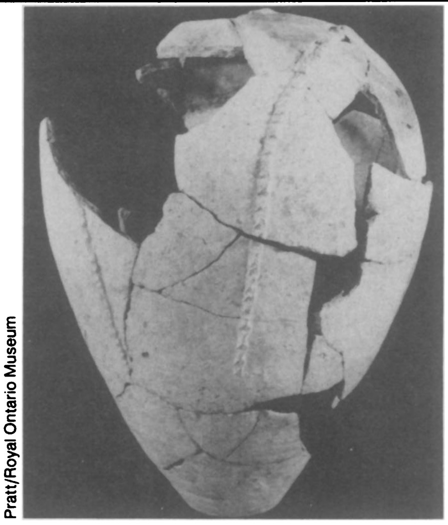
Dregs in jar tell of ancient wine-making

The concept of a "vintage year" took on new meaning this week when scientists presented the first chemical evidence that wine existed as far back as about 3500 B.C.

Wine residues in clay jars and a wine-making apparatus document that people produced the fermented beverage almost half a millennium earlier than experts thought, says Patrick E. McGovern, an archaeological chemist with the University of Pennsylvania in Philadelphia. He and Virginia B. Badler, a University of Toronto graduate student, announced their findings at a symposium on the ancient history of wine, held in California's Napa Valley.

Badler had noticed a red stain while piecing together jars excavated from an Iranian site called Godin Tepe, an outpost built along what later became a major Middle Eastern trade route. The 7- and 14-gallon containers had long, narrow necks and a body shape that suggested they once stored liquids while resting on their sides, just as wine is stored today. Other finds at the site included stoppers for the jars and a funnel with a heavy lid that could have been used to press grapes.

At first, Badler and McGovern didn't know what to make of the stain. "It was just a colored deposit," McGovern recalls. But the jars' shape and the associated equipment made them suspicious, so they compared the stain with a similar stain in an ancient Egyptian vessel known to have contained wine. The researchers scraped the reddish residue from the jars and analyzed the samples with infrared spectroscopy, which distinguishes chemical components by the wavelengths of light they absorb.



Pratt/Royal Ontario Museum

One of the oldest known wine bottles, missing its neck.

Residues from the Iranian and Egyptian jars looked alike and were full of tartaric acid, a chemical naturally abundant only in grapes. "Those crystals are a signature for wine," says anthropologist Solomon H. Katz of the University of Pennsylvania.

More than two dozen archaeologists and other researchers showed up this week at the Robert Mondavi Winery in Oakdale, Calif., to discuss their work. Some came with samples in hand, including an unopened bottle of Roman wine found on a sunken ship. Now that the Iranian discoveries have pushed back the beverage's origins, says McGovern, "we're trying to get people to look more carefully at their collections for potential wine vessels." *– E. Pennisi*

Late atomic bursts from cracked crystals

When brittle crystals break, they often stage a spectacular light-and-particle show, spewing copious quantities of photons, electrons, ions, single atoms and even clusters of atoms. Now, researchers have discovered that certain crystals also emit intense bursts of atoms and molecules after the material has cracked in two – sometimes as much as 250 milliseconds later.

"This is a huge delay in terms of the normal kinds of mechanisms [proposed to account for emissions accompanying fracture]," says physicist J. Thomas Dickinson of Washington State University in Pullman. "It's a very peculiar effect."

Dickinson and his collaborators describe their findings in the April 22 Physical Review Letters.

The researchers first noted this delayed emission when cracking rectangular, single-crystal wafers of sodium chloride and lithium fluoride. In each case, they observed rapid bursts of either sodium and chlorine atoms or lithium and fluorine atoms, as well as neutral sodium chloride or lithium fluoride clusters. These appeared 0.5 to 250 milliseconds after the crystal had finished breaking. Each burst typically lasted a few milliseconds.

More recent experiments show that cracked germanium crystals similarly produce delayed bursts of single germanium atoms and molecules consisting of pairs of germanium atoms. "The presence of the emission is very reproducible," Dickinson says. "But because every fracture is different, the time delay is fairly erratic."

To explain this delay, Dickinson and his co-workers propose that the tip of a crack streaking through a breaking crystal induces microscopic dislocations, or shifts, in the crystal's orderly array of atoms or ions. Driven by stresses in the material, these crack-injected "ripples" travel into the crystal, reverse direction, then come speeding back to the newly formed fracture surface. The simultaneous arrival of several mobile dislocations at the surface furnishes sufficient energy to eject an atom or a cluster of atoms.

"The dislocations basically dump their energy at the surface, releasing atomic and molecular species into the vacuum," Dickinson says. However, "the details of the transfer of this energy to the atoms and molecules are not clear."

Monitoring the atomic and molecular emissions that result from dislocation "popout" may nonetheless prove useful for studying such important processes as energy dissipation during fracture. At the very least, the researchers say, such signals could provide a relatively simple way of investigating dislocations generated by fractures. *– I. Peterson*

Hypertensive smoking gun

Smoking a couple of cigarettes can substantially raise blood pressure for at least 20 to 30 minutes. Yet when hypertensive patients visit their doctors, even those who smoke heavily tend to have blood pressure readings no higher than their nonsmoking counterparts.

This seeming paradox has furrowed many a researcher's brow. Now, a research team has verified the suspicions of many cardiologists: that among older smokers at least, readings taken in the doctor's office lead to underestimates of average daytime blood pressure.

At the New York Hospital-Cornell Medical Center in New York City, Samuel J. Mann and his co-workers fitted 177 people suffering from untreated hypertension with small blood-pressure monitors. The volunteers included 59 smokers and 118 nonsmokers matched to the smokers by age, sex, weight and race. The portable monitors assayed blood pressure every 15 to 30 minutes throughout one day.

Neither sleeping nor daytime blood pressures varied between smokers and nonsmokers under age 50. Indeed, the researchers report in the May 1 Journal of the American Medical Association, the only major difference they observed involved the older smokers' systolic blood pressure – the larger of the two pressure values, reflecting pressure as the heart contracts. During the day, smokers 50 and older maintained a significantly higher systolic pressure (averaging 153 millimeters of mercury) than did nonsmokers the same age (142 mm Hg). Both groups averaged 143.5 mm Hg at the doctor's office.

Mann says these findings may reflect arteriosclerosis in the older smokers. "What I think I'm seeing is a stiffer arterial system – [one] less able to buffer an increase in blood pressure during exercise," he says. □