These features appear more specialized than those of previously known forms, allowing us to recognize the presence of a new taxon representing, for the moment, the youngest member of the Indaleciidae.

HINDLIMB EVOLUTION AND LOCOMOTION IN LITOPTERNA

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Many mammals use the horse gallop or leaping gait to increase speed or endurance. Those that use the horse gallop (equids, large ruminant artiodactyls) elongate the distal limb and have a high metatarsal-femur ratio (Mt/F). Those that use a leaping gait (carnivorans, other artiodactyls) usually lengthen the entire limb, especially the tibia. Unexpectedly, extinct litopterns have Mt/F ratios like digitigrade carnivorans rather than extant ungulates, even though all were unguligrade and some were monodactyl. Long proximal phalanges have been proposed as an alternative mechanism for foot elongation (cursoriality) in some members of this group. We tested this hypothesis by qualitatively analyzing litoptern hindlimb functional morphology and quantitatively comparing limb bone lengths in litopterns to 153 extinct and 82 extant mammals representing nine orders. For the quantitative comparison, we used several indices, a simple correspondence analysis and Daggs body shape method. Relative proximal phalanx length, measured by (Mt+PP3)/F, increases over time in proterotheriids but remains unchanged or decreases over time macraucheniids. However, this ratio does not distinguish mammals using the horse gallop from those using the leaping gait, since some carnivorans and small artiodactyls use both. Relative tibia length (T/F) tends to be greater in artiodactyls and small proterotheriids than in perissodactyls and macraucheniids, probably more related to size than function. The proterotheriid distal tibia differs from that of both perissodactyls and artiodactyls; the extreme reduction of the medial malleolus is more like that of cursorial rodents (*e.g.*, *Dolichotis*). The tarsus of litopterns is also more like of rodents and artiodactyls than horses; it has a secondary fulcrum in the transverse tarsal joint, which is the principal joint during the propulsive phase of the leaping gait. Some of these traits are present in litoptern remains from the Paleogene of Itaboraí, Brazil, which suggests that tarsal specializations for bounding in early-diverging litopterns may have been preadaptive for the evolution of cursoriality in later litopterns (proterotherids and macraucheniids). These early litopterns may have been small, gregarious browsers in closed environments. Macraucheniids subsequently differentiated from proterotheriids by increasing size and weight-bearing adaptations through time and losing the tarsal traits associated with mobility. Recent studies of fossil trackways have suggested that macraucheniids used a gait known as walking pace that is found in extant long-legged artiodactyls and carnivorans. Our leg length analyses indicate that macraucheniids had relatively long legs, providing a link between this unusual gait and the expected morphology.