EARTH SCIENCES

Major lava flow at Mt. Etna

In what may be the biggest eruption since 1971, Mt. Etna, Sicily's on-again, off-again volcano, last week sent lava pouring down its flanks toward the 15,000 population town of Randazzo. While details are still sketchy, Lindsay McClelland of the Smithsonian Event Alert Network says the March 18 and 19 lava eruption came from a new fissure at approximately 1,200 meters altitude on the northwest flank of the 3,200 m high volcano. Fissure eruptions, which are common events in Etna's 2.5-million-year history, occur along an elongated crack in the earth rather than from a central vent or crater. By one unconfirmed estimate, the lava flow may have extended about 5 kilometers from the fissure. Interestingly, the fissure apparently opened in an area that has not been active in recent history, according to McClelland, and apparently little other activity, such as earthquakes or ash flows, accompanied the lava flow. On March 20, however, some earthquake activity was recorded near the summit of the volcano. The lava flow apparently did not reach the town of Randazzo, possibly diverted by the local topography. The flow did, however, cut off some rail lines and damage some crops, reports McClelland. By March 22, activity at the volcano had ceased.

Fishing by satellite

An eye in the sky has saved an Alaskan herring processing plant $8,000 daily in wages and fuel costs during the past year, according to the National Oceanic and Atmospheric Administration. The eye, which is the NOAA-6 polar-orbiting satellite (SN: 8/4/79, p. 87), detects heat and reflected light from the sea surface. Those measurements are then converted into imagery made up of varying shades of gray that correspond to specific sea surface temperatures. That imagery is used to prepare temperature charts that have been distributed on an experimental basis for about a year to various users, including the Coast Guard and oil companies. The Alaskan company, for example, is looking for areas where sea surface temperatures have warmed to 4°C, because those are the areas in which herring runs occur most often. Data gathered during the satellite's twice-daily passes over Alaskan waters can tell the company exactly where to send its floating processing plant.

A positive side to lightning

Most lightning flashes that travel from a cloud to the ground have a negatively charged current of 30,000 to 80,000 amperes. Occasionally, positive cloud to ground bolts occur that have been measured at 100,000 amperes. These positively charged bolts have been thought rare, occurring only if triggered by a tall structure or mountaintop or as a solitary flash in a dissipating storm. Recently, however, such bolts have been detected in the middle of violent thunderstorms on flat land. Researchers now suggest they may be linked to the severity of the storm.

Researchers at the National Oceanic and Atmospheric Administration's National Severe Storms Laboratory in Norman, Okla., have found several prairie storms each season that contain the positive flashes, says NOAA's David Rust. The flashes seem to come from the part of the storm where an intense updraft occurs — called the mesocyclone — which is also believed to be the source of tornadoes. Rust suggests that this circulation or the shear of the horizontal winds may cause the positive bolts. A severe storm is "highly sheared"—meaning that the wind speed changes significantly with height—explains Rust, and the usual positive-over-negative layers tilt. That tilt, he says, may allow the bolts that originate in the positive layer to reach the ground without being absorbed by the lower negative layer.

TECHNOLOGY

Variable-rate insulin-delivery implant

An 11-ounce insulin-delivery pack—about the size of a deck of cards — is taking over for the malfunctioning pancreas in a 41-year-old diabetic man. Implanted below his right rib cage, it delivers insulin to the peritoneal cavity where it is absorbed by the body and used to regulate blood-sugar levels. The experimental system is being developed by Sandia National Laboratories and the University of New Mexico medical school.

Every-time the system pumps, a two-microliter drop of insulin is dispensed. Frequency is controlled with a pulsating (rotary solenoid) motor powered by a seven-volt battery. With a hand-held electronic programer, the user can signal the implant when and how to vary the insulin dose — from a maintenance rate of perhaps one drop every four to 16 minutes, to a meal-time high of one drop every eight seconds. It will also query the implant for operating details and display answers. Commercial models, still years away, could last seven years and hold a 30-day insulin supply that's refilled through the skin.

Cool approach to faster circuits

A new integrated-circuit technology that merges the most attractive attributes of its existing alternatives was announced by its inventors, Richard Konian and James Walsh, at a computer-science conference in San Francisco on Feb. 25. According to the IBM engineers, their circuit couples the low power and size of transistor-transistor logic (TTL) with the switching speeds of emitter-coupled logic (ECL) — the fastest circuit known.

Heat, which can cause circuit failures, is a major enemy of semiconductors and because ECL circuits dissipate so much heat — roughly 10 milliwatts or more per circuit — they require advanced cooling and a limit on the density with which they can be packed onto an integrated-circuit chip. But their payoff has been fast switching speeds, on the order of once every 400 to 500 picoseconds (trillionths of a second). On the other end of the spectrum is TTL. A low performer, it can only switch in 1.3 to 2 nanoseconds (billionths of a second). However, dissipating little heat—about 0.3 to 1.2 milliwatts per circuit—TTL circuits can be packed together densely. Now there's the Konian-Walsh circuit. It occupies the same space as TTL, has about the same power, but switches in the range of 200 to 300 picoseconds—actually faster than ECL.

What basically differentiates circuit technologies is how their transistors are arranged and connected. Circuits, the building blocks of computer chips, group transistors and other basic electronic components into a configuration that can perform a "logical" function. And two major attributes distinguish Konian-Walsh circuits from ECL and TTL, the most commonly used circuits in the computer industry. The first is a very short electrical path through its transistors: Input signals exit transistors "in one collector time," Konian explains. "At the same time," he told SCIENCE NEWS, "we gave our circuit push-pull capability. . .so it actively charges and discharges line capacitors rapidly. It's the first time we've been able to get push-pull capability in one collector time across a very low voltage — a range of just two volts to support two transistors in the push-pull arrangement."

The first hardware demonstrating this new technology — a wafer of 159 chips using Konian-Walsh circuitry — was completed only a month ago. And since the technology is still so new, the IBM pair have much to learn about how it functions. But their circuits were constructed using manufacturing techniques standard to the circuit-building industry. So unless future experiments identify strange and unforeseen problems, if and when they are made commercially available, Konian-Walsh circuits should prove cost competitive with alternatives.