Cameroon's killer lakes: A rising threat

In August 1984, little Lake Monoun in the African nation of Cameroon briefly captured international attention when it suddenly belched a cloud of carbon dioxide gas that asphyxiated 37 people. Scientists might have written the event off as a freak occurrence except that it happened again just 2 years later at nearby Lake Nyos. That time, more than 1,700 people perished.

Lake scientists who have studied Monoun and Nyos now say that carbon dioxide is building up in the lakes so quickly that it raises the risk of new catastrophic releases. The gas comes from springs of carbonated groundwater that percolate upward into the bottom of these volcanically formed crater lakes.

"Our recent measurements indicate that the [carbon dioxide] recharge rate is tremendously fast," says George W. Kling, a limnologist at the University of Michigan in Ann Arbor. "If these recharge rates continue, the bottom waters of Nyos will become saturated with CO_2 in less than 20 years. In Monoun, it'll be less than 10 years. We didn't have any idea it was that rapid." Kling discussed the recent research results last month at NASA's Goddard Space Flight Center in Greenbelt, Md. The findings will appear in an upcoming issue of NATURE.

Gas accumulates to such dangerous concentrations in Monoun and Nyos because these lakes are naturally stratified into layers that do not mix. A boundary called a chemocline separates freshwater at the surface from deeper, denser fluids containing dissolved minerals and gases.

The Cameroon disasters occurred when some trigger — an earthquake, landslide, or even strong winds — upset the delicate balance within the lakes, creating waves that overturned the water layers. As the deep water rose, dissolved carbon dioxide came out of solution to form bubbles, just as soda fizzes when one uncaps a bottle.

At Nyos, the larger of the lakes, a dense cloud of carbon dioxide spilled over the edges of the crater and sped down a river valley at 20 meters per second (45 miles per hour). Hugging the ground, the gas cloud remained potent enough to kill people up to 25 km downstream from the lake.

Scientists do not know what particular event caused the Nyos and Monoun disasters, but they note that both occurred in August, the coolest and rainiest time of the year in Cameroon. In fact, the 1980s had record low temperatures and high rainfalls, which would have cooled the surface waters and destabilized the lake stratification, Kling says.

Although the lake turnovers in 1984 and 1986 discharged a vast quantity of carbon dioxide, dangerous amounts of gas remained trapped in the lakes even after those releases. By measuring concentrations in 1990 and 1992, Kling and his colleagues determined the rate at which gas seeps into the lake bottoms.

Kling believes that saturation of the lake bottoms will raise the odds of a gas release. "Then, any small movement of the water could trigger it," he says.

In theory, such a trauma need not happen. In 1992, a team of investigators tested a technique for lowering gas concentrations within Lake Monoun by pumping up deep water through a pipe. The scientists and engineers calculated that a system of three pipes, each 14 centimeters wide, could drain Monoun's gas in 3 years.

Nyos presents a more difficult problem. It is deeper than Monoun, contains much more trapped gas, and has a weak natural dam at one end that threatens to collapse. If the dam breaks, the upper 40 meters of the lake will spill into a region inhabited by 10,000 people, says Kling. To make matters worse, the flood would probably trigger a gas release.

Engineers could combat both threats by pumping deep water out of Nyos, thereby draining away gas and lowering the lake below the level of the dam. A conference last fall addressed the topic of reducing the threats at Nyos and Monoun. But so far, Cameroon has not funded this project, nor has any other country volunteered, Kling says.

"It's a social irresponsibility for the world to let that time bomb sit ticking away there," says Daniel A. Livingstone, a lake scientist at Duke University in Durham, N.C. *— R. Monastersky*


Kling

Jacques Grangeon

Left: Lake Nyos, just after the disaster. Right: At Lake Monoun in 1992, dissolved gases propel deep water up through a pipe to the surface.

Modern humans linked to single origin

A new study that calculates the mathematical fit of competing explanations of human evolution with the geographic array of specific fossil features supports a single African or southwest Asian origin for modern humans.

The analysis enters a heated debate over human origins. One theory posits an African genesis for modern humans between 100,000 and 200,000 years ago, after which *Homo sapiens* spread elsewhere and replaced Neandertals. An opposing view argues that modern humans evolved simultaneously in several parts of the world beginning about 1 million years ago, with genetic input from Neandertals (SN: 9/25/93, p.196).

"Africa and southwest Asia are good candidates for areas where modern human anatomy originated," asserts Diane M. Waddle, an anthropologist at Duke University Medical Center in Durham, N.C. "I'm confident that Neandertals had nothing significant to do with modern human evolution."

Waddle's study relies on a method, developed by geneticist Robert R. Sokal of the State University of New York at Stony Brook, for calculating the correspondence between various scientific predictions and sets of relevant data. Sokal and his coworkers have used this method to evaluate theories of modern language origins based on links between language patterns and genetic traits in European populations (SN: 8/22/92, p.117).

The Duke scientist studied 83 fossil craniums of *H. sapiens* and Neandertals found at sites in Europe, southwest Asia, and Africa. Specimens ranged in age from around 40,000 to 400,000 years old. Waddle placed the fossils in 12 groups, depending on geographic location and age.

She then measured a series of cranial features and traits to calculate the anatomical variation in each group and the degree to which pairs of groups resembled one another.

Considered either as separate origin sites or lumped into a single group, African and southwest Asian fossils account better for the resulting pattern of anatomical relationships than the assumption that evolution took distinctive paths in Africa, Asia, and Europe, Waddle contends in the March 31 NATURE.

Advocates of multiregional human evolution, such as Alan G. Thorne of Australian National University in Canberra, doubt that Waddle's conclusion will hold up once she studies East Asian and Australian fossils. Waddle plans to analyze these specimens, which have often been cited in defense of a separate Asian evolution of modern humans. *— B. Bower*