EARTH SCIENCES

Dilatancy caveat

The dilatancy model, increasingly fashionable in earthquake prediction research, should not be taken as the last word on the subject, warns Hiroo Kanamori of the California Institute of Technology. A magnitude 5.2 quake that occurred last June 1 in the Mojave desert failed to show the characteristic slowing of seismic waves predicted by the theory, he reported at the San Francisco meeting of the American Geophysical Union, even though the region was being carefully monitored at the time for evidence of dilatancy.

According to the theory, increasing strain in the rocks prior to an earthquake causes microscopic cracks that reduce the speed of seismic waves passing through the region. When the cracks, which weaken the rocks, finally fill with water or close, the quake is presumably imminent. For a magnitude 5.2 tremor, says Kanamori, dilatancy theory calls for a 10 to 20 percent decrease in wave velocity (in this case from nearby quarry blasting) for two to five months in advance. Instead, the June 1 event was preceded by an *increase* of about one percent, with only a tiny decrease just before the quake.

Other precursors have been associated with dilatancy models, but the velocity change has clearly been favored. It is not yet known, says Kanamori, whether such change precedes all types of quakes, or even whether there is a universal relationship between the time interval and the size of the quake. "Clearly," he says, "if we are looking at only one kind of data, we may not see evidence that a quake is in the offing."

Hear it now, feel it later

When residents of California's Imperial Valley, where more than 1,000 small earthquakes occurred between Jan. 23 and Feb. 12, 1975, reported that many of the quakes were heard before they were felt, U.S. Geological Survey researchers decided to try to capture the sound on tape. On Feb. 9, after three nights of waiting, they recorded three seconds of a low rumbling, which was followed by a slight tremor. A check of other instrumentation revealed that the sound arrived within 0.02 seconds of the tremor's first P (pressure) waves, but before the slower but larger S (shear) waves that produced the perceptible shaking, thus accounting for the "heard-before-felt" reports according to David P. Hill of the USGS.

China's mineral potential

A report said to be "the first overall study of China's position in the all-important energy and minerals field" has been issued by the U.S. Bureau of Mines.

China's steel industry now ranks among the top half-dozen, the report says, and its still-growing coal industry is already third in the world. Petroleum production in 1974 was about 475 million barrels, triple the country's 1970 output, and due to intensive onshore and offshore drilling and exploration, the report predicts that in the 1980's China will become one of the world's top five oil producers.

Natural gas production is "significant," with large reserves believed to exist. There is also widespread use of methane generated by fermentation of organic wastes. Though lacking workable deposits of nickel and chrome, according to the report, China is the world leader in tungsten production, with substantial exports of tin, antimony, manganese, bismuth and mercury, and the potential for large-scale production of aluminum and copper.

Titled "The People's Republic of China—A New Industrial Power With a Strong Mineral Base," the report (No. 024-004-01801-1) costs $3.75 from the Government Printing Office.

PHYSICAL SCIENCES

Motes in the laser's eye

That a light beam can induce the formation of solid particles as it shines through a gas has been known at least since 1869, but until now it was not known that that could happen in metal vapors. In the Dec. 15 PHYSICAL REVIEW LETTERS Andrew C. Tam, George W. Moe and William Happer of Columbia University report that such flecks about a micrometer in breadth will form in the vapor of the alkali metal cesium when a resonant laser beam shines through it.

Formation of the flecks depends on the presence of a certain amount of hydrogen, and they are identified as cesium hydride crystals. Such a process can be a nuisance in devices where light shines through gases (excimer lasers, for instance), but it is also of potential use as an isotope separation method.

The reaction is initiated by the light energetically exciting one participant or the other and rendering it able to react. If it is the cesium that is energized, the process could be used to separate one isotope of cesium (or possibly other metals if the effect happens for them) from another. (Laser light can often be tuned to excite one isotope of an element and leave the others alone.) The cesium hydride crystals come out electrically charged, and if that is true in other cases, sweeping the desired isotope out of the gas chamber would be easy. If it is the hydrogen that is excited, the method could be used to separate the potential nuclear-fusion fuels, deuterium and tritium, from ordinary hydrogen.

No nuclear squirts

The advent of accelerators that drive beams of energized atomic nuclei (heavy ions) against other nuclei has stirred theorists to figure out, from the evidence of early experiments, how lumps of nuclear matter behave dynamically when they hit others.

The outcome of such cogitation is the somewhat curious theory that nuclear matter in such circumstances behaves rather like a viscous liquid or slush. It is subject to heating by friction, to acoustical vibrations and to shock waves. One of the specific predictions of the new theoretical work is that when two nuclei bang together, jets of nuclear matter should squirt out the sides.

Unfortunately, a group of experimenters who searched for such squirts (A. M. Poskanzer, R. G. Sextro and A. M. Zebelman of the Lawrence Berkeley Laboratory, H. H. Gutbrod of the Society for Heavy Ion Research in Darmstadt, West Germany, and A. Sandoval and R. Stock of the University of Marburg in West Germany) report in the Dec. 22 PHYSICAL REVIEW LETTERS that they find no evidence of such squirts even though a previous experiment reported some.

The group used LBL's Bevalac to bombard silver and uranium targets with protons, alpha particles and oxygen 16 ions. They recorded helium 3 and helium 4 fragments emanating from the collisions, but found no evidence for peaks in the distribution of the fragments at certain angles that the nuclear squirt prediction would require.

A magnetic pole discriminator

Controversy over the claimed discovery of a magnetic monopole indicates the need for a sharper way of distinguishing electric charges from magnetic ones. In the Dec. 22 PHYSICAL REVIEW LETTERS Ray Hagstrom of the Lawrence Berkeley Laboratory points out that Cerenkov radiation from a magnetic charge is polarized in a direction 90 degrees away from that of an electric particle. He proposes that a thin polarizing coating (about 5×10^{-4} centimeters thick) on the Cerenkov counters now used in the observations could make the discrimination.