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TITLE: Ocean Acidification and the Loss of Phenolic Substances in Marine Plants

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ABSTRACT:

Rising atmospheric CO₂ often triggers the production of plant phenolics, including many that serve as herbivore deterrents, digestion reducers, antimicrobials, or ultraviolet sunscreens. Such responses are predicted by popular models of plant defense, especially resource availability models which link carbon availability to phenolic biosynthesis. CO₂ availability is also increasing in the oceans, where anthropogenic emissions cause ocean acidification, decreasing seawater pH and shifting the carbonate system towards further CO₂ enrichment. Such conditions tend to increase seagrass productivity but may also increase rates of grazing on these marine plants. Here we show that high CO₂ / low pH conditions of OA decrease, rather than increase, concentrations of phenolic protective substances in seagrasses and euryhaline marine plants. We observed a loss of simple and polymeric phenolics in the seagrass *Cymodocea nodosa* near a volcanic CO₂ vent on the Island of Vulcano, Italy, where pH values decreased from 8.1 to 7.3 and pCO₂ concentrations increased ten-fold. We observed similar responses in two estuarine species, *Ruppia maritima* and *Potamogeton perfoliatus*, in in situ Free-Ocean-Carbon-Enrichment experiments conducted in tributaries of the Chesapeake Bay, USA. These responses are strikingly different than those exhibited by terrestrial plants. The loss of phenolic substances may explain the higher-than-usual rates of grazing observed near undersea CO₂ vents and suggests that ocean acidification may alter coastal carbon fluxes by affecting rates of decomposition, grazing, and disease. Our observations temper recent predictions that seagrasses would necessarily be "winners" in a high CO₂ world.

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