

Taking up the cudgels for paraphyletic taxonomy

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Classical Linnéan taxonomy requires natural groups of organisms based on hierarchically ordered grades of similarity. In contrast, cladistic phylogeny since Hennig is a method that recognizes and diagnoses natural groups by objective arguments. Modern taxa supported by cladistics are additionally required to be monophyletic. Due to this claim many established and approved terms have to be given up. But because of their practical usage, two sets of terms exist simultaneously: the correct taxonomical terms, and paraphyletic names. There is then a problem with taxonomical praxis for many who don't primarily work on systematics. Because of the status of phylogeny and taxonomy as an ancillary discipline, it is contrary to intention when linguistic ballast is necessary to fulfill theoretical dogmatism. - At first, paraphyla are natural groups, having a single common ancestor, and thus being a case of monophyly. This is never disputed by having descendants that obviously have left a formerly dispositive feature set (gestalt). Every paraphylum was once a pure monophylum. The claim, that the recent time of observation forces inclusion of all known branches, has no philosophical justification, as the observer should be irrelevant. In praxis, many paraphyletic stem groups, the „unwanted children“ of modern phylogeny, build reasonable terms. They can be diagnosed objectively by excluding the descendants, if those build a sister group or not. Every definable type of gestalt should allow a taxon (of course without an artificial ranging of sub-, intra- and superfamilies). Real evolution is well described, if a more primitive anatomical and ecological stage is gathered within one term. To give an example, there is the pelycosaur problem. The word „Pelycosauria“ is well known and definable, only rejected by its paraphyletic condition. The fact that it is used in many publications attests to its reliability. Correct formulation requires „stemgroup synapsids“, „basal synapsids“, „pelycosaur-grade synapsids“ or „non-therapsid synapsids“ This is increased if dealing with sphenacodonts, producing „non-therapsid sphenacodonts“, although nobody uses „sphenacodont“-words for any therapsid or mammal. (Additionally, „Pelycosauria“ is an invalid designation, whereas „Eupelycosauria“ is valid.) To discuss lower levels, say that a clade is [A+B(sp.1)]+B(sp.2). In consequence, one genus is not valid anymore, but there is no reason why the renaming (depending on a particular phylogenetic interpretation) describes evolution in a better way. Considering B a true stage from which A has strongly derived, justifying a new genus, would be the same, but without renaming. Dealing with historical

synonyms is often exhausting and should be minimized for the future. - Admitting paraphyletic taxa is justified by phylogeny itself, as long as abiding by binomials. The stem line of a clade consists of real populations that theoretically could be binomially named. Be it that we could recognize a species as plotting on the stem line (never to be done with real diagnoses!), all descendants had to carry its binomen, from species to class level. This is the point - hierarchical Linnéan thinking is still widespread in a subtle way. Besides that, the proven method of binomial taxa is a reason not to overact with phylogenetic dogmata. Also some higher levels, if used judiciously, are a good tool to describe diversity and diversification. „Families“ and „Classes“ are soft and artificial, but not totally abstract (within a narrow stratigraphical window!). Taxonomy must be user-friendly. Linné and Hennig, both with their strengths and weaknesses, may yet come to an arrangement.

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Preservation of tetrapod skin in the Triassic Madygen Formation

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Excavations carried out in the lacustrine shales of the Kyr-gyz Madygen Formation, a terrestrial succession of Middle to early Late Triassic age, yielded, among others, a rich floral assemblage, a highly diverse entomofauna including fossil insects with fully preserved bodies, and rare fossils of „enigmatic“ small reptiles with skin preservation. In the previously described specimens the surface relief of the skin is conserved as an impression surrounding the skeletal remains. In case of the controversially discussed *Longisquama* both sides of the elongated integumentary appendages are imprinted in the fine-grained sediment and separated by a sedimentary core. These observations are in agreement with an early diagenetic cementation process active at the time of decay.

Here we discuss the recent find of a reptile fossil which displays a skin colouration pattern superimposed on a detailed scalation relief. Indicative for a substantial preservation of certain skin parts, the presence of a colouration pattern is not entirely surprising given the conspicuous wing colouration of certain previously described insects from the same locality and stratigraphic level. The laterally compressed reptile specimen includes the skull, neck, and anterior thorax surrounded by scale impressions whose

outlines mark the presence of a prominent throat pouch. The ventral scales have sizes of up to 2.5 mm, polygonal morphologies, and their relief displays no clear overlapping pattern typical for squamate scales. Dorsally the scales are generally smaller, but conspicuous craniocaudal rows of large oval to rectangular scales occur within the meshwork of smaller scales. The reddish preserved skin colouration follows no simple pattern: There is a larger colour patch along the posterior margin of the skull, the ventral neck and anterior trunk display scales with tiny colour spots, and the dorsal rows of larger scales are sometimes marked by thin aligned stripes. Apart from ecological and functional implications the skin fossils of the Madygen Formation yield the rare possibility to acquire data concerning the evolution of integument in basal diapsids of the Triassic.

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The evolution of freshwater stingrays (Myliobatiformes, Potamotrygonidae) revisited

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Extant stingrays (Myliobatiformes) form a monophyletic group characterized *inter alia* by one to several serrated tail spines. The monophyly also is supported by molecular studies. However, despite all progress accomplished in the last years, the phylogenetic relationships among the major lineages of myliobatiforms are still poorly resolved, and there is a lack of consensus regarding composition of some myliobatoid families. Additionally, the evolutionary history of South American Potamotrygonidae, which is the only group of myliobatiforms that adapted completely to freshwater conditions remains ambiguous. This is mainly because of the lack of fossils and because their sister group remains unsettled, with both *Urobatis* and *Himantura* being candidates. Potamotrygonidae includes four living genera, *Heliotrygon*, *Paratrygon*, *Plesiotrygon*, and *Potamotrygon*. The fossil record of freshwater stingrays is very patchy and includes rare isolated bucklers, tubercles, spines, and oral teeth occurring in the Middle Miocene of central Colombia, the Late Miocene of Brazil and the Late Miocene of Argentina. These very patchy

occurrences may indicate a time of origination in the early Neogene, probably related to extrinsic factors such as plate tectonics (uplift of Andes, closure of marine connections). Nevertheless, one must caution the use of rare fossils to reconstruct evolutionary events.

Based on all available information, the origination of Potamotrygonidae generally is assumed to have occurred in the Late Cretaceous or Palaeogene during one of several marine transgressions into the Amazonian Basin. Their common ancestor most likely was trapped in isolated freshwater habitats by subsequent orogenic events during the Palaeocene-Miocene (65–23 Ma). Different hypotheses exist from where stingrays invaded continental habitats. One hypothesis assumes that an ancestral stingray population immigrated from the Pacific into an inland sea. The inland rivers subsequently were blocked in the course of the Andean orogeny in the early Mesozoic. Nevertheless, this hypothesis underestimates the age of the Atlantic Ocean and opening of the proto-Caribbean. Consequently, a marine stingray population could have immigrated from northern South America or along the eastern coast. Evidence for a northern invasion includes the discovery of marine deposits in Ecuador, Colombia, Venezuela, and the Guyanas. The southernmost records of marine fossils are from Peru and Brazil. Additionally, three different evolutionary scenarios are conceivable: (1) change from a marine to euryhaline lifestyle in the ancestor of the clade including *Himantura* + *Potamotrygon* and then a second change to a freshwater lifestyle in the *Potamotrygon* lineage (the *Himantura fluviatilis* complex includes three species, which may be synonymous.); (2) the ancestor of the *Himantura* + *Potamotrygon* clade also was marine and each lineage made an independent change to a euryhaline (*Himantura*) or a freshwater (*Potamotrygon*) lifestyle, respectively; and (3) direct change from a marine to freshwater lifestyle in the ancestor of the *Himantura* + *Potamotrygon* clade, and then a second change to euryhaline lifestyle in the *Himantura* lineage. If *Paratrygon* represents the most basal potamotrygonid, it might have been the first true freshwater member of this group and the onset of their successful radiation. The hypothesis that evolution from a marine to freshwater lifestyle passed through a euryhaline intermediate only is applicable if one assumes a priori that freshwater adaptation occurred from marine through an euryhaline to a freshwater lifestyle, which would be a circular argumentation. Although we can't provide a final conclusion to the problem, we favour the third hypothesis although slightly modified.

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