

## ANALYSIS OF INTRAMEMBRAL PROPORTIONS IN ENDEMIC SOUTH AMERICAN UNGULATES AND COMPARISON TO MODERN TAXA

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Prior to the Great American Biotic Interchange (GABI), the South American mammal fauna included several groups of ungulate-like mammals. Comprised of orders such as Astrapotheria, Litopterna, and Notoungulata, these endemic ungulates were all extinct by the end of the Pleistocene. Due to the lack of living members, these ungulates have been compared to a variety of more distantly related extant taxa; astrapotheres have been likened to rhinocerotids and hippopotamids; litopterns have been compared to equids, bovids, and camelids; and notoungulates (the most diverse group) have been compared to taxa ranging from rodents and leporids to rhinocerotids and hippopotamids. One aspect of endemic ungulate morphology that has not typically been taken into account in such comparisons are limb intramembral proportions. In this study, we explored how intramembral proportions of these endemic ungulates compare to those of their presumed modern analogs in order to determine which modern species had limb proportions most similar to extinct South American ungulates. We gathered length measurements of forelimb bones (humerus, radius, metacarpal III) and hind limb bones (femur, tibia, metatarsal III) from the literature for 25 species of endemic ungulates (10 families in 3 orders) and compared them to measurements of 365 species of extant mammals from 66 families and 18 orders. Two exploratory principal components analyses (PCAs) were conducted to assess variation among species. The first PCA utilized untransformed measurements to determine variation in absolute limb segment length and permit comparisons of overall size. The second PCA used standardized length measurements (i.e., residuals from regressions of length measurements on PC1 from a PCA of log-transformed data) to explore limb length variation independent of body size. We used ternary plots of forelimb and hind limb proportions to compare intramembral proportions among taxa. Our analyses indicate that the limb proportions of many endemic ungulates are unlike those of the species to which they have traditionally been compared. For example, notoungulates plot equally close to carnivorans and rodents (far from extant ungulates); astrapotheres plot far from all sampled taxa; and litopterns are generally more similar to carnivorans, suids, and rhinocerotids than bovids, camelids, or equids. Our study highlights the unusual anatomy of extinct South American ungulates and suggests that limb proportions should be taken into account along with body size and presumed dietary niche when describing the appearance and ecology of these species to non-specialists and the general public.

