How confident can we be in foraminifer shell Mg/Ca thermometry?

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The empirical correlation between the foraminifer shell Mg/Ca composition and temperature is widely used as a seawater thermometer. An important consideration for this thermometer is its behaviour in seawaters with different chemical compositions than the modern ocean, such as pre-Pleistocene ocean chemistry.

To determine the influence of seawater composition on the Mg/Ca thermometer, the planktic foraminifer *Orbulina universa* was cultured in seawaters where both Mg and Ca concentrations were varied independently across a range of seawater [Mg/Ca] ratios. Shell Mg/Ca compositions varied in response to changes in the Mg/Ca ratio and the Ca concentration of seawater. Our results show both seawater Mg/Ca ratio and Ca concentration need to be considered to determine past seawater temperatures accurately. Applying our new calibration across the Paleocene-Eocene Thermal Maximum reveals seawater temperature changes that are double those previously estimated from foraminiferal Mg/Ca.