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A digital battle to protect wine's fragile chemistry and integrity

Ensuring you have perfect storage conditions comes to nothing if your wine endures extremes of temperature before it even gets to you. Launched in November, eProvenance's new sensor technology is designed to track a wine's temperature as it passes around the world. And as Joel B Payne discovers, it may also help in the battle against fraud

Eric Vogt has one simple mission: to ensure that fine wine reaches the consumer in perfect condition. Estates go to great lengths to groom singular wines from hallowed sites with impeccable viticulture, proven winemaking techniques, and pristine bottling conditions, but what happens once it is shipped?

Long supply chains, lack of feedback systems, and insouciance are anathema to most fine-wine producers. Shipping and storage conditions are seldom monitored and are essentially out of producers' control once a bottle leaves the warehouse. Little do most collectors know that, en route to their cellar, a coveted trophy may have lost much of its original charm.

Winemakers understandably want the bottle that you uncork at home to contain the same wine that they put on the market, but with cases now traveling to the four corners of the world, heat shock and freezing temperatures during transportation and storage can alter the color, aroma, and flavor of the original, not to mention permanently damage its ability to age. For a cheap Chianti purchased at the local supermarket for tomorrow's pasta dinner, we might well turn a blind eye and mark it down to poor luck; but for a case of 1959 Château Latour won at auction, the stakes are considerably higher.

What exactly happens to a given bottle under challenging conditions is a complicated question, but it is clear that chemical reactions quickly begin to degrade wine as temperatures rise too high or fall too low. Though the damage proceeds linearly with time, it increases geometrically at higher temperatures. The common method of expressing chemical reaction rates is the number of degrees Celsius required to double the pace of the reaction. For the five parameters used by eProvenance to measure degradation, that data is well known: For oxygen uptake, it is 4°C (7.2°F) (Ribereau-Gayon 1933); for browning, 8°C (14.4°F) (Berg & Akiyoshi 1956); for sulfur dioxide decline, also 8°C (ETS Labs 2008); for anthocyanin fade, 12°C (21.6°F) (ETS Labs 2008); and for the formation of ethyl carbamate 15°C (27°F) (Butzke 2001).

Studies in 2008 at ETS laboratories in Santa Helena, California, showed that after a cumulative exposure of 18 hours at 86°F (30°C), aromas are irreparably altered. At 81°F (27°C), 36 hours are required; at 93°F (34°C), only ten. Above that, it happens in a blink.

For years, producers like Corinne Mentzelopoulos of Château Margaux have realized that their wines often tasted different in London, Chicago, or Hong Kong than in their own cellars.

Fakes having caused such valid concern over the past few years, the next field of endeavor for collectors who actually want to drink their wines—rather than merely speculating on their ever-rising value—must be to know how they have been stored over time.

Sensing change

This is where Eric Vogt comes in. After graduating from Harvard Business School with George Bush and Mitt Romney in 1975, he founded and sold four other companies before starting eProvenance (eprovenance.com) seven years ago, combining his business skills with a passion for wine.

His company's research has shown that, despite the use of refrigerated containers and the vaunted cellars of London, a brief stay out of doors on the docks, on the way to the warehouse, trapped in customs, or during transport by DHL can permanently impact on any wine's chemistry. Even the ambient storage conditions of some shippers in Bordeaux is not what it should be.

eProvenance introduced its first generation of sensors in 2007, which were quickly employed by producers such as Pierre Lurton at Cheval Blanc in Bordeaux and Christopher Howell at Cain in California. With a tracking period of four to six months, 702 data points, and radio frequency identification (RFID) technology, this system monitored shipping conditions over time, getting significant results for early clients.

Bruno Clair hired a new transporter for shipments to Italy in order to avoid temperature fluctuations. Bordeaux Index found that its partner's warehouse in London had no temperature control. Corney & Barrow discovered that its delivery trucks in Japan were not turning on its cooling units. Ginsberg & Chan in Hong Kong found that its transporter was leaving cases on the tarmac in 100°F (38°C) heat. Wine Tasting Network in Napa Valley changed distributors in



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By using eProvenance temperature sensors, Napa Valley's Wine Tasting Network discovered its distributors were leaving wines on loading docks in 121°F (49°C) heat

Arizona and Texas after its wines reached 121°F (49°C) sitting on loading docks. Using the data at hand, each of the problems was solved in its own way.

Statistical evidence empowers the trade to make necessary changes, be it complaining to FedEx, changing freight forwarders, or improving their own storage conditions. In one of the early cases monitored, a container going from Bordeaux to Oakland via Boston saw—despite enjoying perfect conditions while at sea—both freezing temperatures as it passed through Chicago in late February and a spike to 100°F (38°C) as the cases sat on the docks in the Bay Area.

Even short jaunts by air can be critical. The ambient conditions may be fine on the flight but not before or after. One bit of data showed that a shipment of Bordeaux with Chronopost reached 95°F (35°C) on its way to Scarsdale, New York. The customer, Ralph Hauser, who received the sensor return card, was furious. "The wines were hot to touch," he said. "I'll throw them out." In another case with FedEx, the temperature on a two-day journey peaked at 136°F (58°C).

What, though, is acceptable? Although we would all like to think that our wines never rise above the bar of 64–68°F (18–20°C), Vogt calls these optimal conditions.

For shipping, he believes that short spikes that do not surpass 77°F (25°C) are acceptable or must at least be tolerated. A dry container of Burgundy shipped to Hong Kong that peaked at 106°F (41°C) obviously does not fit that bill. The problem, though, was not at sea but on the truck to Le Havre.

Asian burn

Since their introduction six years ago, 913,678 measurements by eProvenance's sensors have shown that 75 percent of all wines shipped in dry containers to Asia—and this is 80 percent of all transport—reached temperatures of 83°F (28°C) for

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more than 24 hours and thus surpassed the threshold for permanent impact. On shipments from France to the wine haven Hong Kong, 81.3 percent of all shipments exceeded 77°F (25°C) and 46.9 percent surpassed 83°F (28°C), the point at which the cork seal breaks, pumping fresh oxygen into the headspace.

While the blame is always put on the producers or sellers, collectors have shown a willingness to pay more for wines that have been handled with care. Lisa Perrotti-Brown, a Master of Wine based in Singapore, was quoted as saying that she would be willing to pay 15 percent more for particular wines if she knows they have been shipped and stored properly. Apparently, many collectors in that Asian metropole share her view.

Similar opinions have been espoused elsewhere. Joe Raymond, a wine collector from Bakersfield, California, wrote on eRobertParker.com that he would be willing to pay upward of 20 percent extra for wines of impeccable provenance and guaranteed care. "When you consider," he continued, "that some bottles you buy could be in the thousands of dollars, what would an extra \$4–5 on shipping hurt to make sure it is transported correctly?"

A second generation

After two years in development and testing, the second-generation eProvenance sensor was introduced to the market for demonstration purposes in June 2012. Partially sponsored by the French government, it was a significant step forward. More intelligent, smaller, and easier to use, the new sensors track both temperature and humidity, have a life span of 15 years, and can store 20,000 data points.

Embedded into the case to ensure provenance, they are combined with near-field communication (NFC) protocol for smartphones. Using these new sensors, wineries can track cases as they move through the world both to correct any systematic flaws in the distribution channel and gather market information. Each bottle is linked to a unique sensor, so they can't be mixed or matched in order to provide the desired results. Further, the NFC capabilities allow wineries to collect consumer information and fuel their social-media

strategy—an advantage that Laurent Ponsot, who helped the FBI arrest Rudy Kurniawan, found effective.

After downloading eProvenance's application, anyone can access data from the sensor by placing a smartphone near the NFC symbol on the case. The information, depending on your wish, appears as an easy-to-read summary of its history or as a detailed graph of where it has been and when, as well as what temperature and humidity it endured along the way. At the same time, information about the consumer is transmitted to eProvenance and the client. The later point is of particular importance to estate owners in Bordeaux, who—because of the structure of their sales through shippers—know little about where their wines are going or who is drinking them.

Global Tracker

The third-generation Global Tracker, released in November 2012, provides uninterrupted, real-time information on whereabouts, temperature, and humidity. Continually transmitting infinite data points as hexadecimal codes via SMS, it has coverage wherever GSM mobile phones work, be it inside containers or on a freight forwarder's lorry. This signal is 100 times stronger than those via GPS from satellites, so the client follows the shipment of his wines on computer in real time and is alerted as problems arise.

On its maiden voyage aboard a truck from Bordeaux headed to Moscow, the Global Tracker alerted its client that the temperature in Lithuania was dropping near to freezing point. Since tartaric crystals begin to form at 41°F (5°C) and wine freezes at about 27°F (–3°C), the seller was able to call the transporter, have the merchandise brought to a warmer warehouse, and avoid a ruined lot. Seeing the importance, luxury brand FICOFI has now decided to use the unit on many of its shipments as well.

However, as notes Christoph Hillebrand, chairman of the board of the venerable freight forwarder of the same name, this information is only of value if the client can reach the officer on board, the truck driver, or the warehouse manager in order to make the necessary changes. Otherwise, the information costs

time and money but has no effect on the outcome. You merely watch your wine decompose in real time.

With a five-month rechargeable battery, the Global Tracker can be used on multiple trips and is billed as a sort of geo-fencing to avoid valuable pallets being diverted or, in the jargon of shippers, falling off the truck. This is a serious issue for merchants such as Christian Moueix, who is unable to replace a lost case of Pétrus at any price.

eProvenance is now working on a patent-pending back-label code that could move this information from pallet to case and then to individual units to create what it calls *la bouteille intelligente*. Since it could not be counterfeited and would be valid only for a single bottle whose whereabouts would be known online, it would, especially when paired with the 2G sensor, be an indelible sign of authenticity, something Eric Vogt had not even thought about when he began. The code would provide photographs, information about the wine, its provenance, make its entire life history available on the cloud, and allow all to be transmitted with the bottle.

Originally, Vogt had wanted to help combat counterfeits but decided to leave that work to companies like Prooftag. Now, partnered with them, he has come full circle and is back in that game as well. The two companies' solutions are linked and complementary.

Counterfeits

For as long as wine has been made, it has been adulterated and counterfeited. Already in ancient Rome, Pliny the Elder complained that fraudulent wine was so widespread that even the gentry had no idea if the wine they were drinking was genuine. The stakes today, though, are considerably higher.

Given the concern of fine-wine collectors in Asia, wine merchant Berry Bros & Rudd in Hong Kong began using iG sensors five years ago for quality control and market differentiation, publishing the results as proof to customers that their wines were shipped and stored under optimal conditions. An unintended side effect was the trust created between the merchant and their wine-producing partners upstream.

According to Nicholas Pegna, who opened their operations in Hong Kong and who is now the managing director of their Singapore branch, they were originally worried that well-stored wines that were not monitored might be treated with suspicion. Indeed, even some auction houses have tried to downplay this aspect of provenance, because they worry that it will have an adverse impact on the values that they hope to achieve on the block.

Pegna, however, sees even more potential for the 2G sensors, particularly with the traceability and smartphone technology, using eProvenance data in marketing and promotional strategies to further reassure the consumer.

In general, cases that have had only one owner attract a premium at auctions; this can be as high as 25 percent. Wines shipped directly from the château often sell for 50 percent more, so proof of provenance captures higher value. The Asian merchant Bacchus has begun using the technology to enjoy this premium.

But there are a number of catches. The price of 2G sensors is highly sensitive to annual purchases. For small volumes, they cost €45 (\$60) each. That translates to \$5 a bottle if it is put on every case. For 10,000 units, which is about the number of cases a grand cru château puts on the market each year, the price falls to only €20 (\$27). That works out at about \$2 a bottle—hardly more than a rounding error on 2010 Lafite Rothschild.

One possibility for producers whose wines are not expensive trophies and who thus need spare no expense is to put the sensor in only every third, fifth, or seventh case to reduce costs. The other is to use the 3G Global Tracker to at least ensure that the cold chain is being respected. It costs €500, but the batteries are rechargeable, and the unit can be used over and over again. Monthly charges depend only on the number of data packets used. Each packet of data—consisting of date, time, temperature, and humidity—costs about €1. The customer can choose up to 24 per day, depending on how much information granularity he thinks necessary.

Another problem for avid collectors is, of course, that the technology does not work retrospectively. It cannot guarantee the provenance nor the condition of a wine that was on the market before the system was developed. Collectors who are bidding on a bottle of 1945 Mouton Rothschild must still pray to the stars.

That said, it is surprising that more importers are not more concerned about the condition of their wines during transportation or storage. Producers, though, are very concerned and will certainly be the driving force in this development. Jean-Nicolas Méo, of Domaine Méo-Camuzet in Vosne-Romanée, understands only too well that at present the major problems begin once wines have left the ship. "We encourage our clients to be more responsible with our wines," he says, "and will establish a charter this year for their transport and storage in order to ensure that clients in the most remote parts of the world drink the same wine that I open here at the estate."

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Fine Wines at auction

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Online auction to follow

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