The Case of the Vanishing Euros

A Chemical Reaction Caused Banknotes To Disintegrate



More than 1,000 German banknotes have mysteriously disintegrated recently, and police say they have found acid on the brittle bills, authorities said Thursday Nov. 2, 2006. The notes, most of them in denominations of less than 100 euro (US28), have surfaced in 17 cities since June, Elke Martens, a spokeswoman for the Bundesbank, Germany's central bank, said Thursday.

by Dom Yanchunas

In Germany, they're calling it the mystery of the disappearing banknotes.

This case, though, has nothing do with a Frankfurt bank heist, or a forgetful old lady leaving her handbag behind in a Berlin streetcar, or even a gust of wind blowing while a Hamburg wurst vendor tries to hand change to a customer.

It's a caper that more likely will be solved with the help of biochemists and narcotics detectives than by bank security men and surveillance cameras.

Since June 2006, more than a thousand euro notes have literally disintegrated in people's hands. After they pop out of the cash machine, the brittle 20-euro and 50-euro notes promptly develop holes as though they are being eaten by invisible moths.

When consumers first began complaining about the holey money, authorities feared the worst and began probing whether a currency saboteur or racketeers might be preparing an extortion bid.

By November, however, German police and European Central Bank investigators figured out that the vanishing banknotes more likely were the result of a chemical reaction due to illegal drugs.

Detectives in Germany have said the trendy designer drug "crystal meth" probably is the culprit. A relatively new drug of choice on the German club scene, methamphetamine often is snorted through a rolled-up banknote. Users have discovered that 20-euro and 50-euro bills are just the right size.

Apparently, one of the homemade drug's ingredients—sulfur—is reacting with perspiration on people's fingertips to form a corrosive acid that is eating away the currency's paper.

Methamphetamine is known on the street as "crank," "chalk," "ice" or "tina." The addictive stimulant has been a scourge in rural America for several years. It caught on in Europe only recently.

Weimar W. White, a chemist and numismatist in Steuben County, New York, suggests that a sulfur compound could very well be causing the problem with the euro notes.

"It might be a combination of some kind of acid formation, and that may be reacting with the paper and destroying it," said White, author of the recent book *Coin Chemistry, Including Preservation and Cleaning*.

"Certainly, sulfur in the right environment can form sulfuric acid, and that can eat the heck out of the paper," he said.

Much of the methamphetamine invading Germany is being cooked up by organized-crime syndicates in Poland and the Balkans. German investigators suspect that recent traffickers have produced particularly nasty batches using a sulfate-salt substance as a minor ingredient or cutting agent.

The trace amount of sulfur compound may be reacting with perspiration or another environmental chemical to form acid, they theorize.

David Locker, a biochemist and numismatist in Kirkland, Washington, said sulfur dioxide or similar compounds can indeed be transformed easily into a corrosive material in the presence of moisture.

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"This is actually one of the components of acid rain," Locker said. "When they react with water, they can form sulfuric acid."

But Locker doubts a methamphetamine connection. He thinks some other explanation likely will emerge—or an additional chemical will be found to have been mixing with the drug residue. No one can say for sure, he said, without taking a few euro notes and testing their reaction in the presence of the chemical components of crystal meth.

"This seems a little peculiar to me," Locker said. "If all of this does prove to be plausible, it would be possible to do a few experiments" with the various chemicals to test the effects.

By November, more than 1,700 of the see-through bills had been turned back into the German banking system.

The porous notes began appearing in June and July in Berlin and Potsdam—two cities with a high degree of interaction with Eastern Europe.

Soon, self-destructing 20s and 50s were discovered in Dusseldorf, Karlsruhe, Kiel, Wurzburg and about 10 other German towns. All of the crumbling banknotes were confirmed as genuine. Their serial numbers confirmed that all had been produced at Germany's federal printing plant.

The Bundesbank said the scope of the problem was "unprecedented" in the history of the region's currency. German and European authorities promptly began probing various theories, including a few wild ones.

Among the relatively benign scenarios they considered was that there was some kind of isolated, accidental cause. Perhaps, for example, it was a one-time problem affecting a small number of notes coming from the German printing press. Or maybe sulfur came to be present as a result of cleaning solvents used to service equipment inside certain cash machines.

Officials quickly ruled out any production problem with the currency printing or the paper. They worried, though, that a saboteur had intentionally unleashed dangerous chemicals, or that brazen racketeers, preparing to blackmail the European banking system, were establishing their ability to destroy a much larger amount of currency and cause a panic.

European Central Bank President Jean-Claude Trichet even suggested the possibility that hijackers had stolen a cash shipment and used chemicals to disable anti-theft coloration.

Then police detectives in Berlin and the state of Rhineland-Palatinate built a theory based on drug residue. When lab tests detected sulfur, the probe turned to likely methamphetamine use. German authorities announced that conspirators apparently were not intentionally targeting the currency.

Six months into the case, Germany appeared to be the only European nation affected by the rash of Swiss-cheese banknotes. Germany, the euro zone's largest national economy, accounts for 5 billion of the 10.5 billion euro notes of all kinds in circulation.

At first, Germany's Bundesbank didn't want to accept the disintegrating notes from the public, but multinational European monetary agreements required it.

"National central banks will replace a damaged euro banknote if you present more than half of the note or can prove that the missing [larger] part of the banknote has been damaged," the ECB said in a statement.

The national bank must replace the banknote free of charge if it has been burnt, cut or decomposed. The bank may charge a fee if the note was damaged by an anti-theft device, according to the ECB rules. Banknotes that were damaged intentionally may not be exchanged.

Some of the disintegrating euro notes had been in circulation for only one day, pointing to automatic teller machines as a potential source of the problem—or a place where the chemical might be spreading from bill to bill.

The latest version of the euro notes was introduced in 2002. At the time, European bankers trumpeted the notes' state-of-the-art additives, which, they said, made them tamper-proof and tough to counterfeit.

The paper is made of cotton. Security features include raised print, a watermark and a hologram. There are built-in fibers that glow under ultraviolet light, while the paper itself doesn't glow. The ECB adds one caveat: The paper of a genuine note may glow if the note has been washed accidentally in the laundry.

Evidently, it's the dimensions of the 20s and 50s that appeal to drug users, who measure out doses with a bill and then roll it up and snort through it like a straw. The 20-euro banknote is 133 millimeters by 72 millimeters; the 50-euro note is 140 millimeters by 77 millimeters.

It's no surprise to Europeans that their continentwide currency is being used to snort drugs. In 2003, the Nuremberg Institute for Pharmaceutical Research studied drug traces on banknotes in the 12 nations of the euro currency zone. The researchers found that 90 percent of euro notes contained measurable traces of cocaine. Often, there is enough cocaine to contaminate other notes in cash-counting machines.

Further, the researchers found that more banknotes contained cocaine in nations with a higher reported incidence of cocaine use, especially Spain. Fewer notes had cocaine traces in nations where there is known to be less cocaine use—Finland, France and Greece.

Of course, U.S. banknotes also are used to snort drugs. And no widespread damage to U.S. currency ever has been reported as a result of contact with cocaine, methamphetamine or other drugs.

U.S. bills are made of a combination of cotton and linen. Manufactured since 1879 by Crane & Co. of Dalton, Massachusetts, Uncle Sam's currency paper is considered to be the most durable in the world.

The U.S. Bureau of Engraving and Printing periodically introduces new versions of the nation's paper money, with updated security features, to stay one step ahead of counterfeiters. The banknotes contain watermarks, metallic fibers, embedded threads and micropatterns that can be read only by special electronic machines.

Each U.S. formulation is tested for vulnerabilities to physical wear and contact with various chemicals. The most recent change was the new $10 bill that entered circulation in March 2006.

Claudia Dickens, a spokeswoman for the BEP, said no one in the bureau would comment on whether sulfur compounds ever had caused any problems with old or new U.S. currency.

Whatever the lessons learned from the broken-down euros, the next opportunity for the U.S. to make an adjustment will be in 2008, when a new $5 bill debuts. The bureau also plans a new $100 bill.

European officials have not announced any changes to their banknote components in response to the recent acid problems.

The issue is a concern to numismatists—and not only collectors of paper money. Few coin collectors are aware of the negative effects sulfur compounds can have on copper, silver and even gold, said White, whose book teaches collectors how to avoid problems such as chemical wear and thin-film interference.

The traditional ancient English name of sulfur is "brimstone"—and it can represent a hellfire worth of trouble to coins. Sulfur, an abundant element, is a tasteless, odorless non-metal. In its pure form, it is yellow and crystalline. It is an essential substance for living things and is present in amino acids and commonly used in fertilizer, insecticides and matches.

Sulfite compounds are commonly present in wine and dried fruit—and are used to bleach paper.

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Iron sulfide is better known to numismatists as pyrite, or fool's gold.

Sulfur dioxide from the burning of fossil fuels leads to acid rain, which results in the chemical weathering that damages buildings and bronze statues. Similarly, coins can be harmed by the presence of sulfur compounds that are common in the environment.

Chemical wear is different from physical wear, and can be more insidious, White emphasizes. One example is what happens when silver comes into contact with sulfur. Not only does the coin appear tarnished, but the reaction also can permanently alter the chemistry of the metal surface.

"That's caused basically by a sulfide. It reacts with the silver and oxygen to form silver sulfide," White said. "The silver sulfide actually etches the coin and destroys the mint bloom—the little teeny ridges and valleys."

In particular, White cautions novice collectors to avoid coins with a surface that displays the colors of the spectrum. That, he says, is thin-film interference, sort of like an oil slick on a river or soap film on the surface of bathwater—and though the coin may look unique and pretty, it's really a troubled piece of metal.

"There are people out there who don't understand tarnish," White said. "They see rainbow colors—blue, red, yellow—and they don't know any better, and they go nuts over it. They pay huge amounts of money. They don't know it's chemical wear. They don't realize the coin has been damaged.

"The next step is, it turns to black, and it's awful. This is what happens to silver coins that are exposed to sulfur."

White's most basic advice is to keep coins away from the elements—and, of course, to handle coins along the edge at all times and not to touch the face.

By December, German authorities were still the lead investigators in the case of the disappearing banknotes because the problem hadn't been detected in any other country. The affected paper money has been nicknamed the "gebrochene Noten"—German for "broken bills."

The Bundesbank said the contaminated notes pose no danger to the public. German newspapers, however, have published stories telling worried consumers to use gloves when handling banknotes—and even suggested spending cash as quickly as possible after receiving it.

The police investigations—and chemistry experiments—continue.

Now, if only someone could invent a way to make currency mysteriously *appear* in your hands.