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Reconstructing the palaeoecology of the hybodont shark *Lissodus* of the Rhaetian Central European Basin using oxygen isotopes

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The biogenic fluor-apatite in shark teeth enameloid is extremely resistant against diagenetic alteration, and reliably reflects the ambient water chemistry at the time of tooth mineralisation. Thus, the oxygen isotope composition of teeth allows conclusions about the isotopic composition of the ambient aquatic fluid. In this way we will obtain new insights about ancient terrestrial palaeoenvironments, the possible migration behavior of analyzed taxa, as well as the hydrological cycle of the early Mesozoic. The small hybodont *Lissodus*, a durophagous bottom-dwelling shark, occurs in marine and non-marine deposits. Thus, the palaeoecology of this taxon is controversially discussed. Because of the continuous tooth replacement in sharks, the tooth $\delta^{18}O$ values of *Lissodus* can be used to differentiate between marine or freshwater signatures, and to decipher stationary or diadromous behavior.

In the present study, small-sized (2-3 mm) teeth of *Lissodus minimus* from Late Triassic (Rhaetian) bone beds of 3 different localities from the Central European Basin (CEB) in Germany were investigated. In total, we analysed 22 teeth from the Kallenberg (Thuringia), 23 teeth from the Mooseberg (Thuringia), and 21 teeth from Stuttgart-Möhringen (Baden-Württemberg) for $\delta^{18}O$ values of their enameloid layer by single tooth measurements. The mean $\delta^{18}O$ values are 16.8 ± 0.4 ‰ for Kallenberg, 15.6 ± 0.6 ‰ for Mooseberg, and 15.4 ± 0.6 ‰ for Stuttgart-Möhringen with the standard deviations being comparable to standard deviations calculated for $\delta^{18}O$ values in different teeth from individual recent sharks. Moreover, the mean $\delta^{18}O$ values of the shark teeth from the different locations are in a similar range. Published values for a definite marine setting are available from brachiopods of the Dolomites providing a $\delta^{18}O$ signal for the Late Triassic Tethys that is about 4-5 ‰ heavier than those of *Lissodus*. The

comparison of shark tooth and brachiopod $\delta^{18}O$ clearly shows a heavy isotopic fractionation from fully marine conditions in the Tethys to the continental areas of the CEB.

The strong difference in $\delta^{18}O$ indicates an extensive brackish or even freshwater environment of *Lissodus minimus* within the CEB, at least in middle and southern Germany. In spite of continued tooth replacement, no significant heavier $\delta^{18}O$ values were observed that could indicate a marine or marginal marine setting in the CEB. During the formation of tooth enameloid *Lissodus* occupied a non-marine environment with the $\delta^{18}O$ values of the studied teeth from each locality suggesting no habitat migration. The generally low $\delta^{18}O$ values of the shark teeth indicate a strong freshwater supply into the basin by drainage systems from the Vindelician-Bohemian Massif during the latest Triassic. Future analyses of the geographically wide spread bone beds and associated faunal assemblages should reveal regional differences referring to the Rhaetian Transgression within the CEB.

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