

LATE CRETACEOUS AND PALEOCENE PAN-AMERICAN INTERCHANGES OF CONTINENTAL VERTEBRATES

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Pan-American exchanges of continental vertebrates are recorded in both directions. Hadrosaurid dinosaurs (as also, perhaps, ceratopsians) and the mammal *Cimolestes* (Leptictidae) are the only terrestrial vertebrates which illustrate an ascertained North America-South America dispersal; during the late Cretaceous for the dinosaur, during the latest Cretaceous or the Paleocene for the mammal. Dispersal of cyprinid fishes is till now questionable.

Evidence of late Cretaceous and Paleocene dispersals from South America to North America is stronger than in the opposite direction. These exchanges include fish, reptiles and mammals. During late Cretaceous Lepisosteid fishes reached North America following a continental (fluvial) route; teiid lizards, aniliid and boid snakes, both families being of Gondwanian origin entered North America in Maastrichtian time; titanosaurids a dinosaur family widely distributed on Gondwanian continent entered North America in the same time along with the mammal Caroloameghinidae. Later, mammal Pantodonta reached North America in the middle Paleocene at the latest, whereas Didelphidae and Notoungulata arrived on that continent during the late Paleocene.

Other continental vertebrates probably passed from South to North America but it is not established whether their dispersal occurred during the late Cretaceous or the Paleocene. These vertebrates are phareodontine osteoglossid and ariid fishes, iguanid lizards, tropidopheid snakes and didolontid or phenacodontid and mioclaenine hyopsodontid mammals.

Some vertebrates provide strong evidence of terrestrial interchange but the direction of interchange remains indeterminate. So is *Avisaurus* (enanthiornithes flightless birds) and mammal *Peradectes* known in the Maastrichtian in both continents. Because of their aquatic and/or aerial habits some other vertebrates (bothremydid turtle, dynosaurid crocodile and cryorhynchid pterosaur) involved in dispersal but without significantly indicative of a continuous land route. A few other groups (ceratophryne frogs, sebecosuchian crocodiles, phorusrhacids and ratite birds) could have taken part in inter-American dispersals but crossing of the Tethyan area between Africa and Europe cannot be ruled out.

It is of interest to note that several terrestrial groups of vertebrates widely distributed either in the Laurasian and/or the Gondwanian realms in the Late Cretaceous and the Paleocene never crossed the central America area (and even did not cross any part of the Tethyan area): acipenserid, polyodont, hiodontid, goniorhynchoid, siluroid and esocid fishes as well as palaeobatrachid frogs, baenid turtles and anguimorph lizards known in the late Cretaceous of North America did not enter South America. Conversely, polypterid, chanid, characiform and coelacanthiform fishes as well as pipid frogs and araripemyid turtles known in the late Cretaceous of South America never reached North America. The failure of various groups to cross the central American area would apparently favour the hypothesis of a discontinuous terrestrial route but the ascertained dispersals of large-size titanosaurids or freshwater fishes require a continuous land route. These failures could result from climatic factors, faunal interactions or shortness of duration of the unbroken nature of the land route.

It is also supposed that the central American land route which permitted the interchanges was first connected to South America permitting the colonisation of this area with South American vertebrates thus advantaged in reaching the North America continent. The terrestrial bridges which linked North and South America by latest Cretaceous and Paleocene time probably comprised the Greater Antilles and the Aves Ridge which consisted of a magmatic submitted to uplift and deformation between North and South America at that time. Part of this arc began to collide with both North and South America during the Campanian, an age which corresponds to the beginning of the faunal interchanges.