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Pollution Changes Ocean Nutrients

Biogeochemistry: Acidifying phosphorous-containing dust makes element more accessible to ocean ecosystems

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Jacques Descloitres/NASA

BLOWIN' IN THE WIND Strong winds blow dust from the Sahara Desert over the Mediterranean Sea and into Southern Europe in this satellite image from 2002.

Airborne acids react with dust particles and transform the dust's phosphorous into a more available form for marine organisms, according to studies of Saharan dust collected in the Eastern Mediterranean Sea (*Atmos. Chem. Phys.*, DOI: 10.5194/acp-11-6265-2011).

Like iron and nitrogen, phosphorous is an essential but limiting nutrient in marine ecosystems. Near continents, phosphorous comes to the ocean in rivers, but in the open ocean, airborne sources are important. Mineral aerosols, such as those from desert dust, contain phosphorous. But in mineral form the element is insoluble. As a result, marine organisms cannot consume it.

However, if the aerosols pass through humid air containing sulfuric and nitric acids, the particles take up both water and acid, reports an international group led by Athanasios Nenes, a professor of earth and atmospheric sciences at the Georgia Institute of Technology, and Michael Krom, a professor of marine and environmental chemistry at the University of Leeds, in the U.K. The team uncovered this change by analyzing the chemical composition of aerosol samples collected on the Greek island Crete. In the laboratory, they also tested the effects of acid on the aerosols' composition by placing samples of Saharan dust in solutions of sulfuric acid.

In the atmosphere, acids can come from biologic and volcanic processes as well as from industrial emissions. The water and acid form a layer on the particles that reacts with the minerals and dissolves the phosphorous, the researchers found. When the particles land in the ocean, organisms can feed on the dissolved phosphorous.

Previous studies have shown that acidification of airborne dust particles also makes iron more available to marine organisms. By polluting the atmosphere, human activity may consequently increase levels of ocean nutrients and accelerate the growth of photosynthetic organisms, Nenes says. More of these organisms could remove carbon dioxide from the atmosphere, but also could lead to oxygen-deprived dead zones in the water.

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