A selective approach to draw data from altered foraminifera shells

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A sudden surge in the concentration of carbon dioxide in the air and the ocean 56 million years ago may have triggered the Paleocene-Eocene thermal maximum (PETM), a period of rapid and dramatic warming. In conjunction with the rising atmospheric temperature, ocean acidification significantly increased the dissolution, or "burndown," of carbonate sediments on the seafloor, destroying the preservation quality of seafloor foraminifera shells. Analyzing foraminifera shells is one of the main proxy measurements used by paleoclimatologists to reconstruct past ocean temperatures. Kozdon et al., however, find that by using two highly precise analytical techniques, they can draw useful data from foraminifera samples that were damaged by the burndown.

When single-celled foraminifera die, their calcite shells sink to the seafloor. Locked inside are records of the environmental conditions when the foraminifera formed their shells, indicated by the isotope ratios and the concentrations of various elements. The burndown caused many of these shells to fully or partially dissolve. When the warm period ended, the dissolved carbonate reprecipitated on the remaining shells, but with new, different isotope ratios.

Traditionally, researchers studying the isotope ratios of foraminifera shells use an analytical technique that consumes the whole shell. As such, the recrystallization from the PETM burndown would skew their results. The authors of the present study, however, used two highly selective techniques, secondary ion mass spectrometry and electron probe microanalysis, to measure the compositions of small preserved

fragments of individual shells. The techniques allowed them to measure the isotope ratios of the parts of the shells that were unaffected by recrystallization and to compare original shell material against recrystallized regions within the same shell.

More information: Kozdon, R. et al. In situ ?18 O and Mg/Ca Analyses of Diagenetic and Planktic Foraminiferal Calcite Preserved in a Deep-Sea Record of the Paleocene-Eocene Thermal Maximum, *Paleoceanography*. DOI: 10.1002/palo.20048, 2013 onlinelibrary.wiley.com/doi/10 … /palo.20048/abstract