



Sea change: a satellite image of a 200-km algal bloom (orange) caused by iron fertilization.

## Ocean tests raise doubts over use of algae as carbon sink

**Rex Dalton, San Francisco**

Plans to use marine microorganisms as a sink for atmospheric carbon dioxide appear to have suffered a setback. Early results of an experiment designed to test the concept indicate that the process is significantly less effective than originally thought — and may also have undesirable side effects.

If confirmed, the results, which are being prepared for submission to a number of journals, would weaken the argument that oceanic carbon sequestration can act as a significant component in controlling the build-up of greenhouse gases in the atmosphere.

“The experiment was a tremendous success at every level,” says Kenneth Coale of the Moss Landing Marine Laboratories near Monterey, California, who led the team of researchers, “but some of the results give us cause for concern.”

The team was investigating the effectiveness of iron fertilization, which involves adding iron sulphate to the ocean surface to encourage the growth of phytoplankton. These single-celled algae absorb carbon dioxide from the ocean, which in turn causes more of the gas to migrate from the atmosphere into the water. The huge algal blooms caused by the iron fertilization may then be eaten by other organisms or sink into the deep ocean, taking the carbon with them.

Coale and his team spent 28 days studying patches of iron sulphate spread on the ocean south of New Zealand. Known as the Southern Ocean Iron Fertilization Experiment (SOFEX), the project was the most comprehensive effort yet to study oceanic iron fertilization.

During the experiment, three research vessels dodged icebergs and ugly weather in a region chosen for its significant impact on natural sequestration of carbon dioxide from the atmosphere. Two of the research

vessels — the *Roger Revelle* and the *Melville* — repeatedly spread an iron sulphate solution on the ocean surface. As a result, the team recorded a bloom of phytoplankton 200 kilometres long.

The researchers revealed their preliminary findings at a meeting of the American Geophysical Union (AGU) in San Francisco on 9–10 December. Although the bulk of the carbon stayed near the surface, Ken Buesseler, an oceanographer at Woods Hole Oceanographic Institution in Massachusetts, said that the experiment showed for the first time that carbon can be transported below 100 metres by iron fertilization.

But the process is not as efficient as predicted. The team’s analysis indicates that one tonne of iron spread at the ocean surface could force 1,000 tonnes of carbon below 100 metres, Buesseler told the AGU meeting. Previous laboratory experiments had estimated that one tonne of iron would sink 100,000 tonnes of carbon. More carbon may sink over a longer period, he suggested, but longer experiments are needed to determine how much. “I’m not certain the oceans can ever solve our carbon dioxide problem,” says Coale.

Oliver Wingenter, a chemist at New Mexico Tech in Socorro, reported on the activity of other gases produced by phytoplankton. Wingenter found that emissions of methyl bromide, which can deplete the protective ozone layer at high altitude, increased sharply. And emissions of isoprene — a hydrocarbon that generates greenhouse gases at low altitude — rose “dramatically”, he says.

Kenneth Johnson, an oceanographer from Monterey Bay Aquarium Research Institute who was chief scientist on the *Roger Revelle*, says that these unintended consequences “aren’t great” for the feasibility of using the technique on a large scale. ■

## Mass resignation forces Italian rethink on university funds

**Alison Abbott, Munich**

A tax on smoking could deflect a funding crisis that set off widespread protests at Italian universities last week — including the dramatic mass resignation of the leaders of all 72 Italian public universities.

The university rectors handed their resignations to the minister of universities and research after the Italian parliament’s chamber of deputies approved a 3% cut in the universities’ budget for next year. The rectors had been lobbying for an increase in overall budget to cover the increased costs of salaries, which are fixed centrally.

“We were being pushed to breaking point,” says Piero Tosi, rector of the University of Siena and head of the Italian University Rectors’ Conference. “We decided to resign because we were no longer able to assure our essential services for teaching and research.”

Italian students have expressed concern over the declining competitiveness of their universities, and possible increase in fees, in a series of demonstrations and occupations of university buildings.

Many professors are particularly worried about the consequences of the budget squeeze for research, as most universities’ funds are tied up in salaries, with little left over to support core activities. “Cutting the budget would not affect the lives of those professors who do nothing anyway,” says Dario Braga, a chemist at the University of Bologna, “but would hurt only the dynamic members of the faculty who want to do research.”

But the universities also attracted criticism from some academics, who say they should sort out their management problems before asking for more money. The universities were given autonomy in 1994 after decades of centralized administration. Since then, complains Francesco Giavazzi, an economist at Bocconi University in Milan, they have expanded unwisely. “These organizational issues need to be fixed, otherwise extra money would only go to waste,” he says.

Italian finance minister Giulio Tremonti says that he hopes not only to maintain the university budget at the 2002 level, but also to create a €200-million (US\$200-million) research fund to be spent at the discretion of prime minister Silvio Berlusconi. The measures may well persuade the rectors to withdraw their resignations, but are unlikely to please Italy’s smokers — Tremonti plans to fund his proposal with a 10-cent tax on a packet of cigarettes. ■