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Quantification of planktic foraminiferal depth habitat: Model fits to field data

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The calcite shells of shallow dwelling species of planktic foraminifera generally have a lower oxygen isotope composition compared to species that live in deeper ocean water at lower temperatures. A straightforward relationship between foraminiferal oxygen isotope composition and depth habitat is obstructed because foraminifera are observed to migrate vertically through the water column during their life cycle. Consequently the exported oxygen isotope composition of shells is considered to reflect an integrated, mass weighted, oxygen isotope signal over the upper water column depth interval in which specimens live and secret their calcite.

We present results on the quantification of the depth habitat of different foraminiferal species using a model fit to field observations. This allows to unravel the characteristic depth-integrated growth pattern, which can be used to quantify and understand the relationship between the oxygen isotope composition of different species and the vertical thermal structure of the upper water column. We therefore used plankton tow collected foraminifera from different geographical locations from the Atlantic and Indian Ocean. This enabled to study the modification of the calcification pattern based on hydrographic conditions. Our model application allows a more accurate assignment in terms of species depth habitat compared to the simplified classification in mixed layer-, thermocline- and deep-dwellers.