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Insights from big data into the fossilization potential of marine communities

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Only a small percentage of all life that ever existed is preserved in the rock record. Some animals and environments are particularly unlikely to fossilize—e.g., soft-bodied organisms and high-energy habitats—biasing fossil deposit faunal composition and resultant inferences about macroevolution and macroecology. To estimate the extent of information loss caused by non-preservation we compared diversity data in over 20,000 modern marine assemblages (Ocean Biogeographic Information System; OBIS) with fossil occurrence data (Paleobiology Database; PBDB) to yield a global assessment of assemblage-level fossilization potential as it varies across depth, habitats, and environments. We used two different metrics, taxon fossilization potential and within-environment fossilization potential, to assess the proportion of taxa in a modern community with PBDB occurrences or with PBDB occurrences in the same environment, respectively. Averaged across all 20,000+ marine assemblages, mean taxon fossilization potential is 38% and mean values vary between environments: from 34% in shallow and deep water, 44% in coral reefs, 51% on seamounts, to 15% in pelagic assemblages. Mean within-environment fossilization potential, in contrast, does not exceed 32% (in shallow water), a lower value than that obtained in other studies, and may approach zero (on seamounts and pelagic environments). Differences between these two metrics indicate the large control of environment on fossilization potential. Our results provide a means to include and compare palaeoecological dynamics across a broader range of settings in the fossil record, while accounting for differences in fossilization potential among environments.