Dr. Patrick McGovern - MASCA [2005]

Stone Age Beer

BY LARRY GALLAGHER

PHOTOGRAPHY BY ANDREW HETHERINGTON

It's one thing to re-create a 9,000-year-old brew. It's another thing to drink it

AT 9 A.M. IN REHOBOTH, Delaware, the windows of Dogfish Head Brewery, on the town's main drag, are steamed up. Mike Gerhart, a head distiller for Dogfish, has arrived early to stoke the kettles for today's historic brew. Joining him is his boss, Sam Calagione, Dogfish's founder. Down from Philadelphia for the day is Patrick McGovern, an archaeological chemist at the University of Pennsylvania Museum.

Adventures in brewing are not uncommon at Dogfish Head. In the 10 years since he started the brewery, Calagione, 36, and his crew have distinguished themselves in the brewing subculture for whimsy and imagination. They have made ales with beet sugar and raisins, with chicory and St. John's wort. Their Pangaea ale used ingredients from all seven continents. Five years ago, Calagione and McGovern collaborated on Midas Touch, a beverage informed by the 2,700-year-old remains of a funerary feast discovered in central Turkey and believed to have been that of King Mita, the historical figure behind the Midas legend.

This morning they are pushing further into the murk of alcoholic prehistory. For the past few years McGovern has been analyzing scraps of pottery excavated from a site in central China. Last year he announced that he had detected traces of the oldest alcoholic beverage yet discovered, a Stone Age brew dating back 9,000 years. When I visited McGovern's basement laboratory the day before, he handed me a plastic bag containing one of the shards. I could not get my mind around the stretch of human culture it embodied—a time period twice the span from the pyramids of Egypt to the pyramids of Las Vegas; Christianity rising four and a half times. Nonetheless, with this meager evidence, McGovern and the brewers at Dogfish have found their mission: to coax an ancient brew back to life.

MOLECULAR ARCHAEOLOGY IS THE NAME FOR THE NEXUS OF disciplines at which McGovern finds himself. He is one of a number of scientists who in the last quarter century have been using the analytic tools of modern chemistry—spectrometers and chromatographs—to scrutinize the artifacts of lost worlds, seeking evidence with which to piece together the lives of our ancestors. McGovern has made a name for himself tracking down and studying traces of prehistoric alcohol, the details of which he reveals in a recent book, *Ancient Wine: The Search for the Origins of Viniculture.*

For many years, the analytic machines in McGovern's laboratory were too expensive to fit the modest budgets of most archaeology departments. Many of McGovern's are hand-me-downs, donated by DuPont when they upgraded to newer,

fancier models. The growing availability of the technology has permitted artifacts long cataloged and relegated to museum storage rooms to be reanalyzed.

The pottery fragments in McGovern's laboratory hail from Jiahu, a Neolithic dig site in the province of Henan in central China, where they were excavated in the 1980s. Little was left after nine millennia but a few salts and organic chemicals. Alcohol and sugars were long gone. McGovern boiled the shards in the solvents methanol and chloroform, then evaporated away the solvents, leaving behind an organic residue. He ran some of the residue through his spectrometers and chromatographs, which shoot a beam of light at a sample to measure its absorption. Other residues he farmed out to colleagues. When the results were pooled and collated, McGovern found matches for rice, beeswax, and a fruit containing tartaric acid. Tartaric acid is easily attributed to grapes, but at the time of McGovern's study, the scholarly record showed little use of wild grapes in China. McGovern proposed an alternative source from among the local flora: the fruit of the Chinese hawthorn, *Crataegus pinnatifida.* (Archaeobotanists have since found both grape and hawthorn seeds in the dusts of the Jiahu site, adding credence to McGovern's idea.)

Archaeologists will tell you that what they do is not about the dead but the living—connecting the former world with the current one. Off the record they might admit that it gets a bit dry and dusty down in the tombs and that they sometimes long for a connection with a little more juice in it. Thus the domains of archaeology and brewing have met on several occasions over the years: In 1989 Fritz Maytag of the Anchor Steam Brewing Company in San Francisco staged a re-creation of an ancient Sumerian recipe decoded from the "Hymn to Ninkasi," an ode to the goddess of brewing. In 1996 Delwen Samuel of England created what became Tutankhamen Ale, a beer based on analyses of an ancient Egyptian tomb, and in 2000 followed it with Heather Ale, based on druidic digs in Great Britain. McGovern's collaboration with Dogfish on Midas Touch garnered so much attention that when he mentioned the Jiahu findings to Calagione, the question was not whether but how soon.

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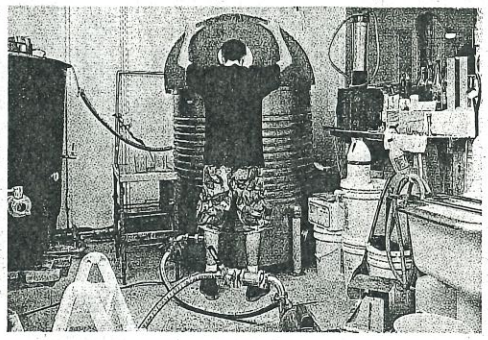
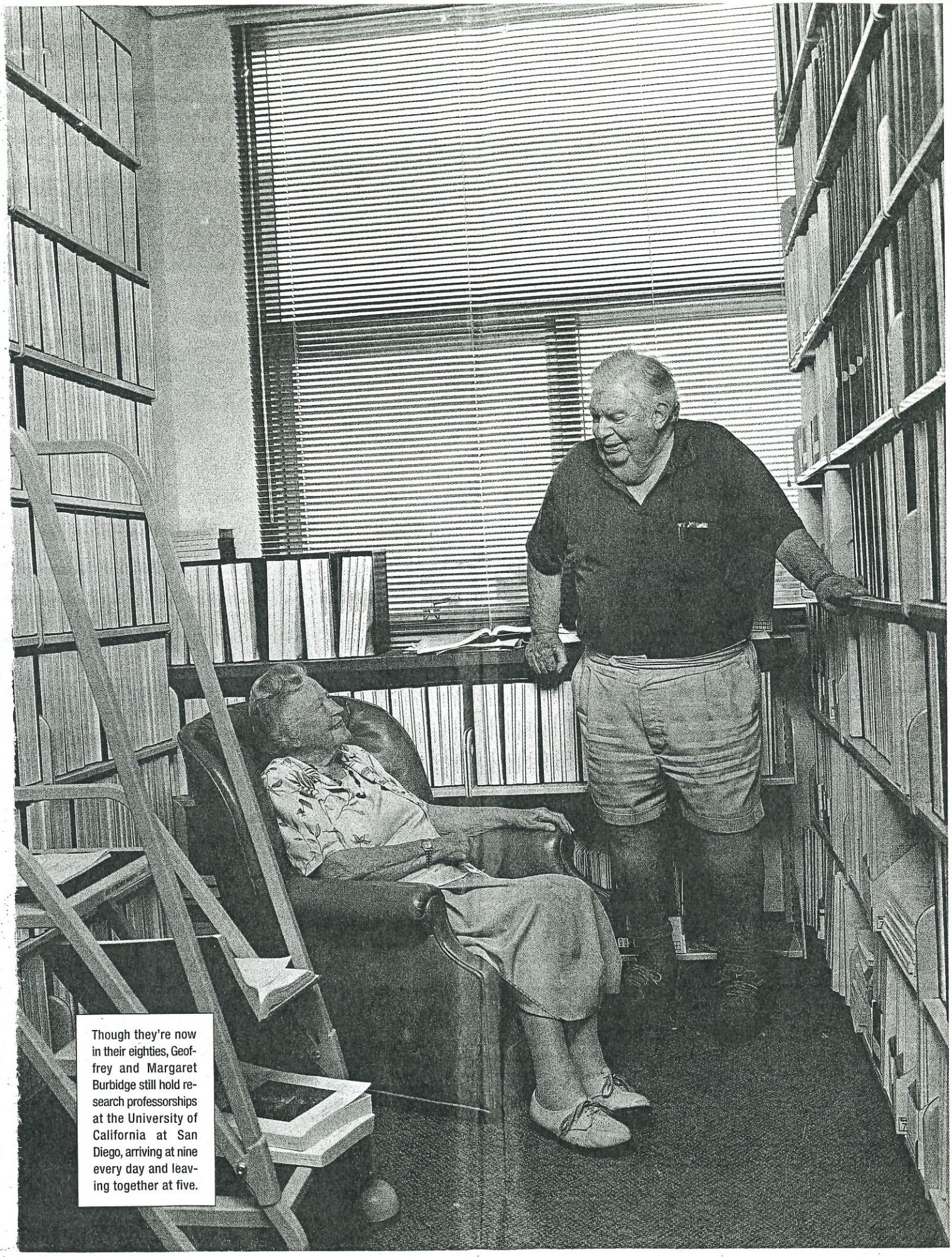
THERE WAS NO RECIPE TO BE FOLLOWED, SO IT WAS UP TO McGovern and Gerhart to apply quantities to the ingredients. Striving for maximum authenticity, McGovern suggested that the brew contain 50 percent brown rice (the technology for grinding off the outer layers of bran did not exist 9,000 years ago). He e-mailed Gerhart a list of modern rice strains closely related to those of Neolithic China. "Some of these rice species haven't been grown in 5,000 years," Gerhart said. He chose the pregelatinized rice favored by brewers: precooked to burst its starch cells and less likely to leave a mass of goop in the bottom of the vat.

McGovern wasn't sure whether the original fruit was a grape or a hawthorn, so he suggested they add a little of both. Each presented its own challenges. Hawthorn is the English name for the family of plants of the genus *Crataegus,* of which there are several hundred worldwide. It produces a small tart fruit that the Chinese use in both confectionery and medicine. It is possible to track down wild hawthorn fruit in season in this country, but no one sells it. Gerhart settled for a dried, powdered version—50 pounds of it, ordered online from an Asian herb company.

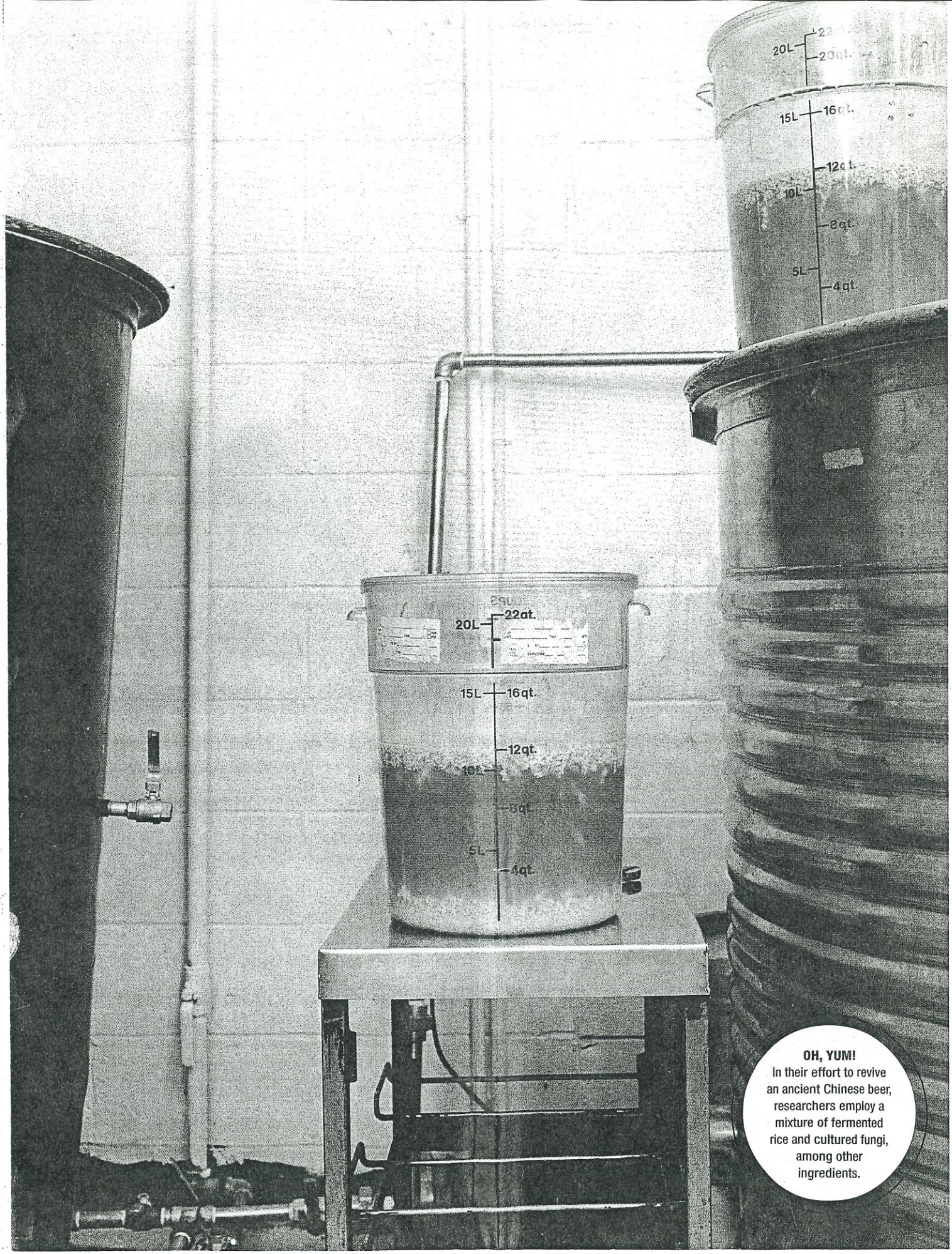
Likewise grapes. The Eurasian species, *Vitis vinifera vinifera,* probably did not reach the Far East until 2,200 years ago. Forty or 50 grape species still grow wild in China today—17 in Henan Province alone—but acquiring them proved impossible. So McGovern settled for a canned concentrate of muscat grapes, considered to be the closest kin genetically to wild Eurasian grapes.

THE FERMENT BEGINS
Brewer Mike Gerhart loads bags of malt—a modern concession to federal law—into the mash tun (below) and periodically checks its progress (right).





Though they're now in their eighties, Geoffrey and Margaret Burbidge still hold research professorships at the University of California at San Diego, arriving at nine every day and leaving together at five.



OH, YUM!
In their effort to revive an ancient Chinese beer, researchers employ a mixture of fermented rice and cultured fungi, among other ingredients.

in a phone call to my fiancée. She came up with the obvious solution: "Well, you'll just have to make it yourself."

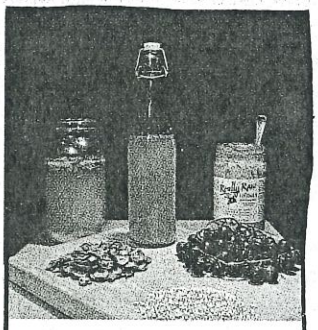
START BANDYING ABOUT A WORD LIKE *AUTHENTIC* AND YOU'RE setting yourself up for trouble. You might think you're as Neolithic as the next guy, but there's always somebody out there even more hard core than you, more willing to reenact the history of ceramics or the quest for fire to prove his point.

Still, how tough could this be? If I simply took the basic ingredients (or their modern descendants, anyway), threw them into a jar, and let them rot for a while, wouldn't that be authentic enough? I ran my theory past McGovern, who left me with a sobering thought: "One goal of the Neolithic beverage maker would be to make a drinkable beverage."

Two technological hurdles stood between me and quality. One was starch conversion; starches are long chains of sugars and can't be consumed by humans until first broken down. The second challenge was attracting enough wild yeast to ferment those sugars quickly, before marauding hordes of bacteria and fungi turned the brew into a frightful and possibly hazardous libation.

These riddles festered until the day I stumbled across the book *Wild Fermentation* by Sandor Ellix Katz, a fermentation fetishist. It was full of formulas for making pickled nasturtium capers, fruit kimchi, and other unusual dishes, as well as alcoholic drinks like chicha, the chewed-corn brew of the Andes, and chang, a mild, homemade rice beer still brewed in Nepal.

Katz laid out my starch conversion options: molding, malting, and chewing. Asia has a long tradition of inoculating cooked rice with the fungal culture of *Aspergillus oryzae*, a wild yeast that generates the enzyme amylase as it digests the grain. But the protective layer of bran on brown rice evolved to thwart this kind of parasitism, and my attempts to catch wild aspergillus ended badly.



Home Brew

The author concocted his own pale brew (center bottle) from rice, grapes, honey, a starter culture, and dried hawthorn berries.

Another option was to employ the rice grain's own enzymes, initiating them with the right combination of heat and moisture. That's how malting works. Compared with barley, however, brown rice generates too little amylase, and white rice won't sprout, which may explain why there is no strong tradition of malted beverages in the East.

I was down to my last option: chewing the grain and spitting it out. Horrifying, perhaps, to our fussy 21st-century sensibilities, this Neolithic technology is still very much alive today. In Africa they do it with manioc roots; in the South Pacific they do it with kava. The idea is simple: Digestion begins in the mouth. Saliva contains, among other things, ptyalin, a form of amylase. By chewing the grain, I myself would initiate the starch conversion.

Or rather, I and my fiancée would. I made two cups of brown rice, plunked it down in the living room, and we went to work, repeatedly filling and emptying our mouths. The experience was disgusting and oddly satisfying. The result, after half an hour, was a quart of something resembling that healthy whole-grain cereal I dreaded as a kid. I heated the mash to 155°F and let it sit for an hour. After straining out the solids, I was left with a beige liquid, cloudy and sweet.

Fermentation was the final hurdle. As it turns out, you don't have to go hunting for wild yeast—it will find you. Raw honey is full of it; diluted four to one and left in an open vessel, honey will ferment all by itself. And grape skins are covered with wild yeast (that white, cloudy stuff). I concocted a honey-wine starter culture, which I used to prime a pot of fresh honey and crushed grapes. As for fresh hawthorn berries, that's a long story. I found some dried chopped fruit online, stewed it like prunes, mashed it, and threw it into the mix.

NINE THOUSAND YEARS AND ONE WEEK LATER, YOU'RE WONdering how it tasted. I cannot tell a lie: It was unspeakable. To call it swill would be an insult to bad alcohol everywhere. Its angry, vinegary bouquet recalled descriptions of pruno, the prison hooch made of canned fruit cocktail, Wonder Bread, and ketchup.

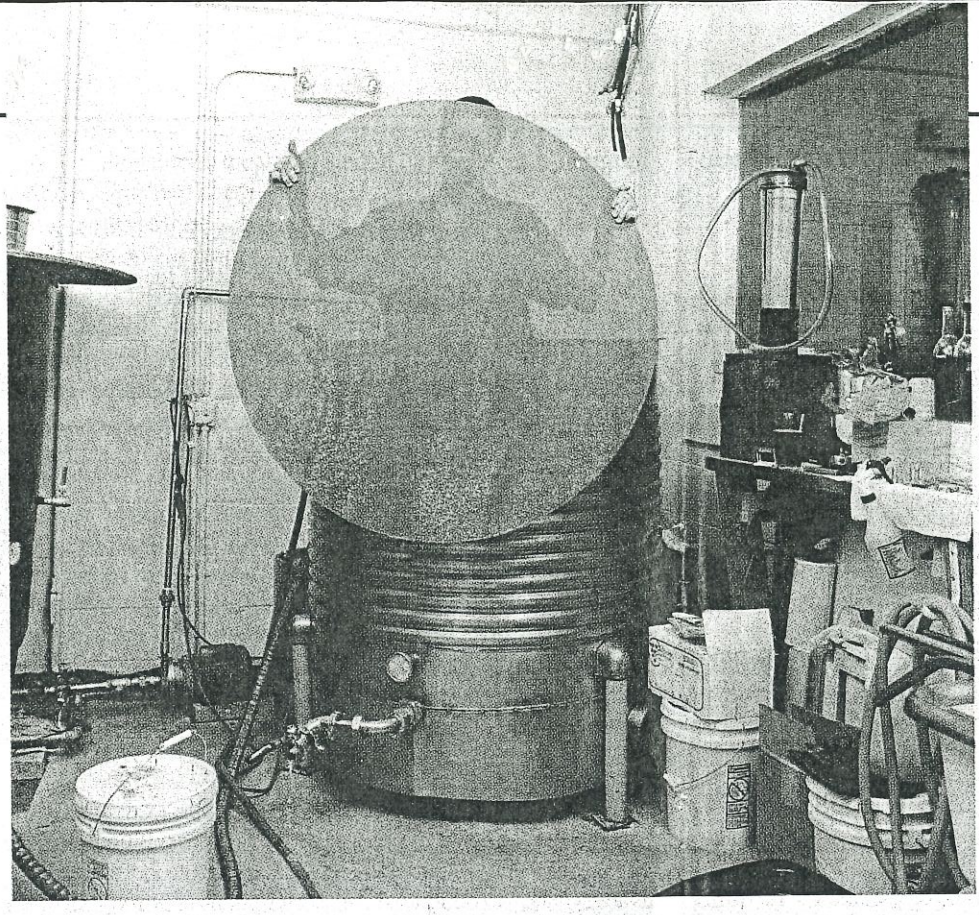
Undeterred, I repeated the process, this time easing up on the hawthorn and keeping a closer eye on the pot. After a week, a thick barrier of scum floated on the surface, with chunks of grape embedded in it. A few months ago it might have stopped me but no longer. I stabbed it with a turkey baster and tapped into the cloudy bilge below. I performed the tasting on an empty stomach, just in case. Lacking an oenophile's nomenclature and nuance, I can only describe it as a sort of Flintstones wine cooler: sweet and sour, with a honey funk and blurry sight lines. With a second glass I proved to myself that it was drinkable and caught enough of a buzz to trip over the border in my garden. I could hear my Stone Age fraternity brothers cheering.

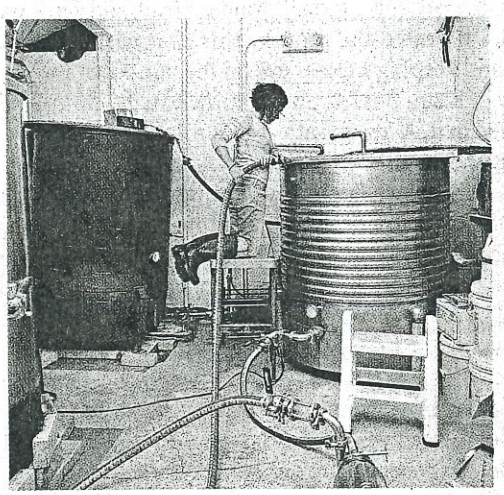
Around that time, two bottles of Château Jiahu arrived at my door. "It definitely does not taste like beer," Gerhart said over the phone. He described it as having "a smoky profile," which he described as a tribute to Neolithic open flames and wood fires, but which I interpreted as, "Oops, we burned it." It had a dry, sour flavor, bubbly from the carbonation. I held a taste-off with a few close friends. I'm proud to report that the votes were split down the center, although one comment seemed to capture the prevailing attitude: "There's a reason people don't live in the Neolithic anymore." ⊠

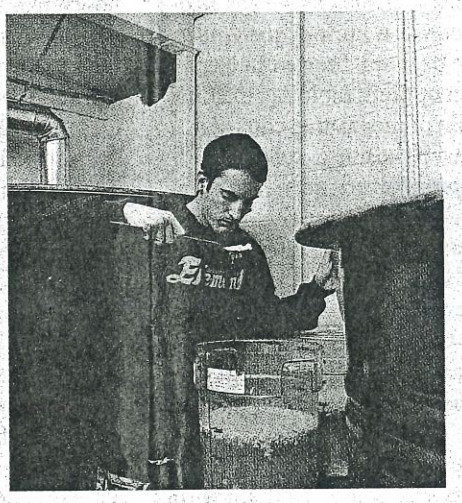
DISCOVER MORE [also see Resources, page 82]

Ancient Wine: The Search for the Origins of Viniculture.
Patrick E. McGovern. Princeton University Press, 2003.

The American Homebrewers Association Web site, **www.beertown.org**, is a help for do-it-yourselfers.







STIRRED, NOT SHAKEN
Neolithic brewers may have lacked sediment filters (left) and brewing hoses (below left), but like Gerhart, they doubtless sampled their brew as it fermented.

To drive fermentation, he bought a five-gallon bucket of honey.

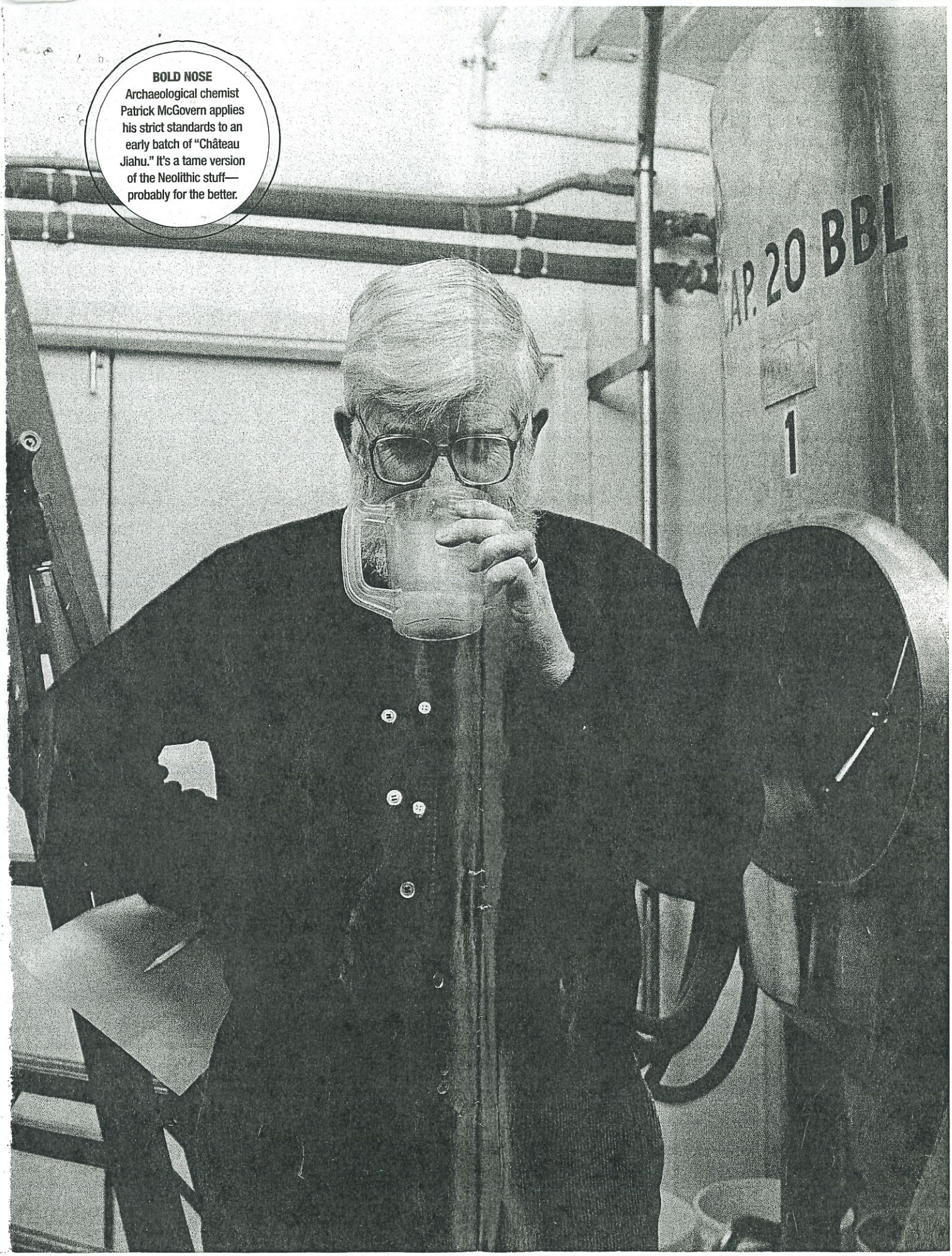
Then there was a factor with which no Neolithic brewer would have had to contend: the Bureau of Alcohol, Tobacco, and Firearms. A federally licensed brewery is authorized only to make beer, and that beer must contain at least 25 percent barley malt. Alas, barley did not appear in China until about 5,000 years ago. Gerhart chose the lightest malt he could find, to interfere with the taste as little as possible.

Gerhart began the morning's brew by dumping the grains into the mash tun, a 200-gallon stainless-steel vat with a strainer in the bottom. He let them stew at 152 degrees Fahrenheit for an hour, to allow the enzymes in the barley malt to convert all the available starches to fermentable sugars. The resulting wort was pumped into the kettle, to be boiled with the hawthorn. Gerhart dumped bag after bag of orange hawthorn powder into the pot, his bemused shrug suggesting that he had only a loose idea of what effect it would have on the finished product.

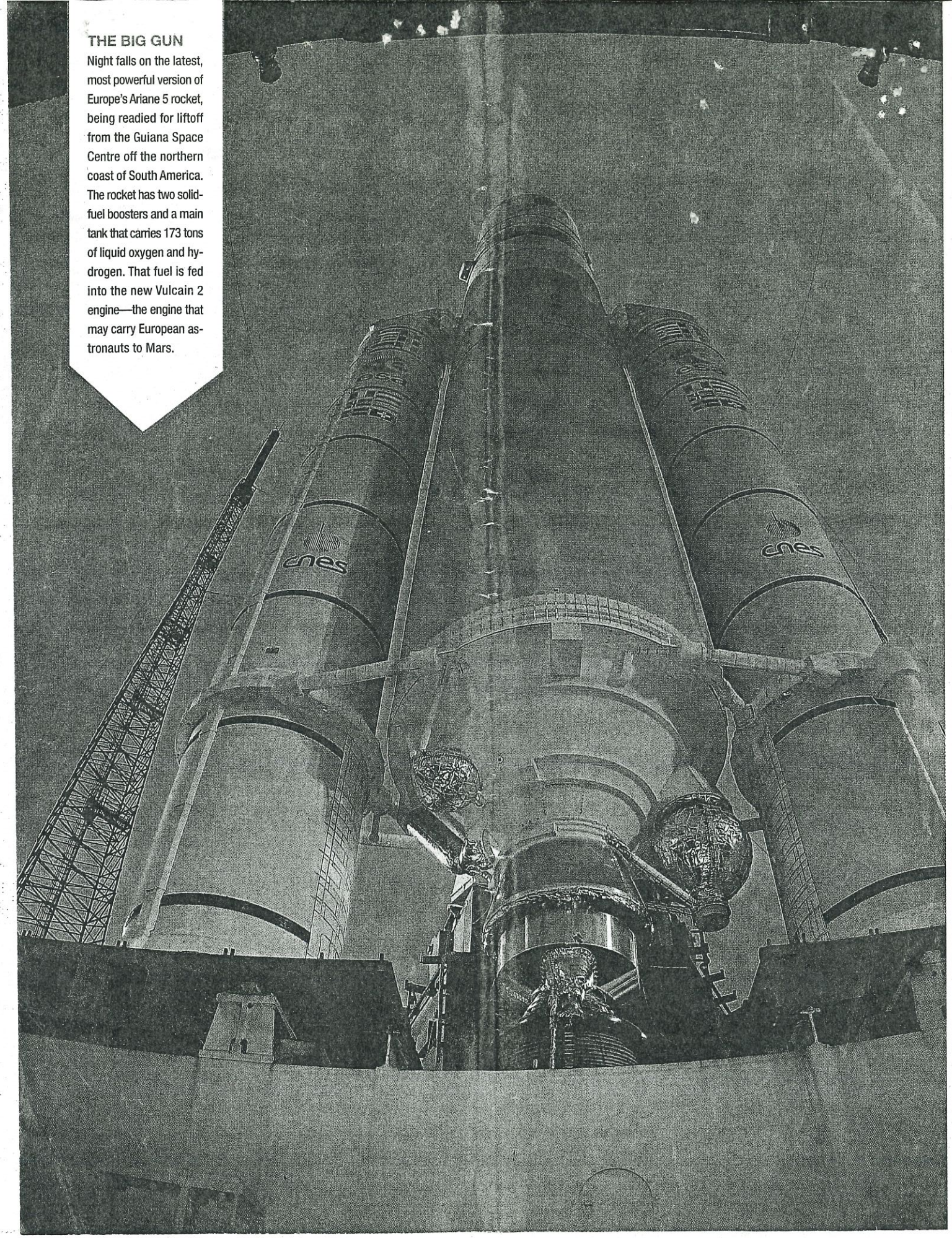
The wort was slow to heat up, so Calagione and Gerhart took turns leaning over the cauldron with shovels, trying to keep the solids from sticking to the bottom. "I've never seen so much muck in the bottom of a tank," Calagione said. At last the mixture came to a boil. Gerhart ran the hot liquid through a heat exchanger and into the fermentation tank, where it was sweetened with the addition of the honey and muscat extract. In late afternoon, Gerhart inoculated it with a liter of liquid sake yeast, chosen because of its affinity for rice.

Three weeks of fermentation and the concoction would be ready for tasting. "Château Jiahu," as they dubbed it, will make its debut at the Waldorf-Astoria, at a party for Calagione's new book, *Brewing Up a Business*. I couldn't help asking Calagione how he planned to label the beer, given how far the project—with its barley and muscat grapes—had wandered from its Stone Age roots. He didn't blink: "We'll call it 'The Closest Approximation of the Oldest Alcoholic Beverage Ever Discovered.'"

McGovern, Calagione, and Gerhart seemed satisfied with the day's brew. I was not. Archaeology draws its authority from the science that underlies it, but its true power derives from its ability to spark the imagination, to transport scientist and nonscientist alike back in time to another place, another culture, another frame of human mind. To make that trip we must shed at least some of our modern baggage. Château Jiahu, it seemed to me, was still too burdened by the present. Later, in my motel room, I expressed disappointment



BOLD NOSE
Archaeological chemist Patrick McGovern applies his strict standards to an early batch of "Château Jiahu." It's a tame version of the Neolithic stuff—probably for the better.



THE BIG GUN

Night falls on the latest, most powerful version of Europe's Ariane 5 rocket, being readied for liftoff from the Guiana Space Centre off the northern coast of South America. The rocket has two solid-fuel boosters and a main tank that carries 173 tons of liquid oxygen and hydrogen. That fuel is fed into the new Vulcain 2 engine—the engine that may carry European astronauts to Mars.