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Make the most of palaeodata

Studies of past global change from sediments and ice cores have revealed a rich diversity of gradual and rapid perturbations. But more should be done to make the data usable by the research community as a whole.

One of the many depressing signals emerging from the budgetary proposals of President George W. Bush and the initial response of Congress is an absence of enthusiasm for environmental research. But there is surely no question that, as Exxon is somewhat disingenuously but rightly saying in a current advertising campaign, research into global change is essential. In the absence of reliable instrumental records spanning more than a century or so, that surely includes the study of global change over the Earth's past.

In that context, Japan, at least, can be commended for pursuing a major commitment to the next, expanded phase of the Ocean Drilling Program, starting in 2003. That programme, in conjunction with land-based drilling of ice cores and other sources of palaeo-records, has delivered a picture of the past that would have been hard to anticipate 10 years ago. Astonishingly fast excursions in global temperature and ocean circulation since the last ice age have been documented, as — further back in time — have massive emissions of methane from deep-sea clathrates, patterns of species extinction and recovery, and detailed studies of major periods of global warmth.

All of these and more have not only enlarged but also challenged our understanding of the evolution and dynamics of the Earth at its surface: the atmosphere, biosphere, oceans, ice and the mobile crust, both within themselves and also as a whole, influenced by changing fluxes in energy from the Sun caused by variations in the Earth's orbit and in solar luminosity. The orbital effects on incoming solar radiation are a vital ally for stratigraphers. For example, the 40,000-year cycle in the tilt of the Earth's axis of rotation to the plane of its orbit affects the strength of seasonal contrasts and is readily detected in sediment indicators. Understanding that and other cycles allows deep-sea sedimentologists to achieve high resolution in chronology. That helps to disentangle influences such as changes in ocean water formation and natural greenhouse-gas abundances.

There is no alternative to committed public funding if those studying the history of the Earth's systems are to pursue these challenges and the potential they offer for the understanding of contemporary global change. These include key issues, over millennial and also much longer timescales, such as the history of sea-level changes and of the hydrological cycle, the relationships between events in the northern and southern hemispheres, and the links between the biosphere and the chemical evolution of the atmosphere.

To get the best return on such funding, there must be strong interdisciplinary collaboration between those taking data from sea sediments, ice and land, and also between those making measurements and those developing models. But above all, the community must deliver more by way of systematic deposition of its data.

In making the most of data, funding agencies, journals and researchers themselves all have a role to play. There seems to be too little awareness by researchers of what is admittedly something of a maze of publicly supported databases. And too often, as researchers will readily complain, trying to extract the numbers in a large data set from the originators of published work is like pulling teeth. That in itself is bad for science. Journals could insist on public deposition at the time of acceptance (as some do with biological data) — but only if the community had more faith in the quality of databases and their long-term support.

The latter issue points to a need for funding agencies to devote more resources to a prosaic but invaluable goal: the long-term maintenance of open archives of geoscientific data and of sophisticated tools with which to exploit them. ■

Learning to speak and write

More needs to be done to turn young scientists into comprehensible professionals and citizens.

Where does a scientist first learn the formal communication of research in talks and papers? Typically it's during doctoral training, where senior graduate students, postdocs and advisers pass on their knowledge and experiences. But this is too *ad hoc*. The remedy for the situation seems obvious: require, as part of a graduate degree, a formal course in science communication.

Even better would be to have this formal training in every undergraduate science degree, regardless of intent to pursue doctoral research. That way, scientists going into different walks of life can better communicate with non-scientists, such as work colleagues, the general public and the media. The ability to effectively communicate one's ideas and thoughts is becoming increasingly important as society and economics grow more intertwined with science and technology.

Such a proposal is hardly new, but is still all too apt. So who should be responsible for teaching at least the more formal aspects of scientific communication? In the United States, enterprising undergraduates have seized an opportunity. The National Science Foundation (NSF) has funded a journal run by undergraduates for undergraduates that has the public support of the NSF's Rita Colwell (see page 13). Submitting to and working for this journal have been positive experiences for those who know about this resource, but it does not satisfy the wider needs of all undergraduate scientists.

The Division of Undergraduate Education at the NSF has several programmes for enhancing undergraduate science literacy and communications skills. But there is no programme that specifically aims to improve science communication for science majors. Perhaps we should look to a model developed in the physics and astronomy department at University College London, where all degree students are trained in essay writing, conducting research and giving presentations during each year of their study.

There is surely a need to spread this type of programme more widely. Anything to spare us all from more conference talks with no take-home message aided by wordy slides in tiny typefaces presented by tongue-tied, mumbling scientists. ■