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Calibrating Mg/Ca of multiple planktonic foraminiferal species with δ^{18}O-calcification temperatures: Paleothermometry of the upper water column

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Mg/Ca ratios of eight shallow, thermocline, and deep-dwelling planktonic foraminiferal species from 77 tropical Atlantic and Caribbean sediment-surface samples were calibrated vs. δ^{18}O calcification temperatures derived after the Shackleton (1974) δ^{18}O-paleotemperature equation. The overall range of calcification temperatures amounts to ca. 8-28°C. The species-specific exponential temperature dependencies are relatively similar for all species (ca. 7-11 percent per 1°C) and largely agree with existing calibrations, whereas the pre-exponential constants of the calibrations are significantly different for the deep-dwelling (0.83-1.31) with respect to the shallow and thermocline-dwelling species (0.23-0.65). Combining the species-specific data sets, we extracted two multispecies calibrations, which differ in the pre-exponential rather than in the exponential constants: The 'warm water' multispecies calibration (Mg/Ca=0.223exp(0.113T), r=0.90) holds for shallow and thermocline dwellers at temperatures >19°C, while the 'cold water' dual-species calibration (Mg/Ca=0.842exp(0.083T), r=0.85) is valid for deep-dwelling species at temperatures <15°C.