

Tiny fossils record big climate changes

Chris Emery

Tiny plankton fossils entombed in ocean sediments can tell a detailed story about climate patterns and ocean currents over the past 40 000 years, according to a paper published in the journal *Paleoceanography* (2006; 21: DOI: 10.1029/2005PA001251).

The authors, a team of Canadian researchers, reconstructed past climate trends in the Northern Pacific Ocean, based on fossil evidence of fluctuations in the abundance and species composition of populations of dinoflagellates, a group of single-celled plankton. The fossils were embedded in sediment cores drilled from the ocean floor off the coast of Santa Barbara, California. "They are fantastic cores. We're talking hundreds of meters long", enthuses Vera Pospelova, a researcher at the University of Victoria (Victoria, Canada) and the paper's lead author.

Dinoflagellates produce a particu-



Courtesy of V. Pospelova

A cyst of the dinoflagellate *Spiniferites ramosus*.

larly reliable and continuous fossil record because their life cycle includes a dormant stage known as a "cyst", which is protected by a resilient outer shell. "Cysts are tough, so they don't dissolve like many other microorganisms as they settle to the bottom of the ocean", continues Pospelova.

The researchers analyzed the cysts present in the cores at 1000-year intervals. Because different species prefer different water temperatures and nutrient conditions, the researchers were

able to infer past ocean temperatures and currents based on cyst abundance and species composition in the cores. They found clear evidence of several well-established instances of abrupt climate change, including the Younger Dryas, a 1300-year long cold spell that gripped the planet beginning about 12 000 years ago. "We have been impressed that dinoflagellates are so sensitive to changes in climate", says Pospelova.

The researchers hope to use the fossil record to produce a more precise timeline of past climate changes in the Northern Pacific and other regions, and to fill in the gaps in climate reconstructions based on fossils of diatoms, another common phytoplankton. Pospelova also hopes that the tiny fossils will help scientists predict the impact human activities will have on the world's oceans, explaining that, since plankton form the basis of marine food chains, fish populations are likely to rise and fall with plankton populations. ■

CNG improves Delhi air quality, but....

Dinesh C Sharma

The use of compressed natural gas (CNG) to fuel public transport has improved air quality in the Indian capital of Delhi, but inefficient burning and the rising number of non-CNG vehicles are contributing to an increase in certain pollutants, according to a new study in *Environmental Monitoring and Assessment* (April: DOI: 10.1007/s10661-006-7051-5).

The entire fleet of public buses and three-wheelers shifted from diesel to CNG in 2001. CNG-run vehicles emit 85% less nitrogen oxide (NO_x), 70% less reactive hydrocarbons, and 74% less carbon monoxide compared to similar gasoline vehicles. However, the annual average concentration of these pollutants was reduced by only about 50% in Delhi, while NO_x levels increased by 10–20%. There was no

significant change in the levels of benzene, toluene, and xylene (BTX), suspended particulate matter, and particulate matter of 10 microns (PM 10).

The rise in some pollutants is attributed to the inefficient use of catalytic converters in CNG vehicles and an increase in the total number of vehicles. "The increase in NO_x levels is a cause for concern in urban areas, because ground-level ozone and photochemical smog forms when NO_x and volatile organic compounds react in the presence of heat and sunlight", points out lead author Ravindra Khaiwal of the University of Antwerp (Antwerp, Belgium). "Both NO_x and ozone at ground level are important pollutants because they are associated with extensive health effects, particularly respiratory ones."

The maximum concentration of polycyclic aromatic hydrocarbons

(PAHs) was measured from late at night to early morning, when diesel-run heavy vehicles from other states with less stringent exhaust regulations pass through the city. "To the best of our knowledge, this is the first study showing high levels of PAHs in an urban center at night", says Khaiwal.

Says Anumita Roychowdhury (Centre for Science and Environment, New Delhi, India), "Despite increasing dependency on imported oil, the government has not set fuel economy standards for vehicles. The transport sector already consumes almost half of the total petroleum products in the country, but the government continues to provide tax breaks to the car industry to sell more cars. The industry resists fuel economy standards, but sells diesel cars in the name of fuel efficiency, disregarding the pollution and health impacts of diesel." In 2004, Delhi had 4.17 million registered vehicles, compared to 2.5 million in 1996. ■