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Acid secretion by the boring organ of the burrowing giant clam, *Tridacna crocea*

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Abstract:

The giant clam *Tridacna crocea*, native to Indo-Pacific coral reefs, is noted for its unique ability to bore fully into coral rock and is a major agent of reef bioerosion. However, *T. crocea*'s mechanism of boring has remained a mystery despite decades of research. By exploiting a new, two-dimensional pH-sensing technology and manipulating clams to press their presumptive boring tissue (the pedal mantle) against pH-sensing foils, we show that this tissue lowers the pH of surfaces it contacts by greater than or equal to 2 pH units below seawater pH day and night. Acid secretion is likely mediated by vacuolar-type H⁺-ATPase, which we demonstrate (by immune-fluorescence) is abundant in the pedal mantle outer epithelium. Our discovery of acid secretion solves this decades-old mystery and reveals that, during bioerosion, *T. crocea* can liberate reef constituents directly to the soluble phase, rather than producing sediment alone as earlier assumed.

Keywords: bivalve, pH, vacuolar-type H⁺-ATPase, bioerosion