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Experimental analysis of decay biases in the fossil record of lobopodians

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If fossils are to realize their full potential in reconstructing the tree of life we must understand how our view of ancient organisms is obscured by taphonomic filters of decay and preservation. In most cases, processes of decay will leave behind either nothing or only the most decay resistant body parts, and even in those rare instances where soft tissues are fossilized we cannot assume that the resulting fossil, however exquisite, represents a faithful anatomical representation of the animal as it was in life.Recent experiments have shown that the biases introduced by decay can be far from random; in chordates, for example, the most phylogenetically informative characters are also the most decay-prone, resulting in 'stemward slippage'. But how widespread is this phenomenon, and are there other non-random biases linked to decay? Intuitively, we make assumptions about the likelihood of different kinds of characters to survive and be preserved, with knock-on effects for anatomical and phylogenetic interpretations. To what extent are these assumptions valid? We combine our understanding of the fossil record of lobopodians with insights from decay experiments of modern onychophorans (velvet worms) to test these assumptions. Our analysis demonstrates that taphonomically informed tests of character interpretations have the potential to improve phylogenetic resolution. This approach is widely applicable to the fossil record – allowing us to ground-truth some of the assumptions involved in describing exceptionally preserved fossil material.