

# Paleocene Dinosaurs or Cretaceous Ungulates in South America?

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**Abstract:** This is an inclusive paper, with discussions of various ancillary topics which are relevant to its main conclusion. This conclusion is that the mammal-bearing parts of the El Molino and Vilquechico Formations are Paleocene, and not earliest Paleocene, rather than Cretaceous. Therefore it is possible that dinosaurs extend one to three million years into the Paleocene in South America; ungulates, as well as all other placentals and marsupials, are unknown there before the Paleocene. I examine all available evidence in detail.

If dinosaurs did survive well into the Paleocene, for which I review evidence from other regions also, their extinction was not a direct result of the terminal Cretaceous environmental crisis. The marsupial extinction at that time remains severe. There is evidence for appreciable biotic interchange between South and North America in the Paleocene, and for skepticism that larger areas for evolution produce better competitors.

Two other South American dinosaur-bearing rock units, the Balbuena Subgroup of Argentina and the Bauru Group of Brazil, may also be Paleocene at least in part, on poorer evidence. I return the Itaboraí Fauna of Brazil to a later Paleocene (Riochican) age. I comment on correlation of some other South American formations and of some other faunas on various continents, on the theory of correlation by phylogenies, and on charophytes and snails.

The mammalian orders Dinocerata and Pyrotheria (including Xenungulata) both probably originated from the North American arctocyonid condylarth Deuterogonodon, more or less separately. The Phenacolophidae and thereby the Tethytheria may also have done so. The Pantodonta probably originated from the new arctocyonid subfamily Deltatheriinae; Wangliidae and Wanglia in the Pantodonta are also new. I transfer the Bemalambdidae from the Pantodonta to the insectivoran superfamily Palaeoryctoidea. With more doubt I transfer the Arctostylopidae from the Notoungulata to the Astrapotheria; arctostylopids and notoungulates were probably derived separately from primitive astrapotheres. I propose the superorder Ameghinida for this group and the term "rectodont" for upper molars with a straight centrocrista. I comment on the evolution of the Edentata, condylarth phylogeny, the African genus Garatherium, astrapotheres occurrences, the major classification of mammals, canned phylogenies, and the remarkable mammals now known from the real Cretaceous of South America.

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