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Postdepositional Controls on Fossil Body Size Distributions

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Animal body size provides information about the trophic position and reproductive strategies of species, and the presence of environmental stressors. The distribution of body sizes in fossils can be easily measured, making it an important tool for paleoecological studies. However, preservational and collection biases might influence the primary measurements and thus the results. Intuitively, smaller specimens of the same species should be more prone to destructive processes such as fracturing and dissolution. It is often assumed that body size distributions in death assemblages reflect those in living populations. We test this assumption.
Using the body size distributions in monospecific assemblages of Devonian ammonoids, we show that common depositional environments yield distinct distributions of conch sizes. We then simulate postdepositional conditions in recent analogues of these environments. If conch size is proportional to robustness (or disintegration rate), sedimentation rates and mixing intensities characterizing these recent analogues allow us to reconstruct conch size distributions observed in Devonian counterparts of these environments.
The results show that shape parameters of body size distributions (skewness and kurtosis) are modified in predictable ways in sedimentary environments. This implies that fossil body size distributions are not a direct reflection of ecological signals, but can be altered by postdepositional processes. We conclude that parameters of body size distributions, such as mean and dispersion, may not be comparable with parameters in standing populations. If changes in these parameters coincide with changes in the depositional environment, the effect of (post)depositional processes needs to be considered.