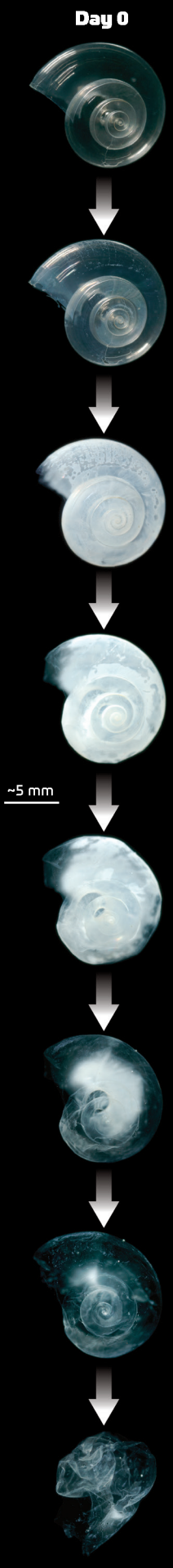

Ocean Acidification's Ability to Transform Ecosystems

Anthropogenic CO_2 emissions not only cause greenhouse warming, they also acidify the ocean. The ecological effects of acidification are many. In the coastal ocean, they include reduced biomineralization, carbonate dissolution of reef deposits and shelled organisms, and changes in the competitive balance of survival between microalgae and corals. In the open ocean, acidification affects fish physiology and the biomineralization of calcareous phytoplankton and pteropods, an important prey group for fisheries.

Scientific ocean drilling will collect pre-Anthropocene sediments to allow comparison of the rates of prehistoric ecosystem change with the rates of change today. Marine sediment archives can reveal how long episodes of acidification lasted and can be used to calibrate biogeochemical and ecosystem models to understand the feedbacks present in Earth's modern carbon cycle. By studying the numerous global warming events of the Cretaceous and Paleogene (from 145 to 23 million years ago), we will be able to gauge the impact of past acidification on ecosystem structure and productivity. Understanding how past ocean acidification transformed communities of carbonate-shelled organisms, including corals, and how fast they recovered, will inform scenarios of future ocean health and habitability.

Pteropods, tiny snails with aragonitic shells, thrive in shallow waters and play an important role in polar ecosystems. These photos show the time sequence of shell dissolution of the Antarctic pteropod *Limacina helicina* in waters simulating the saturation state of surface seawater with respect to aragonite that is projected for the Southern Ocean (Orr et al., 2005, https://doi.org/10.1038/nature04095) by 2100 under the IS92a business-as-usual CO_2 emissions scenario. These experimental results indicate that pteropods may cease to exist in polar latitudes by the middle of the twenty-first century, with potential major repercussions to organisms up the food chain. *Source: The photos were taken in the laboratory of Victoria Fabry from March 31, 2007, to May 15, 2007. Photo credit: David Liittschwager, National Geographic Stock*