physical sciences

A confirmation of element 104

Many isotopes of elements with atomic numbers greater than 100 have been experimentally manufactured in recent years. The usual means of identifying them has been to use their fission products or their alpha-particle spectra to deduce their atomic number.

The best way to identify an unknown element, according to a group from the Oak Ridge National Laboratory (C. E. Bemis et al), is by its characteristic K- or L-series X-rays, which are directly connected to its atomic number. In the Sept. 3 PHYSICAL REVIEW LETTERS the group reports that they have identified element 104 by a modified X-ray technique which includes measurement of the daughter isotope produced by alpha decay of 104 (element 102) in coincidence with the alpha particles emitted in the decay. They say this is an unequivocal identification of element 104 and confirmation of its earlier reported discovery. The sample was produced by bombarding a target of pure californium 249 with nuclei of carbon 12.

More on Titan's atmosphere

Saturn's satellite Titan has aroused interest lately because its atmosphere appears to be thick enough to have a possible greenhouse effect. This could lead to a surface temperature much above what would be expected at Titan's distance from the sun, and there has even been a suggestion it might be warm enough for life.

In an attempt to extend knowledge of Titan's atmosphere F. C. Gillett, W. J. Forrest and K. M. Merrill of the University of California at San Diego observed the satellite in the infrared range between 8 and 13 microns using the UCSD-University of Minnesota 60-inch telescope at Mt. Lemmon. They report in the Sept. 1 ASTROPHYSICAL JOURNAL LETTERS that they find evidence of a strong temperature inversion, a region where temperature rises with distance above the satellite's surface instead of falling as it would be generally expected to do.

There is also evidence for a spectroscopically active component in the atmosphere in addition to the molecular hydrogen and methane that have previously been reported. This might be ammonia or ethane depending on its location. Further observations in the same range with better wavelength coverage and higher-resolution observations around 20 microns are suggested.

A strange new X-ray source

Earlier this year T. H. Markert and collaborators at the Massachusetts Institute of Technology reported the existence of an X-ray source designated GX 339—4. Now, after several months of observation with the MIT experiment on the OSO-7 satellite, they report in the Sept. 1 ASTROPHYSICAL JOURNAL LETTERS that GX 339—4 behaves in a way "unlike that of any previously reported X-ray source."

The intensity of the emissions of GX 339—4 varies by at least a factor of 60 over a time interval of hundreds of days. Yet, unlike a number of other X-ray sources, it shows no evidence of periodic or cyclic behavior. Nor does it show the abrupt intensity changes over time scales between 3 minutes and 13 days that characterize still another group of X-ray sources. GX 339—4 has distinct times when its intensity is high; it has lows during which the spectrum softens and seems to indicate that X-rays are being absorbed by something near the source, and there are off periods when no statistically significant emission is recorded from GX 339—4.

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into a hole drilled in the rock. Fluid is pumped into the sleeve, expanding it and forcing the plastic into the fractures in the surrounding rock. When sleeve and plastic are withdrawn, the plastic retains a "print" of its surroundings, indicating the amount of fracturing and compressing in the area.

Another method involves pumping fluid directly into a hole with enough pressure to open fractures in the hole walls; the pressure is then relaxed, allowing the rock to squeeze the fluid back out. At some point the pressure with which the rock is expelling the fluid will drop off suddenly, representing the "minimum principal stress" at that point. Several such holes will indicate the axis of minimum stress, which can help reveal where, in a seismically active area, a tremor could occur.

To build a united front against damaging earthquakes, the Federal Government is consolidating its troops, moving quake researchers from the National Oceanic and Atmospheric Administration over to join those at the U.S. Geological Survey. Part of the idea is to reduce duplication of effort. Robert Hamilton, who will head the new combine for the Survey, points out that cutting down competition has its disadvantages, but he maintains that the time is certainly right for a concerted effort. "I don't know of any really well-known or prominent seismologist who regards prediction as crazy," he says, "whereas five years ago there were some."

Eaton concurs. "Some of these answers are so long overdue that it strikes me as being criminal to defer," he says. "The inattention to such things, as demonstrated by the San Fernando earthquake, is truly frightening."

On May 27, 70 NOAA seismologists and geologists were transferred to the USGS; in the next month or so, about 100 more will go. In fiscal 1973, the USGS was appropriated an extra $7 million specifically for the earthquake effort; $3 million of that was impounded by President Nixon, but this has since been released and will serve as additional funding for FY 1974.

To go with the mandate of its additional funding, the USGS is also developing a directed program of earthquake hazard reduction.

Additional impetus may come from bills, now in committees of both House and Senate, to delineate plans and appropriate more money for the purpose of carrying them out. The strongest may be that of Rep. Richard Shoup (R–Mont.), who has proposed the creation of a powerful Earthquake Research Board, made up of Presidential appointees recommended by Congress, the National Science Foundation, the National Academy of Sciences, the Interior Department, NOAA, the Defense Department and professional societies. Shoup's bill would give the board an initial budget of $15 million, with an annual allotment of $12 million for five years after that, along with authority to review research, set new goals, "and accept or reject the suitability of proposed research, engineering and development efforts." (This could be an almost unprecedentedly powerful panel, some geologists feel, and an acceptable proposal may have to be a milder one.)

Even without such legislation, however, the war on earthquakes has certainly begun. "New developments have moved us closer to realization of earthquake forecasting," says Shoup, "and the recent quakes in Mexico should be convincing proof of the need for forecast capability." □