Trouble in Polar Paradise

Gaping ozone holes, collapsing ice sheets, rising temperatures, aboriginal villages swept away: These and other disturbing headlines from the high latitudes show that rapid climate change is under way, and that even the far corners of Earth are not sheltered from its effects. In this special issue, we examine how the polar regions have fared in recent decades and how they may be transformed in a future, warmer world.

At the center of global-change research is how the dynamic behavior of the atmosphere and the oceans contributes to the weather patterns that have affected much of the world since the late 20th century. Moritz *et al.* (p. 1497) discuss how the Arctic climate has changed over the past several decades. By comparing observed Arctic climate variations to modeled patterns, they illustrate how large-scale climate dynamics may have varied in response to human-induced warming. In a News story, Kerr (p. 1490) discusses the implications of an ice-free Northwest Passage in the Arctic Ocean, which many readers may see in their lifetimes. Goldman (p. 1493) describes the hazards of melting permafrost, and Stone (p. 1493) provides a snapshot of an American Association for the Advancement of Science project on pollution and Arctic ecology on Russia's Kola peninsula.

One of the greatest concerns related to global warming is how far sea levels will rise if the vast continental ice sheets of Greenland and Antarctica begin to melt. Rignot and Thomas (p. 1502) review what is known about the mass balance of polar ice sheets, based on data collected over the past decade. They show that those ice sheets are much more dynamic than previously thought. In a News story, Kaiser (p. 1494) describes how the Antarctic Peninsula's disintegrating ice shelves may serve as a natural laboratory for studying the melting of mainland ice sheets.

Recent changes in Antarctic seabird populations may reflect complex responses, connected with sea ice change, to regional warming. Croxall *et al.* (p. 1510) explain that more regional environmental data, better ecosystem modeling, and improved knowledge of physical and biological forcing factors are required to understand and predict the responses of seabirds to climate change. The combination of recent harvest-driven changes and those caused by global warming may produce rapid shifts rather than gradual changes.

Because of its large surface area, snow is highly reactive. Dominé and Shepson (p. 1506) present an overview of how the composition of near-surface air is perturbed by snow and how snowpack chemistry affects snow composition, snowpack interstitial air, and the overlying atmosphere. As a result, the composition of the atmosphere over snowpacks is very different from that predicted by gas-phase chemistry models. Processes taking place in surface snow must be taken into account when ice cores are used to reconstruct past climates.

For those interested in knowing more about careers in the frigid high latitudes, a *Science*'s Next Wave Web feature (http://nextwave.sciencemag.org/cgi/content/full/2002/02/26/1) examines how nearly two dozen scientists have made work at the poles a part of their lives.

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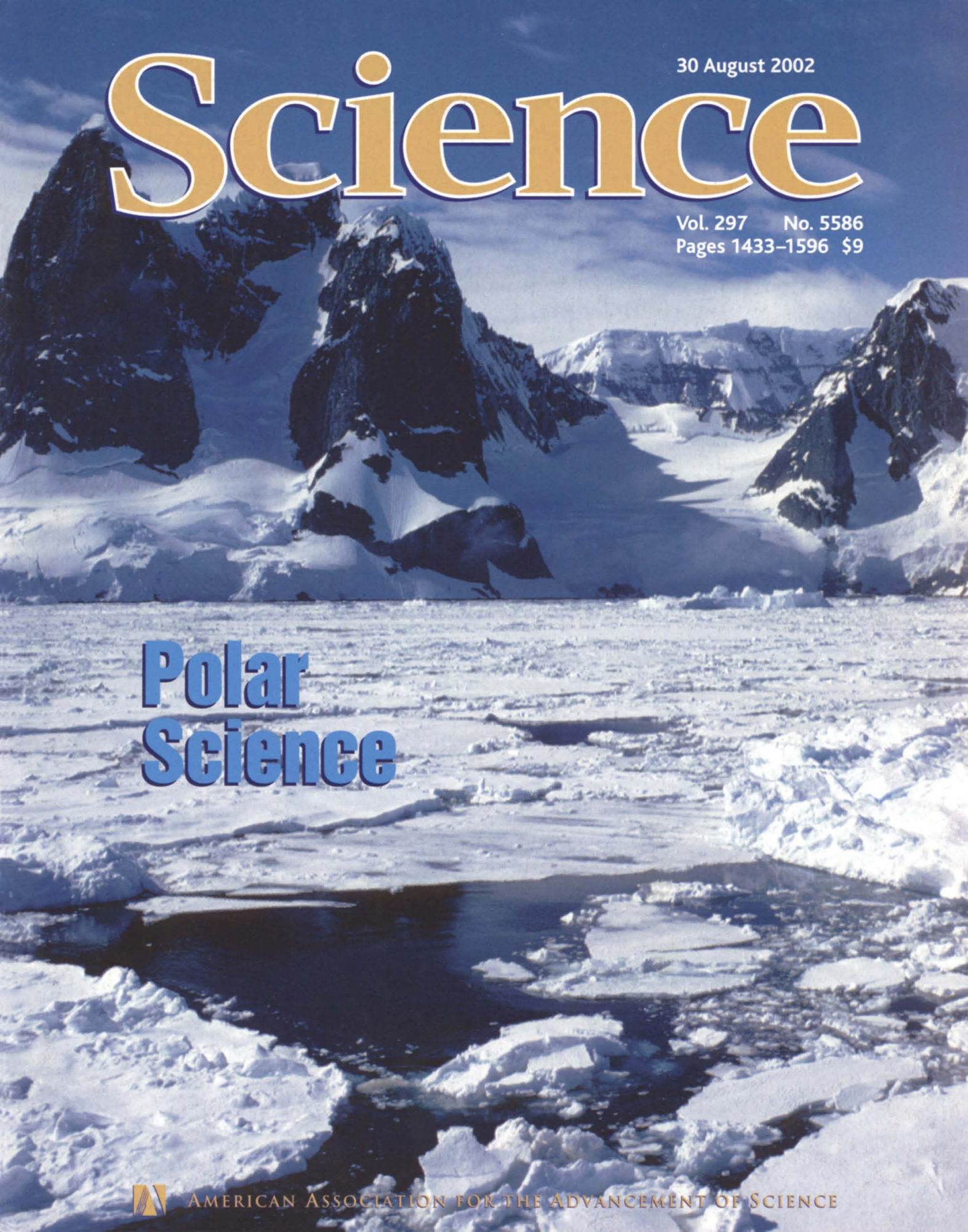

Polar Science

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