

The extinct pinniped *Allodesmus* (Mammalia: Carnivora) from the Miocene of Hokkaido, northern Japan, and its implications for phylogeny and postcranial morphology

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Allodesmus is an extinct pinniped that is known from the Middle and Late Miocene of the North Pacific and belongs in the family Desmatophocidae, which became extinct in the early Late Miocene. According to the previous studies, *Allodesmus* has at least five species and is divided into three subgroups: i.e., "Basal", "Broad head" and "Long head" subgroups. However, the phylogenetic study of *Allodesmus* has been limited until now, and therefore, the evolutionary history of the Desmatophocidae is also still unclear. Moreover, a study of postcranial bones of *Allodesmus* nor the Desmatophocidae is almost nothing because of insufficient skeletal material for those taxa.

In this study, we described a specimen of *Allodesmus* (AMP25) collected in 1991 from the Middle Miocene Okoppezawa Formation, Hokkaido, northern Japan. AMP25 contains 83 bones consisting of a skull, fore- and hind-limbs, ribs and vertebrae. To demonstrate the paleobiological importance of this specimen, we performed cladistic analysis to locate the new specimen in the phylogenetic framework. We used PAUP 4.0 and Mesquite 3.03, and then, we based on 97 morphological characters and 15 species, with the enigmatic musteloid *Potamotherium*, and the basal pinnipeds *Enaliarctos* and *Pteronarctos* as out-group.

As a result, previously recognized "Long head" subgroup was supported as a monophyletic group, but the "Broad head" subgroup was not recognized as a monophyletic group in our analysis. As for AMP25, it didn't have any synapomorphy of the "Long head" subgroup and nested with *Allodesmus packardi* and *A. naorai* as unresolved polytomy. On the other hand, AMP25 has an autapomorphy in that the supraorbital process is located at the anterior portion of the interorbital bar in our analysis. From the above and additional observations, we have concluded that AMP25 belongs to an unknown species. Importantly, some postcranial bones of AMP25 also show very different character combination, differentiating it from *A. kernensis* among the Desmatophocidae. In particular, morphology of the calcaneum (that is one of the component of the ankle bones) of AMP25 is remarkably distinguishable from that of *A. kernensis*. For example, the calcaneum of AMP25 is more slender than that of *A. kernensis*, and its peroneal tubercle is more developed than that of *A. kernensis*. These characters were distinguishable not only among the species of *Allodesmus* but among all other pinnipeds. It means that some postcranial characters other than characters that we used for the phylogenetic analysis in this study also have potential phylogenetic values as well as its functional importance.

Keywords: pinnipeds, *Allodesmus*, phylogeny, postcranium