Estimating Downcore Decline in Skeletal Disintegration Risk in Holocene Environments

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Preservation of skeletal remains is thought to be positively linked to rate of burial, i.e., they are exposed to destructive processes for a shorter time under higher burial. However, downcore changes in time-averaging documented in Holocene skeletal assemblages implies that per-individual burial rates of skeletal remains of the same age cohort can be variable, e.g., owing to bioturbation, and estimation of time (and sediment depth) over which skeletal remains are exposed to destruction is not straightforward.

This variability in the depth of burial exposes them to different intensities of destructive processes that is typically highest in sediments on or close to the seafloor, and accordingly changes their probability of disintegration. This hinders both the reconstruction of taphonomic conditions downcore and the reconstruction of biological archives from age cohorts of skeletal remains.

We present the AALPS (Aging ALong burial PathS) model to estimate downcore disintegration risk and taphonomic age, based on sediment-depth distribution of postmortem age of individual skeletal remains. This model can be applied to individual cores and taxa, accounts for sediment mixing and time-averaging, and incorporates knowledge of changing sediment input.

As an application, we discriminate between distinct hypotheses of changes in skeletal disintegration rates in cores from the Adriatic Sea.

The method provides new insights into the taphonomy of skeletal remains in Holocene and Anthropocene environments and age unmixing of paleoecological time series, which can be used in conservation paleobiology to reconstruct ecological baselines to guide future conservation efforts.