= Argentodites =

Argentodites is a possible multituberculate mammal from the Cretaceous of Argentina . The single species , Argentodites coloniensis , is known from a single blade @-@ like fourth lower premolar (p4) from the La Colonia Formation , which is mostly or entirely Maastrichtian (latest Cretaceous) in age . The p4 is 4 @.@ 15 mm long and bears eight cusps on its upper margin and long associated ridges on both sides . The enamel consists of prisms that are completely or partly surrounded by a sheath and that are on average 6 @.@ 57 ?m apart . Zofia Kielan @-@ Jaworowska , who described and named the fossil in 2007 , regarded it as a multituberculate , perhaps a cimolodontan ? and thus , a member of a mostly Laurasian (northern) group and an immigrant to Argentina from North America ? on the basis of the shape of the tooth and features of its enamel . In 2009 , however , two teams argued that Argentodites may in fact be close to or identical with Ferugliotherium , a member of the small Gondwanan (southern) group Gondwanatheria ; although their relationships are disputed , gondwanatheres may themselves be multituberculates .

= = Discovery and context = =

Argentodites is known from a single premolar tooth , MPEF 604 , in the collections of the Museo Paleontológico " Egidio Feruglio " in Trelew , Argentina . It is from the middle part of the La Colonia Formation of Chubut Province , Argentina , which is Late Cretaceous (Maastrichtian and perhaps partly Campanian) in age . The premolar was described in 2007 by Zofia Kielan @-@ Jaworowska and colleagues as a new genus and species , Argentodites coloniensis . The generic name , Argentodites , combines " Argentina " with the Ancient Greek hodites " traveler " , in reference to the animal 's presumed migration from North America to Argentina , and the specific name , coloniensis , refers to the La Colonia Formation .

= = Description = =

The single known example of Argentodites is a blade @-@ like fourth lower premolar (p4) . It has a length of 4 @.@ 15 mm , height of 2 @.@ 10 mm , and width of 1 @.@ 35 mm . The crown is nearly complete , but the roots are largely missing . Kielan @-@ Jaworowska considered two possible orientations of the tooth ? one with the back margin nearly vertically , and the other with the margin inclined backwards ? but preferred the former , which made for a more natural placement of the roots . Although the left and right sides of the tooth are almost identical , they believed the tooth is most likely a left p4 , as this would make the lingual (inner) side the more convex one , as is usual in the p4 of cimolodontan multituberculates with a large p4 .

The front root is larger than the back one . In side view , the upper and back margins are straight , but the front margin is convex . There are eight cusps arranged in a row on the upper margin , the first of which is located about one third of the tooth 's length from the front margin . Only the last is slightly worn , indicating that the tooth is from a young animal . Long ridges extend from the cusps diagonally toward the front on both the lingual and labial (outer) sides of the tooth . The first seven ridges on both sides are connected to the respective cusps , but the eighth ridges do not quite reach their cusp . On both sides of the tooth , there is also a small ridge behind the eighth ridge that extends to the back margin ; these ridges are called the posterolabial and posterolingual ridge . An even smaller ridge is located below the ridge on the lingual side .

The tooth enamel is well preserved over most of the tooth . It consists of prisms ? bundles of hydroxyapatite crystalls ? with an average diameter of 3 @.@ 8 ?m . Most are entirely surrounded by a sheath , but in some the sheath is open . The prisms are slightly curved toward the outer surface of the tooth . Between the prisms , and oriented at an angle of about 45 ° to them , are crystals of interprismatic material . On average , the prisms are 6 @.@ 57 ?m apart , so that there are about 27 @,@ 247 per mm2 .

= = Identity = =

Kielan @-@ Jaworowska and colleagues identified Argentodites as a multituberculate , a diverse fossil group from the northern continents (Laurasia) that is also known from a few questionable or fragmentary records from the southern continents (Gondwana) . They tentatively allocated it to the multituberculate subgroup Cimolodonta on the basis of its enamel microstructure , which particularly recalls Ptilodontoidea (one of the subgroups of Cimolodonta) , and the convex front margin of the tooth . On the other hand , the straight back margin resembles the condition in the other major subgroup of multituberculates , the " plagiaulacidans " , and it does not have the highly vaulted upper margin of p4 that is characteristic of Ptilodontoidea . They regarded Argentodites as distinct from MACN @-@ RN 975 , a fragmentary fossil mandible (lower jaw) with p4 from the Late Cretaceous Los Alamitos Formation of Argentina , which they identified as a " plagiaulacidan " multituberculate , because the p4 of MACN @-@ RN 975 is rectangular in shape and has fewer cusps . They believed Argentodites to represent an immigrant from North America , but could not determine precisely in which part of the Cretaceous it reached South America .

In a 2009 paper on the affinities of Gondwanatheria , Yamila Gurovich and Robin Beck argue that the difference in shape between MACN @-@ RN 975 and Argentodites is due to extensive wear on the former specimen ; they write that the parts of the p4 that are not worn are virtually identical to the equivalents parts of the Argentodites p4 . In addition , MACN @-@ RN 975 is said to have as many ridges as Argentodites and to be of approximately similar size ? about 15 % larger . They allocate MACN @-@ RN 975 to the gondwanathere Ferugliotherium and consequently , they argue that Argentodites most likely represents either Ferugliotherium or some related species . In the same year , Guillermo Rougier and colleagues also suggested ferugliotherian affinities of Argentodites in a paper on the mammals of the Allen Formation , another Cretaceous rock unit of Argentina . Ferugliotherium is a gondwanathere from Late Cretaceous Argentinean deposits . Gondwanatheres are a small and enigmatic group from the late Cretaceous and Paleogene of South America , Antarctica , Madagascar , India , and perhaps Tanzania . Although the evolutionary affinities of gondwanatheres are controversial , both teams that identified Argentodites as gondwanathere believe gondwanatheres are likely themselves multituberculates or closely related to them .