

CHAPTER 27

Amphibia

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Introduction. The Palaeozoic Amphibia ('Stegocephalia') are divided into two subclasses on the character of their vertebrae—the Labyrinthodontia and the Lepospondyli. The relationship of the three extant orders—Salientia, Urodela and Apoda—to the stegocephalians and to one another is a matter of debate.

The Salientia are often included with the labyrinthodonts as Apsidospondyli, while the Urodela and Apoda are included in the lepospondyls (Watson 1940, Romer 1947). A wider dichotomy is proposed by Jarvik (1942, 1965) who concludes that the urodeles (and possibly the Apoda) are descended from a group of rhipidistian fishes distinct from that which gave rise to the remaining Amphibia and all other tetrapods. This view has been opposed by Thomson (1962, 1964a, 1964b) amongst others.

The arrangement adopted here is based on the assumption that the living orders are fairly closely related to one another and may be grouped as the Lissamphibia (Parsons and Williams 1963). Evidence of the relationship of the Lissamphibia to the stegocephalians is unsatisfactory and it is therefore preferable to recognise three independent subclasses: Labyrinthodontia, Lepospondyli and Lissamphibia (Baird 1965).

Subclass LABYRINTHODONTIA Owen 1861

Order ICHTHYOSTEGALIA Säve-Söderbergh 1932

First, Dev Famenn or Carb Tourn: *Ichthyostega* and *Ichthyostegopsis* spp. Säve-Söderbergh 1932 and *Acanthostega gunnari* Jarvik 1952, Remigolepis Series, E. Greenland (Jarvik 1952, Westoll 1940). *Elpistostege watsoni* Westoll 1938, Dev Frasn, may be an ichthyostegid ancestor (fish or amphibian). *Otocrateria modesta* Watson 1929, Carb Viséan, may be an ichthyostegid. *Colosteus* and *Erpetosaurus*, Carb Moscov, are not ichthyostegids (Jarvik 1952, Romer 1947).

Last, all forms attributed to the Ichthyostegalia are noted above.

Constituent families: Ichthyostegidae Säve-Söderbergh; Acanthostegidae Jarvik.

Order TEMNOSPONDYLI Zittel 1889

(Classification, to families, as in Romer 1947 unless otherwise noted.)

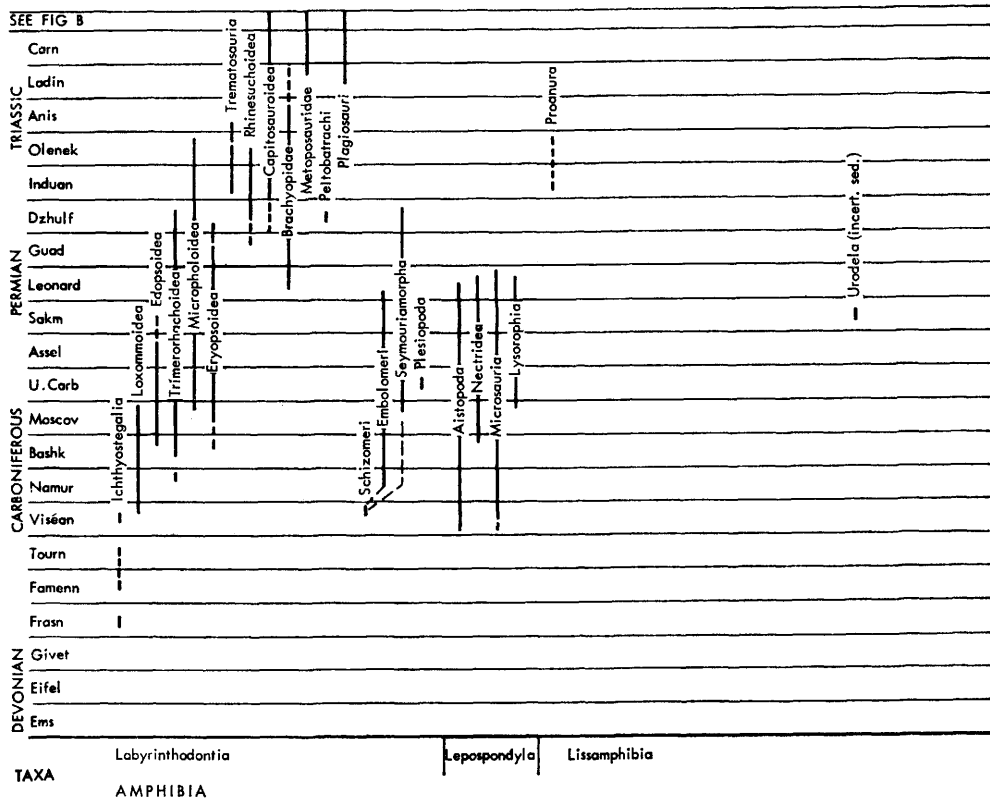
Suborder RHACHITOMI

Superfamily LOXOMMOIDEA

Family LOXOMMIDAE

First, Carb Viséan: *Loxomma allmanni* Huxley 1862, Gilmerton Ironstone, Scotland (Watson 1929).

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FIG. 27.1 A

Last, Carb Moscov: *Megalocephalus lineolatus* (Cope) and *M. sp.*, U. Freeport Coal, Linton, Ohio and Gaskohle, Nýřany, Czechoslovakia (Steen 1938, Baird 1957).

Superfamily EDOPSOIDEA

First, Carb Bashk: *Dendrerpeton acadianum* Owen 1853 (*Dendryazouza*, *Dendrysekos*, *Platystegos* are probably congeneric), Joggins Fm, Nova Scotia (Steen 1934, Baird 1962).

Last, Perm Assel or Sakm: *Edops craigi* Romer 1936, Moran Fm, Texas (Romar & Witter 1942).

Constituent families: Edopsidae, Carb Moscov-Perm Assel; *Dendrerpetontidae*, Carb Bashk; *Cochleosauridae*, Carb Moscov.

Superfamily TRIMERORHACHOIDEA

First, Carb Bashk: *Eugyrinus wildi* (Woodward 1891), Bullion Coal, Lancs., England (Panchen & Walker 1961). Smithsonian specimen U.S.N.M. 22576, Carb Namur, Hinton Shales, W. Virginia, is a possible trimerorhachoid (Romer 1941, Hotton, pers. comm.).

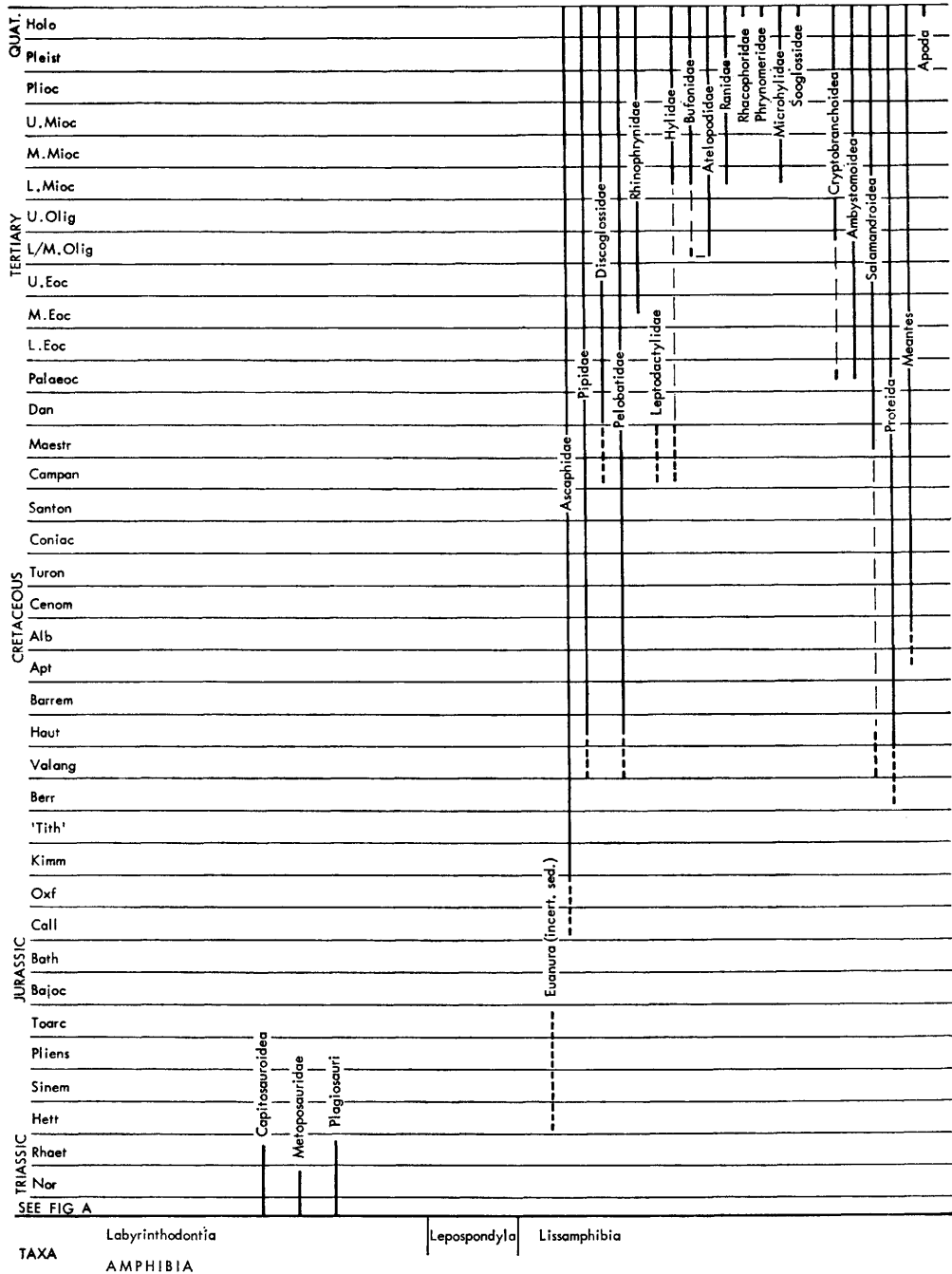
Last, Perm Dzhulf: *Dvinosaurus primus* Amalitsky 1924, Sarma Fm (Z. IV), Dvina Basin, U.S.S.R. (Bystrow 1938, Romer 1947).

Constituent families: *Peliontidae*, Carb Bashk-Carb Moscov; *Trimerorhachidae*, ?Carb Namur-Perm Guad; *Dvinosauridae*, Perm Dzhulf; ?*Colosteidae* Cope 1875, Carb Moscov.

Superfamily MICROPHOLOIDEA

First, Carb Moscov: *Potamochoston limnaios* Steen 1938, Gaskohle, Nýřany, Czechoslovakia (Steen 1938).

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FIG. 27.1 B

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Last, Trias Olenek: *Micropholis stowi* Owen 1876, Procolophon Z., S. Africa (Romer 1947).

Constituent families: Lysipterygiidae, Carb Moscov-Perm ?Sakm; Micropholidae, Trias Olenek; Chenoprosopidae, Carb Moscov-Perm Assel or Sakm; Archegosauridae, Perm Sakm or Leonard-Guad or Dzhulf.

Superfamily ERYOPSOIDEA

First, Carb Moscov: *Amphibamus grandiceps* Cope 1865, Nodule Bed, Mazon Creek, Illinois. *Arkanserpeton arcuatum* Lane 1932, Carb Bashk or Moscov, Paris Shale, Kansas may be an Eryopsoid (Dissorophid) (Carroll 1964).

Last, Perm Guad or Dzhulf: c.f. *Zygosaurus* Eichwald 1848 sp., Z. III, U.S.S.R. (Romer 1947).

Constituent families: Eryopsidae, Perm Assel-Sakm or Leonard; Trematopsidae, Perm Assel or Sakm-Leonard; Dissorophidae, Carb Bashk or Moscov-Perm Guad or Dzhulf; Zatrachydidae, Carb Moscov-Perm Leonard.

Suborder TREMATOSAURIA

Family TREMATOSAURIDAE

First, Trias Induan: *Gonioglyptus kokeni* Huene 1920, Prionolobus Z., India, and *Stoschiosaurus nielseni* Säve-Söderbergh 1935, "Eotrias", E. Greenland (Piveteau 1955).

Last, Trias Olenek or Anis: *Trematosuchus sobeyi* (Haughton 1915), Cynognathus Z., S. Africa (Piveteau 1955). [Not Anis, Fig. 27.1A.]

Suborder STEREOSPONDYLI

Superfamily RHINESUCHOIDEA

First, Perm Guad or Dzhulf: *Rhinesuchus avenanti* Boonstra 1940, *R. whaitsi* Broom 1908, *Rhinesuchoides tenuiceps* Olson and Broom 1937, Tapinocephalus Z., S. Africa (Romer 1947).

Last, Trias Olenek: *Sclerothorax hypselonotus* Huene 1932, Bunter, Hessen, Germany (Romer 1947).

Constituent families: Rhinesuchidae, Guad or Dzhulf-Dzhulf, Tapinocephalus-Endothiodon (?Kistecephalus) Z.; Lydekkerinidae, Trias Induan or Olenek, Lystrosaurus Z.; Uranocentrodontidae, Kistecephalus-Lystrosaurus Z.; Sclerothoracidae, Induan-Olenek.

Superfamily CAPITOSAUROIDEA

First, Perm ?Dzhulf: *Gondwanosaurus bijorensis* Lydekker 1885, Damuda Series, India (Romer 1947).

Last, Trias Rhaet: c.f. *Cyclotosaurus* ("Hercynosaurus" Jaekel 1914), Halberstadt, Germany. *Australopelor wadleyi* Longman 1941 is a jaw fragment ?capitosaur, ?Jur., Marburg Series, Queensland, Australia (Romer 1947).

Constituent families: Benthosuchidae, Perm Dzhulf-Trias Olenek; Capitosauridae, Trias Induan or Olenek-Rhaet.

Superfamily BRACHYOPOIDEA

General comments: The plagiosaurs have here been removed from the Brachyopoidea of Romer's (1947) classification in agreement with Nilsson (1939) and Panchen (1959). The remaining two families are probably not closely related, and are treated separately.

Family BRACHYOPIDAE

First, Perm Leonard: *Eobrachyops townendae* Watson 1956, Clear Fork, Texas (Watson 1956).

Last, Trias ?Ladin: *Pelorocephalus mendozensis* Cabrera 1944, Cacheuta Beds, Mendoza, Argentina (Romer 1947).

Family METOPOSAURIDAE

First, Trias Ladin: "*Trigonosternum latum*" Schmidt 1931, Lettenkohle, Thuringia, Germany (Romer 1947).

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Last, Trias Nor: *Metoposaurus diagnosticus* ("M. stuttgartiensis" Fraas 1913) Lehrbergstufe, nr. Stuttgart, Germany. All other metoposaurs are from the Keuper (s.s.) or Keuper equivalents, thus Carn-Nor (Colbert & Imbrie 1956, Romer 1947).

Order PLAGIOSAURIA Nilsson 1939

Suborder PELTOBATRACHI Panchen 1959

First and Last, Perm Dzhulf: *Peltobatrachus pustulatus* Panchen 1959, "Lower Bone Bed", Ruhuhu, Tanzania (Panchen 1959).

Suborder PLAGIOSAURI Jaekel 1914

Family PLAGIOSAURIDAE Romer 1947

First, Trias Ladin: *Plagiosuchus pustuloglomeratus* Huene 1922, Crailsheim Bonebed, U. Muschelkalk, Swabia, Germany. *Plagiosternum* (same locality and horizon) may not be a plagiosaur (Romer 1947, Panchen 1959).

Last, Trias Rhaet: *Gerrothorax rhaeticus* Nilsson 1934, above "L. Coal Measures", Scania, Sweden (Nilsson 1946).

Order ANTHRACOSAURIA Watson 1917

Suborder SCHIZOMERI Romer 1964

First and Last, Carb Viséan: *Pholidogaster pisciformis* Huxley 1862, Gilmerton Ironstone, Scotland (Romer 1964).

Suborder EMBOLOMERI Cope 1885

First, Carb Namur: "*Pholiderpeton*" *bretonense* Romer 1958, Pt. Edward Fm, Nova Scotia, also undescribed anthracosaur material Hinton Shales, W. Virginia (Romer 1941, 1963).

Last, Perm Leonard: *Archeria* Case 1915 sp., Clyde Fm, Clear Fork Group, Texas (Romer 1947, 1958).

Constituent families: the natural division of embolomeres into families requires new comparative treatment of the material.

Suborder SEYMOURIAMORPHA Watson 1917

First, Carb Moscov: *Diplovertebron punctatum* Fritsch 1889, Gaskohle, Nýřany, Czechoslovakia, and *Diplovertebron digitatum* (Cope 1875), U. Freeport Coal, Linton, Ohio (Romer 1947). *Diplovertebron* = *Gephyrostegus* = "*Solenodonsaurus*" of Pearson = *Eusauropleura*, non *Solenodonsaurus* Broili (Baird 1964 & per. comm.).

Last, Perm Dzhulf: *Kotlassia prima* Amalitsky 1921 Sarma Fm, (Zone IV) Dvina basin, U.S.S.R. *Buzulukia butsuri* Viushkov 1957, *Kotlassia* sp., Pronkino (Zone IV) Chkalov Province, U.S.S.R. *Bystrowiana permira* Viushkov 1957, Vyazniki (Zone IV), Vladimir Province, U.S.S.R. and *Kotlassia* spp. in Zone IV, other localities, U.S.S.R. (Bystrow 1944, Viushkov 1957, Olson 1957).

Constituent families: Diplovertebrontidae, Carb Moscov; Discosauriscidae, Perm Assel or Sakm-?Guad; Seymouriidae, Perm Assel or Sakm-?Guad; Kotlassiidae, Perm Dzhulf; ?Lanthanosuchidae Efremov 1947, Perm Guad; Waggoneriidae Olson 1951, Perm Leonard; Bystrowianidae Viushkov 1957, Perm Dzhulf. (Families as Romer 1947 or as stated).

Order PLESIPODA Eaton & Stewart 1960

First and Last, Carb U. Carb: *Hesperoherpeton garnettense* Peabody 1958, Rock Lake Sh, Stanton Fm, Garnett, Kansas (Eaton & Stewart 1960).

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Subclass LEPOSPONDYLI Zittel 1889

Order AISTOPODA Miall 1875

First, Carb Viséan: "*Ophiderpeton*" sp. of Stock 1882, L. Oil Shale Group, Wardie, nr. Edinburgh, Scotland (Baird 1964).

Last, Perm Leonard: *Phlegethontia* Cope 1981 sp., Arroyo Fm, Clear Fork Group, Fort Sill, Oklahoma (Baird 1964).

Constituent families: Ophiderpetontidae, Carb Bashk-U. Carb; Phlegethontiidae, Carb Bashk-Perm Leonard (Baird 1964).

Order NECTRIDEA Miall 1875

First, Carb Bashk: *Batrachiderpeton lineatum* Hancock & Atthey 1870 and *Keraterpeton reticulatum* (Hancock & Atthey 1869), Low Main Seam, Newsham, Northumberland, England (Piveteau 1955, Steen 1938).

Last, Perm Leonard: *Diplocaulus recurvatus* Olson 1952, Choza Fm, Clear Fork Group, Texas (Olson 1958).

Constituent families: Lepterpetontidae, Carb Bashk-?Perm Assel or Sakm; Keraterpetontidae, Carb Bashk-Perm Leonard; Urocordylidae, Carb Bashk-Perm Assel or Sakm (Piveteau 1955, Olson 1958).

Order MICROSAURIA Dawson 1863

First, Carb Viséan: *Dolichopareias disjectus* Watson 1929, Burdiehouse, Scotland. An earlier unnamed lepospondyl, Carb Viséan, Pumpherstons No. 3 Curley Shale, Scotland, may also be a microsauro (Westoll 1951).

Last, Perm Leonard: *Gymatorhiza kittsi* Olson & Barghusen 1962, Flowerpot Fm, Kingfisher Co., Oklahoma (Olson & Barghusen 1962).

Constituent families: Dolichopareiidae, Carb Viséan; Adelogyrinidae, Carb Viséan; Microbrachidae, Carb Bashk-Moscov; Gymnarthridae, Perm Sakm-Leonard (Piveteau 1955).

Order LYSOROPHIA Williston 1908

Family LYSOROPHIDAE

First, Carb Moscov; *Cocytinus gyrioides* Cope 1871, *Molgophis* Cope 1868 sp. (? = *Pleuroptyx clavatus* Cope 1875), U. Freeport Coal, Linton, Ohio (Steen 1931).

Last, Perm Leonard: *Lysorophus ?tricarinatus* Cope 1877, Choza Fm, Clear Fork Group, Texas (Olson 1958).

Subclass LISSAMPHIBIA Haeckel 1866

Order SALIENTIA Laurenti 1768 (ANURA Duméril 1806)

Suborder PROAN(O)URA Piveteau 1937

First and Last, Trias "L. Trias" ? stage (derived): *Protobatrachus massinoti* Piveteau 1937, Madagascar (Piveteau 1955). *Amphibamus* (= *Miobatrachus* = *Mazonerpeton*), ("Suborder Eoanura", Romer 1945) Carb Moscov, is not a salientian or, probably a salientian ancestor (Gregory 1950). Possible salientian footprints occur Perm Leonard, Eccca Fm, S. Africa (Griffiths 1963).

Comment: unique *Protobatrachus* type may be a larval form, thus questionably separable from other Anura (Griffiths 1963), or possibly not related to other Anura (Hecht 1962).

Suborder EUAN(O)URA Piveteau 1937

General Comments: The accepted major subdivisions of the Euanura are unsatisfactory: recent families as in Griffiths 1963. In the present state of knowledge all fossil frogs not referable to extant families must be *incertae sedis* (Griffiths 1963, Hecht 1963).

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Family INCERTAE SEDIS

First, Jur "Lias": *Vieraella herbstii* Reig 1961, Roca Blanca Fm, Patagonia, Argentina (Reig 1961).

Family ASCAPHIDAE Fejérváry 1923

First, Jur ?Call or Oxf: *Notobatrachus deguistoi* Reig 1957, Matilde Fm, Patagonia, Argentina (Griffiths 1963). **Extant.**

Family PIPIDAE Günther 1858

First, Cret ?Valang: unnamed pipid Nevo 1956, Lacustrine deposits, Makhtesh Ramon, Negev, Israel (Nevo 1956, 1964, Griffiths 1963 Addendum). *Eobatrachus agilis* Marsh 1887, Jur Kimm or "Tith", may be a pipid (Hecht & Ester 1960). **Extant.**

Family DISCOGLOSSIDAE Günther 1858

First, Cret "late Cret.": unnamed discoglossid, Wyoming (Hecht 1963). *Eodiscoglossus santoniae* Villalta, U. Jur. N. Spain may be discoglossid or ascaphid (Hecht 1963). **Extant.**

Family PELOBATIDAE Lataste 1879

First, Cret ?Valang: unnamed ?pelobatid tadpole Nevo 1956, Lacustrine deposits, Makhtesh Ramon, Negev, Israel (Nevo 1956, 1964). Pelobatids may also occur in the late Cret. of Wyoming (Hecht 1963). **Extant.**

Family RHINOPHRYNIDAE Günther 1858

First, Tert M. Eoc: *Eorhinophrynus septentrionalis* Hecht 1959, locality 5, late Bridgerian, Tabernacle Butte, Wyoming (Hecht 1959). **Extant.**

Family LEPTODACTYLIDAE Stejneger & Barbour 1917

First, Tert L. Eoc: *Eophractus casamayorensis* Schaeffer 1949, "Bird Clay", Casamayoran Stage, nr. Pass Niemann, Argentina (Schaeffer 1949). *Comobatrachus aenigmatis* Hecht & Estes 1960, Jur Kimm or "Tith", may have leptodactylid affinity also leptodactylids may also occur in late Cret., Wyoming (Hecht 1963, Hecht & Estes 1960). [Not Cret, Fig. 27.1B]. **Extant.**

Family HYLIDAE Günther 1858

First, Tert L. Mioc: *Hyla goini* Auffenberg 1956 and *Proacris mintoni* Holman 1961, Thomas Farm deposits, Hawthorne Fm, Gilchrist Co., Florida (Auffenberg 1956, Holman 1961). Hylids may possibly occur in the late Cret. of Wyoming (Hecht 1963). **Extant.**

Family BUFONIDAE Hogg 1841

First, Tert L. Mioc: *Bufo praeivius* Tihen 1962, Thomas Farm deposits, Hawthorne Fm, Gilchrist County, Florida (Tihen 1962). *Neoprocoela edentata* Schaeffer 1949, Tert L. Olig, Argentina, has been interpreted as a bufonid (Tihen 1962). **Extant.**

Family ATELOPODIDAE Fitzinger 1843

First, Tert L/M.Olig: *Neoprocoela edentata* Schaeffer 1949, Sarmientan Group, Sierra Canquel, Patagonia, Argentina (Schaeffer 1949, Griffiths 1963). This species, though probably an atelopodid ancestor, has been interpreted as a bufonid. (*Bufo edentatus* Tihen) and a leptodactylid (Tihen 1962, Hecht 1963). **Extant.**

Family RANIDAE Linn. 1758

First, Tert L. Mioc: *Rana* sp. ("pipiens group") Thomas Farm deposits, Hawthorne Fm, Gilchrist County, Florida (Auffenberg 1956). **Extant.**

Family RHACOPHORIDAE

No known fossil record.

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Family PHRYNOMERIDAE

No known fossil record.

Family MICROHYLIDAE Günther 1858

First, Tert L. Mioc: *Microhyla* sp., Thomas Farm deposits, Hawthorne Fm, Gilchrist Co., Florida (Auffenberg 1956). **Extant.**

Family SOOGLOSSIDAE Griffiths 1963

No known fossil record.

Order URODELA Fischer 1813 (CAUDATA Duméril 1806).
(Classification as in Noble 1931).

Suborder INCERTAE SEDIS

First, Perm Sakm: ?urodele vertebrae etc. in coprolite, Cutler Fm, Welles Quarry, Arroyo de Agua, Rio Arriba Co., New Mexico (Vaughn 1963).

Suborder CRYPTOBRANCHOIDEA Dunn 1922

First, L/M. Olig: *Andrias scheuchzeri* (Holl 1831), "Blätterkohle", Bonn, Germany (Westphal 1958). *Wolterstorffiella wiggeri*, Tert Palaeoc, has been interpreted as a cryptobranchoid (hynobiid). **Extant.**

Constituent families: Cryptobranchidae, Tert L/M. Olig-Holo; Hynobiidae, ?Tert Palaeoc-Holo.

Suborder AMBYSTOMOIDEA

Family AMBYSTOMATIDAE Hallowell 1858

First. Tert Palaeoc, *Ambystomichnus montanensis* (Gilmore 1928), Fort Union beds, Bear Butte, Sweetgrass Co., Montana (Peabody 1954), and *Wolterstorffiella wiggeri* Herre 1950, Walbeck, Germany (Herre 1950). **Extant.**

Suborder SALAMANDROIDEA Cope 1890

First, Cret Maestr: *Opisthotriton kayi* Auffenberg 1961, Lance Fm, Niobrara Co., Wyoming (Auffenberg 1961). Specimens from Cret ?Valang, Negev, Israel, may be salamandroids (Nevo 1964). **Extant.**

Constituent families: Salamandridae, Cret Maestr-Holo; Plethodontidae, Tert Palaeoc-Holo; Amphiumidae, Pleist-Holo (Goin & Goin 1962).

Suborder PROTEIDA Cope 1866

Family PROTEIDAE Tschudi 1839

First, Cret Berr or Valang: *Hylaeobatrachus croyii* Dollo 1884, Wealden facies, Bernissart, Belgium (Piveteau 1955). *Comonecturoides marshi*, Jur Kimm or "Tith", Quarry Nine, Como Bluff, Wyoming may be a proteid (Hecht & Estes 1960). **Extant.**

Suborder MEANTES Linn. 1766

Family SIRENIDAE Gray 1825

First, Cret Apt or Alb: *Prosiren elinorae* Goin & Auffenberg 1958, Trinity beds, nr. Forestburg, Montague Co., Texas (Goin & Auffenberg 1958). **Extant.**

Order APODA Oppel 1811 (GYMNOPHIONA Müller 1831)

Family CAECILIDAE Hoffman 1878

No known fossil record.

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