



## **0.1 How far do fossil Neogene surface-dwelling planktonic foraminifera record properties of the ancient ocean surface?**

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Fossil surface-dwelling and near surface-dwelling planktonic foraminifera are used to reconstruct the properties of the upper water masses of ancient oceans. For example, their calcification temperatures provide estimates of sea surface temperature, data that can be used to ground truth computer-based general circulation models (GCMs) of ancient climate. Fossil, core top, and plankton tow material of the surface-dwelling tropical and sub-tropical *Globigerinoides sacculifer* show significant differences in test preservation. Tow specimens, collected *in vivo*, are lightly calcified with translucent tests, calcite which is formed during ontogenesis. Core top and fossil specimens are heavily calcified, white opaque in appearance, and show evidence for thick gametogenic calcite veneers, formed towards the end of the lifecycle of the foraminifera. These veneers add substantially to the mass of the test. Fossil material, particularly from the Neogene, is dissolved and recrystallized. Coccolith plates are incorporated into the wall of the foraminifera by diagenetic calcite overgrowths. Using published  $\delta^{18}\text{O}$  from *G. sacculifer*, we estimate by how much the original ontogenetic isotopic signature of specimens may have been overprinted by calcite formed during gametogenesis and diagenesis. Our methodology provides a guide to identifying pristine fossil material for use in palaeoceanographic studies.