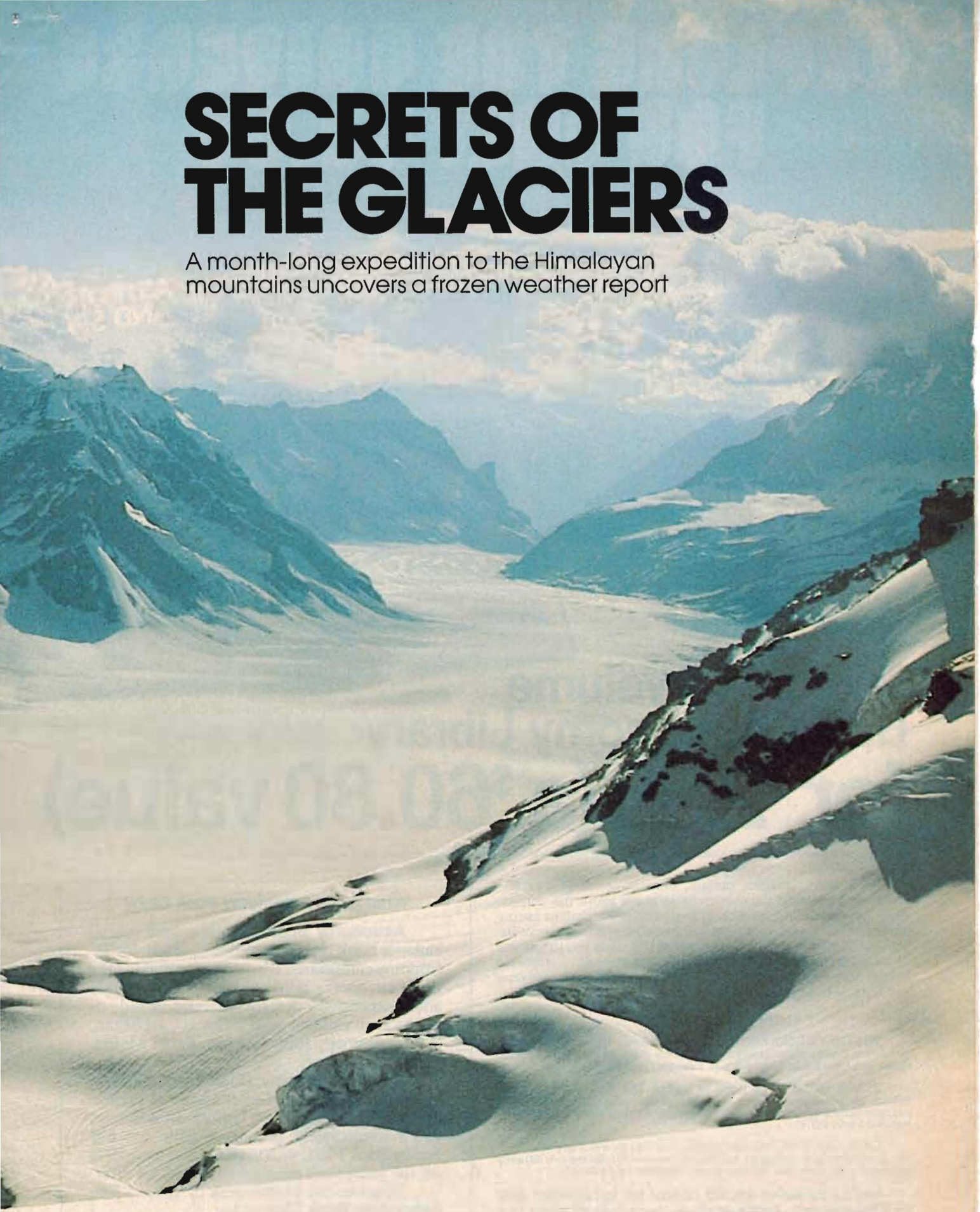
SECRETS OF THE GLACIERS

A month-long expedition to the Himalayan mountains uncovers a frozen weather report



Stretching 1,500 miles across Asia, the Himalayan mountains stand as a silent witness to the ebb and flow of India's relentless weather. In the summer months, strong southwesterly monsoons carry moisture-laden air from the Indian Ocean across the subcontinent. In the winter, the winds reverse, bringing a constant flow of cold air from Tibet in the north. Both summer and winter winds bring new accumulations of snow to the glaciers of the Himalayas. Year after year, one season's snowfall is packed down under that of the next.

Like a tree ring, each glacial layer marks off 12 months of time; each preserves evidence of the year's temperature and air composition, in the form of minute quantities of chemicals captured in the ice. Thus a detailed record of Himalayan weather is locked in the glaciers. As Paul Mayewski, a glaciologist at the University of New Hampshire, says, "There are very few weather stations in the Himalayas." Knowledge of weather patterns there could be of great value to India and would enable climatologists to fill an important gap in the global weather picture.

Now that icebound record is finally being read, the pay-off of an adventurous trek last summer by a team of six American and three Indian scientists led by Mayewski. Starting from New Delhi with 65 boxes of food and equipment, the team drove more than 500 miles along winding dirt roads northward to the frontier Kashmir village of Tongul (elevation 11,000 feet, about twice that of Denver). With 40 porters, they set out toward the nearby 15,500-foot-high Sentik glacier.

After reaching the river of ice, they corkscrewed a yard-long cylinder down into the glacier to extract samples of ice, each about 20 inches long and 3 inches in diameter. In many of the cores, the change from one season to the next was easy to see; snow deposited during summer months sometimes had a reddish cast, caused by the dust that hovers over the subcontinent during warm weather.

To avoid contaminating the cores, only one scientist, totally encased in a plastic suit, was allowed to handle the ice. The slightest contaminant might have overwhelmed the telltale traces of chemicals trapped in the ice. "We had to be very careful," explains W. Berry Lyons, a University of New Hampshire geochemist and a member of the expedition. "Just the sweat from our fingers would have ruined the sample."

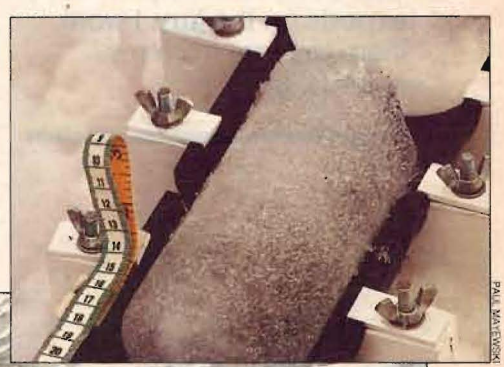
The surface of each core was scraped clean, then the ice was sliced into three-inch pieces. These were wrapped in plastic, labeled, and carried to a base camp 2,000 feet below, where they melted in the warmer temperatures. The precious water was then poured into plastic vials for the trip back to New Hampshire. Within three days the team had drilled almost 55 feet into the glacier—some 30 years back in time. After Sentik, the scientists moved on to other sites. By the end of the month-long trek, the expedition had climbed to a height of more than three miles and drilled into the glacial ice 80 times.

As a result of the trip, some 1,600 vials of Himalayan water are now being analyzed at a University of New Hampshire laboratory. Mayewski's research colleague, chemist Gordon Smith, is testing some of the water to determine its electrical conductivity, which varies with the amount of debris in the ice. Other samples are being checked for nitrates, sulfates, chlorides, and other chemicals deposited by falling snow; each particular trace should disclose facts about Himalayan weather. For example, high iron and silicate levels show that the winds swept in over land and not water. Says Mayewski: "All this ice chemistry will enable us to determine the season the ice was deposited, the volume of that year's snowfall, and where the moisture originated." How is each year differentiated? "Moisture coming in from Tibet during the winter has less sea salt in it than moisture from the ocean. So one way of dating each layer of the core is to map out the pattern of chloride concentrations."

Mayewski has already detected a promising pattern. "There may be regular changes in the character of the monsoon, a shift over a period of years between very intense monsoons and milder influxes of moisture. If we can confirm that cycle, we'll try to project it into the future. This would be a tremendous asset for the Indian people, whose crops and water supplies depend on monsoonal rains." The ramifications could also extend far beyond India; the Himalayas are like a 1,500-mile wall, blocking the circulation of the atmosphere and affecting not only the rest of Asia but the entire Northern Hemisphere as well.

But to confirm the periodicity of these changes, Mayewski and his team will have to dig deeper—and further back in time—into the Himalayan glaciers. "We have the potential to go back a few hundred years," he says, "before meteorological records were ever kept in India." Mayewski hopes to accomplish this next summer. His target: the glaciers of Uttar Pradesh, just south of Tibet.

—Marcia Bartusiak



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PETER JESCHKE

View of glacier high in the Himalayas; members of the expedition (right) extract an ice core (inset) from the drilling barrel

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