# Toxicity of atmospheric aerosols on marine phytoplankton

**Adina Paytan[a,1], Katherine R. M. Mackey[a,b], Ying Chen[a,2], Ivan D. Lima[c], Scott C. Doney[c], Natalie Mahowald[d], Rochelle Labiosa[e] and Anton F. Post[f]**

+ Author Affiliations

[a]Institute of Marine Science, University of California, Santa Cruz, CA 95064;
[b]Department of Civil and Environmental Engineering, Stanford University, Stanford, CA 94305;
[c]Marine Chemistry and Geochemistry, Woods Hole Oceanographic Institution, Woods Hole, MA 02543;
[d]Department of Earth and Atmospheric Sciences, Cornell University, Cornell, NY 14850;
[e]United States Geological Survey, 345 Middlefield Road, Menlo Park, CA 94025; and
[f]H. Steinitz Marine Biology Laboratory, Interuniversity Institute of Marine Sciences, P.O.B. 469, Eilat 88103, Israel

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## Abstract

Atmospheric aerosol deposition is an important source of nutrients and trace metals to the open ocean that can enhance ocean productivity and carbon sequestration and thus influence atmospheric carbon dioxide concentrations and climate. Using aerosol samples from different back trajectories in incubation experiments with natural communities, we demonstrate that the response of phytoplankton growth to aerosol additions depends on specific components in aerosols and differs across phytoplankton species. Aerosol additions enhanced growth by releasing nitrogen and phosphorus, but not all aerosols stimulated growth. Toxic effects were observed with some aerosols, where the toxicity affected picoeukaryotes and *Synechococcus* but not *Prochlorococcus*. We suggest that the toxicity could be due to high copper concentrations in these aerosols and support this by laboratory copper toxicity tests preformed with *Synechococcus* cultures. However, it is possible that other elements present in the aerosols or unknown synergistic effects between these elements could have also contributed to the toxic effect. Anthropogenic emissions are increasing atmospheric copper deposition sharply, and based on coupled atmosphere–ocean calculations, we show that this deposition can potentially alter patterns of marine primary production and community structure in high aerosol, low chlorophyll areas, particularly in the Bay of Bengal and downwind of South and East Asia.

## Footnotes

[1]To whom correspondence should be addressed: E-mail: apaytan@ucsc.edu

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[2]Present address: Center for Atmospheric Chemistry Study, Department of Environmental Science and Engineering, Fudan University, 220 Handan Road, Shanghai 200433, People's Republic of China.

The authors declare no conflict of interest.

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