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Inference of Pliocene marine temperature and other variables through bivalve sclerochronology

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Modern queen scallops, *Aequipecten opercularis*, from cool-temperate waters around the UK, faithfully record seasonal temperature variation in the oxygen-isotopic composition of their shells. Apparently unaltered specimens from the Early Pliocene ($c.$ 3.6 Ma) Coralline Crag of Suffolk, UK, yield isotopic palaeotemperatures little different from modern temperatures in the adjacent North Sea, a finding in agreement with isotopic estimates from the co-occurring bivalve *Arctica islandica* and with Early Pliocene data from the eastern USA, but at odds with the taxonomic composition of various elements of the Coralline-Crag biota, which suggests significantly warmer conditions. Microgrowth increments in Coralline-Crag *A. opercularis* are much larger than in modern N Sea forms and are comparable with those in modern Mediterranean (warm-temperate) forms. While this might indicate that the Coralline-Crag isotopic data provide spuriously low temperature estimates, we strongly suspect that the larger size of microgrowth increments in Pliocene as compared to modern *A. opercularis* from the N Sea area is less a function of warmer temperatures than of differences in the timing and magnitude of phytoplankton blooms and/or a lower frequency of short-term growth interruptions. These possibilities will be examined through an analysis of increment-size variation in relation to overall growth rate and environment in modern and fossil forms. Ongoing sclerochronological work on other taxa will show whether the Coralline Crag represents an interval of continuously cool conditions or, as seems more likely, a time of fluctuating climate, perhaps as a result of variation in

Gulf-Stream vigour.