Sampling-based models, it is suggested, may not be the best choice to examine whether biodiversity enhances ecosystem stability. What the sedimentary deposits from icebergs in the South Atlantic Ocean may indicate about the stability of the Antarctic Ice Sheet is discussed. And although the mortality rates in Eastern European countries did not uniformly decline during the early 1990s, they reflected an unusual feature: "the health crisis in many Eastern European countries...did not affect those groups that are considered especially vulnerable, such as children and the elderly, but instead affected those of working age."

Assessing Biodiversity and Ecological Stability

Jocelyn Kaiser, in her New Focus article "Rift over biodiversity divides ecologists" (25 Aug., p. 1282), repeats the conventional wisdom that Robert May's theoretical work in the 1970s showed that diversity works against stability. The centerpiece of May's work involved Monte Carlo samples of models—the larger the system and the stronger the interactions among populations, the smaller the proportion of the sample that would be stable. Complex ecological systems are generally not, however, the outcome of some sampling process, but arise through development over time with the addition, growth, decline, and elimination of populations.

Several modeling studies in the 1970s and 1980s showed that, whereas stable systems may be extremely rare as a fraction of the systems being sampled, they can be readily constructed over time by the addition of populations from a pool of populations or by elimination of populations from systems not at a steady state (*1*). Both sides of the debate reviewed by Kaiser about whether biodiversity enhances ecosystem function depend, conceptually, on a sampling view of ecological complexity. The developmental view would be preferable for any serious consideration of the implications of human interventions within ecosystems.

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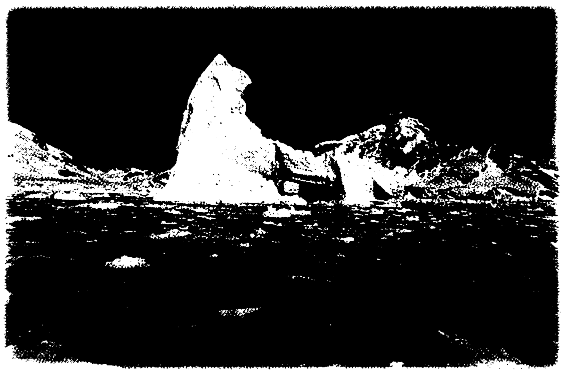
Interpreting Iceberg Deposits in the Deep Sea

In their report "Millennial-scale instability of the Antarctic Ice Sheet during the last glaciation" (9 June, p. 1815), S. L. Kanfoush *et al.* suggest that increases in ice-rafted detritus (IRD) observed in deep-sea sediment records from the South Atlantic Ocean identify times of instability of the Antarctic Ice Sheet. IRD is the material deposited from melting icebergs and is easily identified by its much coarser texture compared with other deep-sea sediments. We believe that the linkages between the physics of ice sheets and the formation of an IRD signal have not been clearly established, and that the de facto claim that IRD layers in the South Atlantic record instability of the Antarctic Ice Sheet is premature.



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The idea that an increase in IRD reflects ice-sheet instability (that is, either mechanical or a highly nonlinear response to a given forcing) originated with studies of deep-sea records from the North Atlantic Ocean. The most celebrated of such interpretations involves Heinrich events, which are thought to represent armadas of icebergs released from an ice stream draining the Laurentide Ice Sheet through Hudson Strait (*1*). The IRD layers representing Heinrich events show high sediment fluxes distributed over a large area in a short interval of time (*2*). The interpretation that such layers require an ice-sheet instability (a surge), however, still poses problems (*3*).

A number of additional IRD layers are found in North Atlantic glacial sediments, but these differ from Heinrich layers in having low sediment fluxes and in being derived from multiple ice sheets. Although these layers have also been associated with ice-sheet instability, their physical properties and their association with cold events in the North Atlantic indicate a stable, climatic response of marine ice-sheet margins to a climate forcing (*4*). Even this interpretation, however, is based on several untested assumptions: (i) IRD is delivered to a site from icebergs versus sea ice; (ii) an increase in IRD represents greater iceberg flux versus a greater amount of debris incorporated at the base of the ice sheet that delivers the icebergs or a greater distance of iceberg transport; (iii) all icebergs carry the same IRD load, and thus there is some common function between IRD concentration and iceberg flux; and (iv) an increase in IRD and associated iceberg flux represents ice margin advance versus retreat.

The IRD records from the South Atlantic described by Kanfoush *et al.* appear to share more in common with the non-Heinrich IRD layers in the North Atlantic than with the Heinrich layers. We suggest that, at the least, IRD layers derived from the Antarctic Ice Sheet must show the characteristics of Heinrich layers to support the argument for ice-sheet instability, but much more work remains to be done in interpreting ice-sheet behavior and climate dynamics from IRD records.

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Response

Clark and Pisias raise several important points. They propose that "at the least, IRD layers derived from the Antarctic Ice Sheet must show the characteristics of Heinrich layers to support the argument for ice-sheet instability" and that those characteristics are "high sediment fluxes distributed over a large area in a short interval of time." We agree with these criteria as evidence of ice-sheet instability.

The areal extent of the South Atlantic