

NEW PHYLOGENY OF LITOPTERNA AND “ARCHAIC” PALEOGENE UNGULATES ENLIGHTENS THE INTERFAMILIARY AFFINITIES WITHIN THE ORDER

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South American Ungulates (SANUs) exhibit astonishing morphological and ecological diversity due to their almost complete isolation during their early evolution. This unique diversity coupled with the limited fossil record of their earliest evolution makes it difficult to establish their phylogenetic position within the placental mammal tree. Litopterna is the second most diverse order of SANUs after only Notoungulata, with species ranging from the middle Paleocene (~63 Ma) to the late Pleistocene. Among SANUs, litopterns are characterized by having cursorial limbs similar to Holarctic groups like Perissodactyla. Currently there are 67 genera of litopterns grouped into nine families, and the affinities of the Paleogene families remain unclear. Furthermore, it is unclear how litopterns are related to older groups of “archaic” Paleogene ungulates of South America (Kollpaninae and Didolodontidae) and North America (e.g., Mioclaenidae), and other SANUs.

To test the phylogenetic relationships of Litopterna, we assembled a new morphological matrix with ~1000 craniodental and postcranial characters for 79 taxa. The data were subjected to Bayesian and maximum parsimony analyses. We conducted tip-dated and undated Bayesian analyses using a Mk + G model of morphological evolution. Fifty percent majority rule consensus trees were obtained from the sampled trees from each analysis. The parsimony analysis resulted in ten most parsimonious trees and a strict consensus was computed. The consensus trees derived from the different analyses were largely congruent. A traditional monophyletic Litopterna failed to be recovered as Protolipternidae was closely related to Didolodontidae. Litopterna was found more closely related to Kollpaninae than to North American Mioclaenidae, and Kollpaninae did not form a monophyletic group with the latter. Adianthidae and Indaleciidae were found in a relatively basal position within Litopterna. Macrauchenidae was found as a sister group to Proterotheriidae, whereas Anisolambdidae was the sister group of Sparnotheriodontidae, these four families forming a monophyletic group. By utilizing a more comprehensive approach, these results alter previous conceptions of the intrafamilial affinities within Litopterna and their position among other Paleogene ungulates, shedding new light on how litopterns evolved and diversified during the Paleogene of South America.

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