



Atlantid heteropods: indicators of past and future ocean changes?

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Atlantid heteropods are a commonly encountered, but often overlooked group of calcareous zooplankton. These small (<14 mm) gastropods represent the only extant calcareous planktonic predators and provide a unique opportunity with which to study ocean change from a predator's perspective. The atlantids display remarkable adaptations for a planktonic lifestyle with a foot modified into a swimming fin, well developed eyes, a trunk-like proboscis and a thin aragonite shell. Atlantid heteropods are currently found in all ocean regions between 49°N and 48°S, and can be as abundant as thecosome (shelled) pteropods.

Here we present evidence that atlantids can be valuable indicators of past and future ocean changes. Isotope geochemistry shows that atlantids calcify their shells in the upper 150 m of the ocean, a region of acute ocean changes. This habitat, and thin (~1.5-10 μm) aragonite shells make atlantids particularly suitable to indicate the impacts of ocean acidification. The atlantid fossil record demonstrates a negative effect of high pCO_2 on shell calcification, however, until now, no ocean acidification studies have been carried out upon atlantids. Here we present the initial findings from the first pCO_2 manipulation experiments on atlantids, providing important information on their use as ocean acidification indicators.

Furthermore, DNA barcoding of cytochrome c oxidase subunit 1 (CO1) reveals that the atlantids have considerable genetic diversity that identifies many geographically separated clades. Clade-specific environmental tolerances have the potential for monitoring ocean warming and other environmental parameters, such as nutrient/food availability. Our future research will use ecological niche modelling to define the environmental tolerances of key atlantid species and apply these directly to the fossil record of extant species, giving us additional insights into past ocean changes.