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New light on the trophic ecology of *Carcharodon hastalis* from teeth embedded in Miocene cetacean vertebrae from Calvert Cliffs in Maryland, USA

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Recent isotopic analyses of the teeth of the extinct lamnid *Carcharodon hastalis* showed that it fed at a comparable trophic level as was the fossil and modern great white shark, *Carcharodon carcharias*. Although there are many examples of shark bite marks on marine mammal bones, there have not been any publications documenting the presence of *C. hastalis* teeth embedded in the bones of marine mammals. Here we report on the first *C. hastalis* teeth found embedded in vertebrae of two Miocene cetaceans. These teeth represent unequivocal evidence of trophic interactions between this shark and cetaceans. It is not known if these interactions were the result of active predation or scavenging. These embedded *C. hastalis* teeth offer supporting evidence to the aforementioned isotopic findings. The finding of *C. hastalis* teeth embedded in cetacean vertebrae demonstrate that in the *Carcharodon* lineage, serrated teeth were not a prerequisite to feeding on marine mammals. *Carcharodon hastalis* may have fed on marine mammals for millions of years prior to the evolution of lightly serrated teeth in its chronospecific descendent, *Carcharodon hubbelli* . The behavioral adaptation to mammalophagy in the *Carcharodon* lineage, regardless as to how inefficient it might have been without serrated teeth, appears to have occurred for millions of years prior to the evolution of fully serrated teeth in *Carcharodon carcharias*. That feeding behavior may well have given natural selection sufficient time to develop and hone the serrated teeth now seen in extant great white sharks (*C. carcharias*). Given that competition for high trophic resources between the *Carcharodon* and *Otodus* lineages seemingly existed for millions of years prior to the extinction of *Otodus megalodon*, it seems that competition alone is likely not the only explanation for why *O. megalodon* went extinct.

Key words: Elasmobranchii, *Carcharodon hastalis* , Cetacea, cetacean vertebrae, trophic interaction, Miocene, Maryland.

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