Planktic foraminifers produce vaterite shells. Big deal or so what?

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The calcium carbonate shells of planktic foraminifera provide our most valuable geochemical archive of climate and ocean conditions spanning the last 100 million years. They also play a role in the ocean carbon cycle providing a carbonate flux out of the surface ocean which may also aid in ballasting organic carbon fluxes to the deep ocean. Planktic foraminifer shells are preserved in marine sediments as calcite, the stable polymorph of calcium carbonate. However, the shells of live-collected planktic foraminifera have recently been found to comprise metastable calcium carbonate polymorph vaterite, implying a non-classical crystallisation pathway involving metastable phases that transform ultimately to calcite. Current understanding of how planktic foraminifer shells record climate, and how they might fare in a future high-CO_2 world is based on classical, inorganic, ion-by-ion growth and dissolution of calcite. If this paradigm needs to change to a non-classical crystallisation model, involving formation and transformation of metastable calcium carbonate phases, it is likely to have potentially important ramifications for shell geochemistry and solubility of the foraminiferal calcite in the ocean. We will explore and speculate on these ramifications.