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Coral reef formation from nanometers to kilometers

Monday, 13 November 2023 15:00 (30 minutes)

Coral reefs cover only 1% of ocean floors, yet they host 25% of all known marine species. This incredible biodiversity is sheltered by the 3D structure of coral skeletons. My group and I revealed that corals form their skeletons by attachment of amorphous calcium carbonate (ACC) nanoparticles[1], then fill interstitial spaces by ion attachment[2]. Polarization-dependent Imaging Contrast mapping (PIC mapping) revealed that subsequent crystallization starts as randomly oriented aragonite (CaCO3) nanocrystals, termed sprinkles, which coarsen and become radially oriented acicular crystals termed spherulites[3-5]. This is Nature's 3D printing4! The resulting space-filling, solid, isotropic structure grows slowly (0.5-5.0 cm/year) to form m-km coral reefs visible from outer space.
Unexpected nanostructures were revealed by PIC mapping in other completely different biominerals, mollusk shell nacre[6] and human tooth enamel[7]. In both cases the slight misorientation of adjacent nanocrystals plays an important role in toughening the biomineral[5], providing it with better function, and thus providing an evolutionary advantage to the forming animal.

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