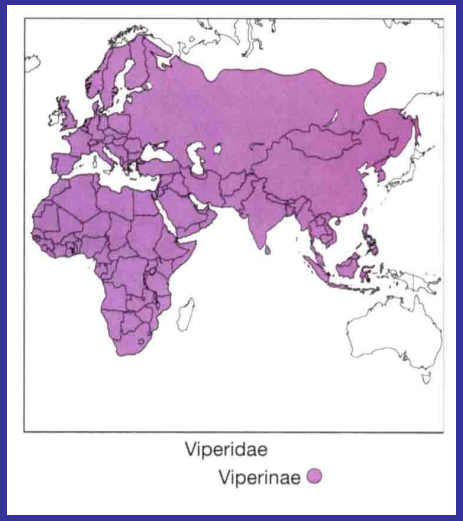

Bothrops

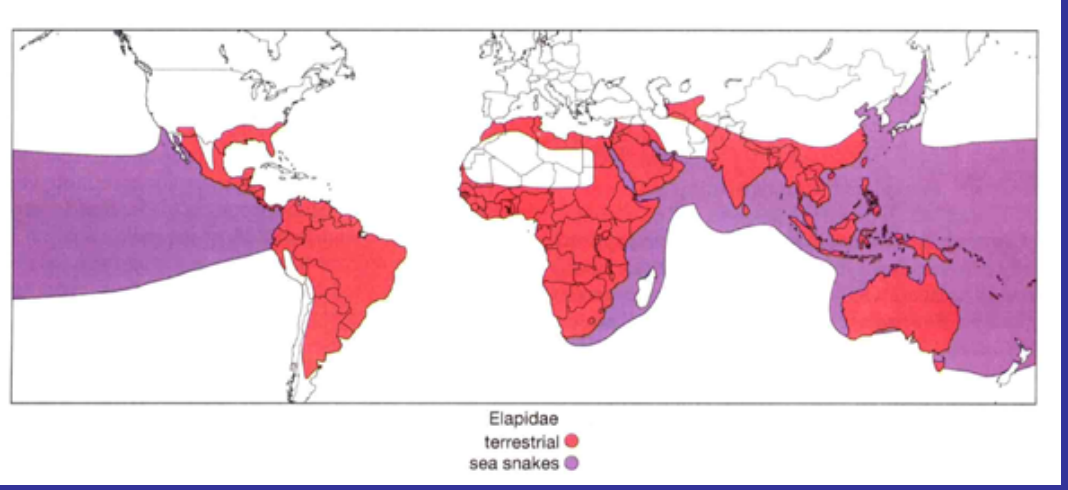

Bothrops


Lachesis


Crotalus

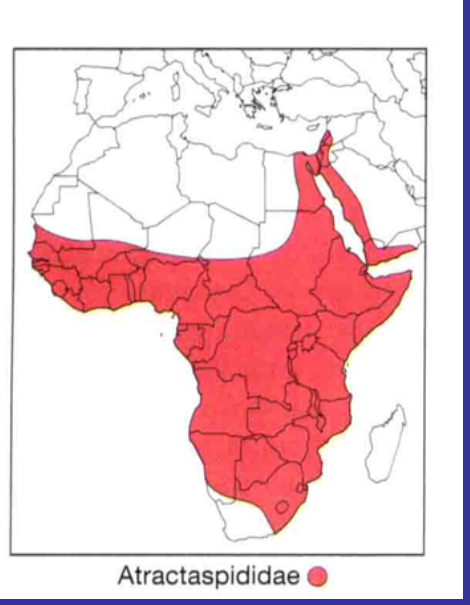

UltraSlo.com


Viperidae
Viperinae

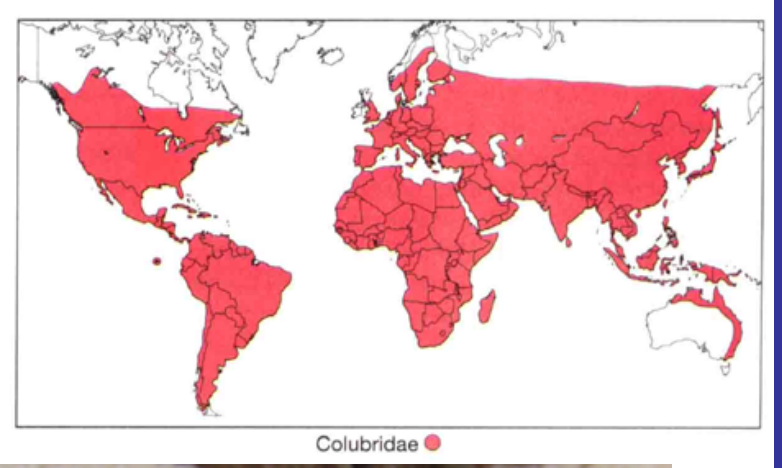

Elapidae
terrestrial
sea snakes

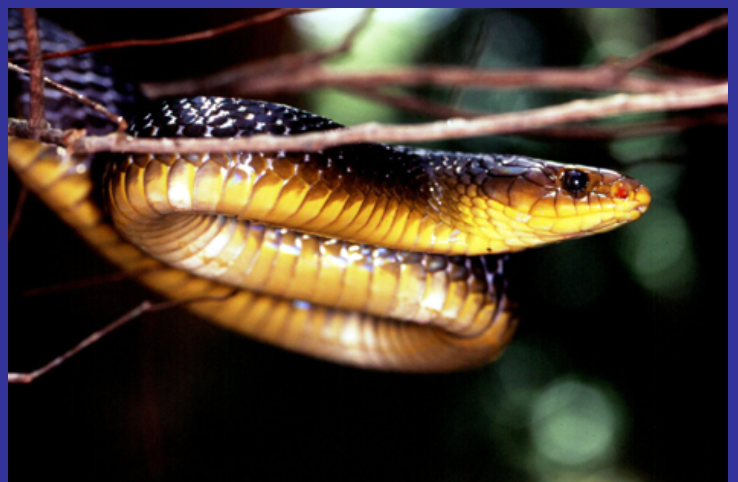

Micrurus

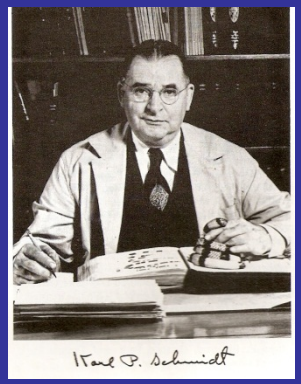
Atractaspididae



Colubridae



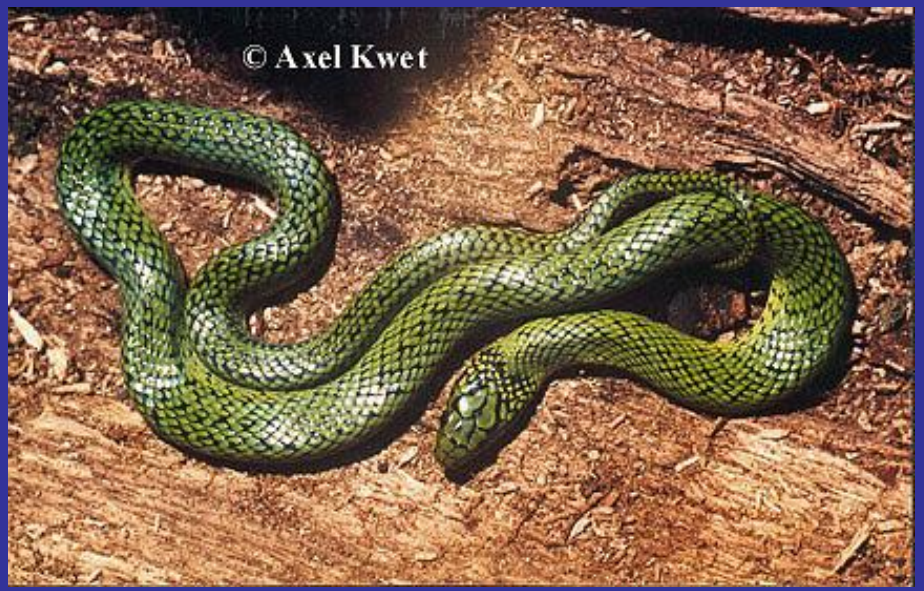




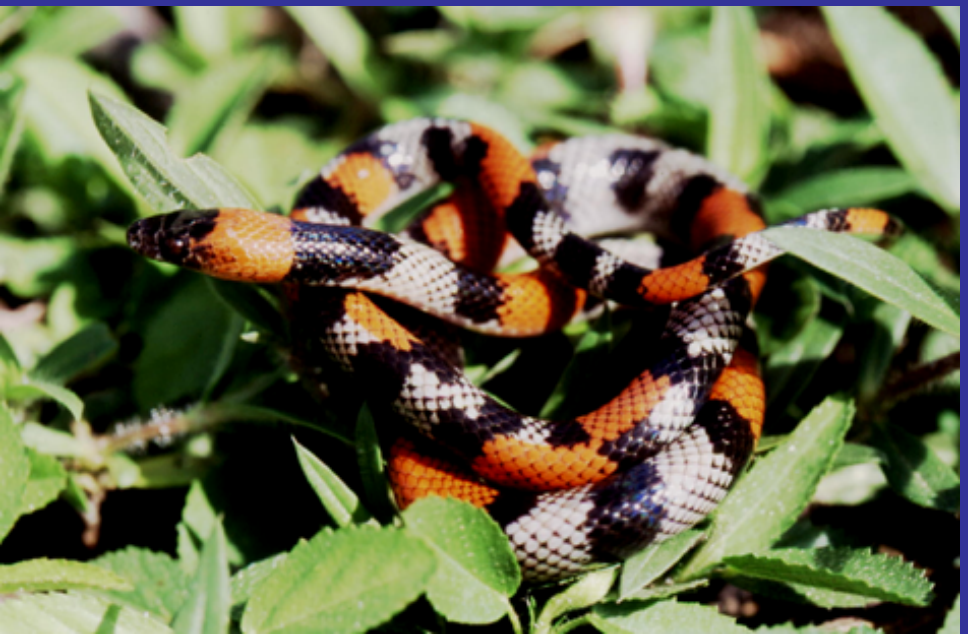
Dispholidus
+ Karl P. Schmidt

Thelotornis
+Robert Mertens

Rhabdophis tigrinus

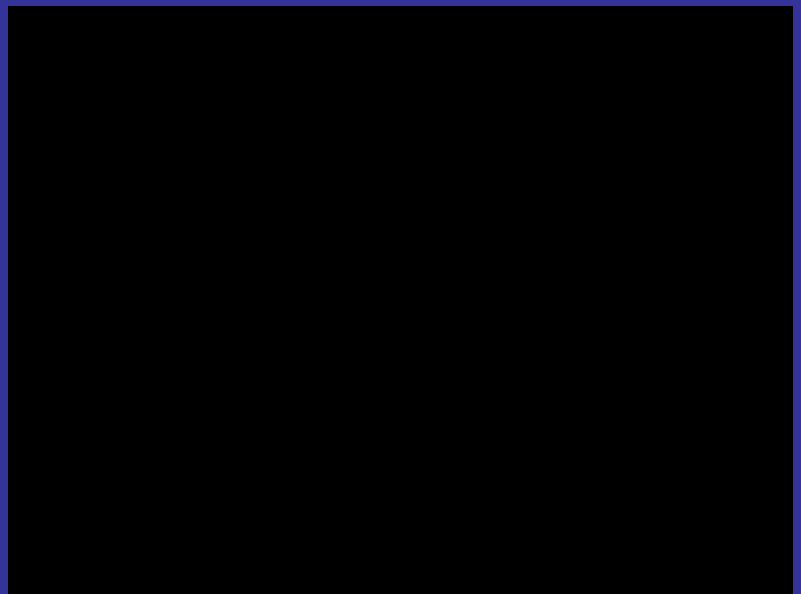


Pseudoboinae



Dipsadidae

Dipsadidae




Dibamidae
Gekkota
Scincoidea
Lacertoidea
Amphisbaenia
Polyglyphanodontidae
Iguania
Anguimorpha
Mosasauria
Serpentes
200Ma
150Ma
100Ma
50Ma