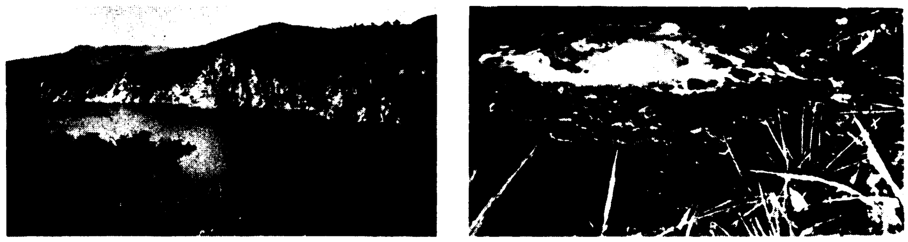
SCIENCE NEWS of the week

Cameroon Clouds: Soda Source?



Evans

Lake Nyos (left) and the prodigious Ahio-Ekenzu soda spring with CO_2 bubbles.

With new evidence in hand, two U.S. scientists have recently returned from a follow-up study of last year's Lake Nyos disaster in Cameroon, in which the lake had expelled a large cloud of carbon dioxide that spread into surrounding valleys, asphyxiating livestock and killing 1,746 people. This event, and a similar but less damaging one at Lake Monoun in 1984, had prompted much concern about the hazard posed by other crater lakes in the region (SN: 9/20/86, p.180). However, the researchers, who have just completed a survey of Cameroon's 33 crater lakes, report that only Nyos and Monoun contain large amounts of dissolved carbon dioxide and therefore are the only lakes to pose any danger of future gas releases.

Also emerging from the study is evidence that will help determine how carbon dioxide entered the two lakes and how quickly this process is occurring. The new findings, which the researchers discussed this week in interviews with SCIENCE NEWS, support a theory proposed earlier that carbon dioxide rises from the earth's interior and becomes dissolved in groundwater, which then feeds into the lakes.

"We strongly suspect that the carbon dioxide enters Lakes Nyos and Monoun through submerged soda [carbonated] springs," says William C. Evans of the U.S. Geological Survey in Menlo Park, Calif., one of the participants in this study.

Numerous springs of carbonated, slightly heated water bubble up to the surface along a line of past and present volcanic activity in Cameroon. In a survey of these surface springs, Evans and George Kling from Duke University in Durham, N.C., found one that was discharging enormous quantities of carbon dioxide. This spring, says Evans, "is potent enough to supply one of those lakes with enough gas to saturate it in a matter of, say, thousands of years," a number consistent with estimated ages for the lakes. Once it enters these deep, highly stratified lakes, the carbon dioxide dissolves and is trapped until some event upsets the delicate equilibrium and the gas comes out of solution.

Evans says that finding such a potent spring at the surface lends credence to the possibility that submerged springs are actively supplying Lakes Nyos and Monoun with carbon dioxide.

The researchers also measured slight increases in the alkalinity and temperature of the water at the bottom of Nyos. An influx of carbonated, heated groundwater would account for these changes, the researchers say in a report presented to the Cameroonian government on June 4. However, Evans and Kling say it is possible that other processes might be creating these observed trends.

Laboratory tests in the coming months will help determine whether groundwaters are causing the increase in alkalinity, says Kling. In particular, U.S. researchers will be analyzing ion and isotope concentrations in samples from Monoun and Nyos. They will also compare samples from the surface soda springs and from the bottom of Nyos.

With all the other Cameroonian crater lakes tested and declared safe, most of the danger to the region comes from a weak dam on the northern shore of Nyos, says Kling. Since the Cameroonian government has evacuated most people from the valley surrounding Nyos, a second release of gas would not be as disastrous as the first; however, a flood from a dam break would cause significant damage to the homes in the region.

Although scientists are unsure how much carbon dioxide remains dissolved in Monoun, this lake's relatively small size prevents it from holding as much gas as Nyos, and it is therefore less dangerous, says Kling. As well, preliminary analyses of the bottom samples from both lakes indicate that the rate of recharge for carbon dioxide is quite small. However, Kling stresses, "We're working with a phenomenon that occurs on a geologic time scale and we're trying to make measurements on a nine-month time scale." — *R. Monastersky*

Sound waves for activating nickel

An ultrasonic cleaning bath is a convenient way to scrub items such as delicate jewelry. Now a group of chemists has shown that a similar technique can be used to strip an oxide coating from particles of nickel powder. That cleansing action turns nickel into a better catalyst for certain chemical reactions.

"We went out looking for the world's worst hydrogenation catalyst," says chemist Kenneth S. Suslick of the University of Illinois at Urbana-Champaign. The researchers came up with nickel, which normally forms a protective oxide coating when exposed to air. This tough, invisible film makes nickel ideal for coins and other applications where resistance to chemical attack is prized. However, the metal is known to be quite reactive if clean, single crystals can be obtained in a high vacuum.

Working with Dominick J. Casadonte, Suslick discovered that irradiation with sound waves at a frequency of 20 kilohertz increases nickel's activity as a catalyst by more than 100,000 times. Their experiments involved the addition of hydrogen to organic compounds called alkenes, a reaction widely used in the chemical industry. The reactions took place in solvents such as octane.

The researchers also examined nickel particles before and after irradiation to see what changes had occurred. They noticed that the initially rough, crystalline particles were quickly smoothed out until they were practically spherical. Particles also tended to clump together to form larger units. At the same time, each particle's nickel oxide coating, originally 200 to 250 angstroms thick, was made much thinner and more fragmented.

The results, reported in the May 27 JOURNAL OF THE AMERICAN CHEMICAL SOCIETY, support the view that a process called cavitation plays a major role. When sound waves pass through a liquid, they cause tiny bubbles to form. These bubbles suddenly collapse to generate highly energetic shock waves.

"This throws the particles into one another at high velocities," says Suslick. Particles brushing against one another do the smoothing, while direct collisions lead to aggregation. The process also helps scrape away the metal's oxide layer.

"This is the first time," says Suslick, "that anyone has really answered the question of where the increase in reactivity [due to ultrasound irradiation] is coming from." — *I. Peterson*