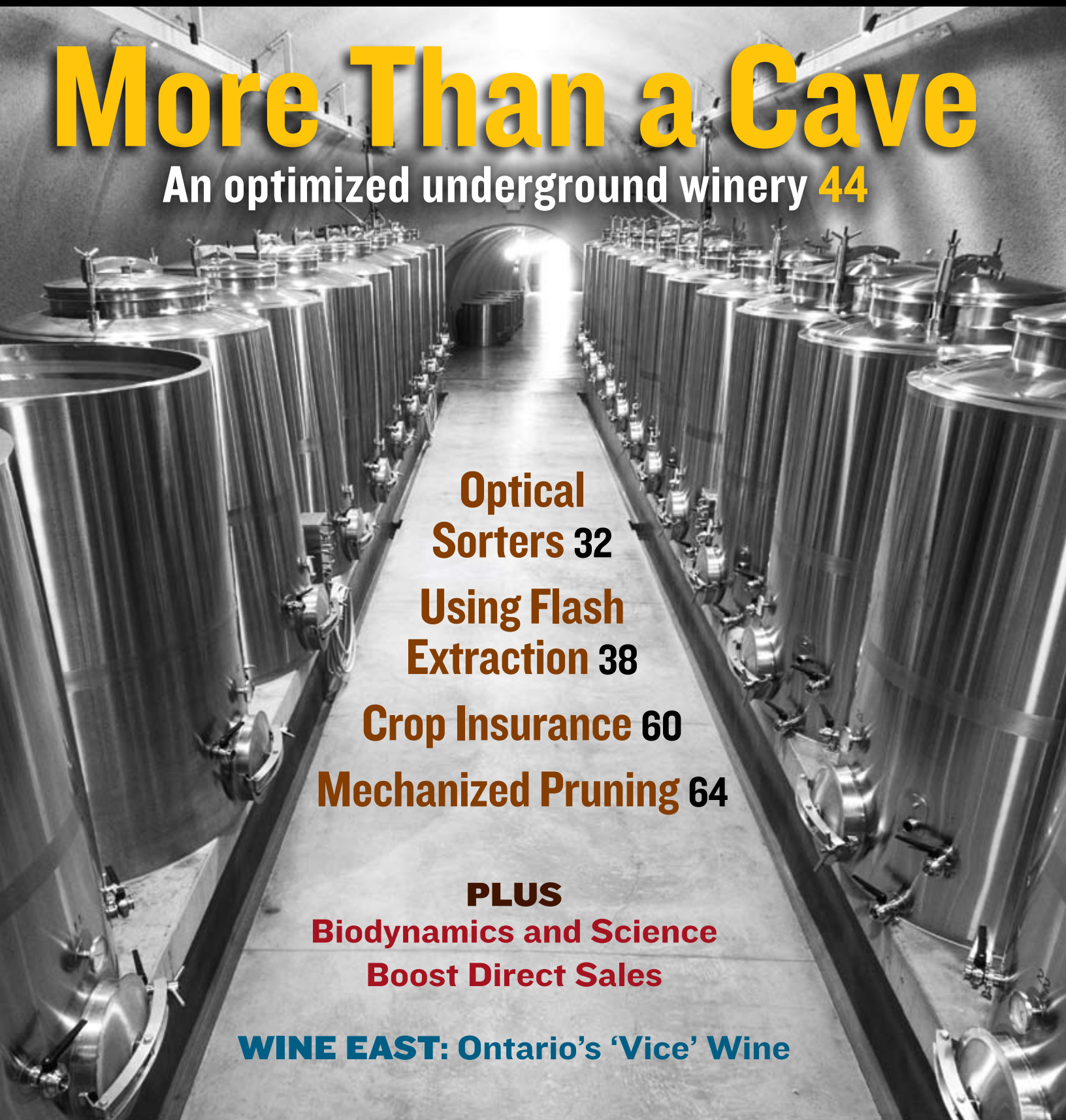
UNIFIED WINE & GRAPE SYMPOSIUM ISSUE

WINES & VINES

THE VOICE OF THE WINE INDUSTRY WWW.WINESANDVINES.COM JANUARY 2011



More Than a Cave

An optimized underground winery 44

Optical Sorters 32

Using Flash Extraction 38

Crop Insurance 60

Mechanized Pruning 64

PLUS

Biodynamics and Science Boost Direct Sales

WINE EAST: Ontario's 'Vice' Wine

BRIANA MARIE CLARK-FORGIE

More Than a Cave

Arkenstone's subterranean winery adds flexible functionality

By William A. Fuchs

The second-level mezzanine overlooks the tanks in the fermentation hall at Arkenstone Vineyards. Beyond is the second-year barrel storage cave.

High on Howell Mountain, a new and complex underground winery demonstrates the innovations possible in today's winery cave construction. Unknown to most, the cave-building industry is evolving in terms of building standards and cave functionality. The 26,000-square-foot cave at Arkenstone Vineyards integrates three separate barrel-storage rooms, two fermentation halls and a variety of support functions often neglected in winery caves. The facilities operate on two levels beneath a crush pad that feeds fruit and must to tanks by gravity.

Ron and Susan Krausz, the owners of Arkenstone, first laid eyes on their Howell Mountain site in 1988. Though the couple had no intention of planting vineyards and building a winery then, both come from families with farming histories; so when a good friend who'd grown up in a Napa Valley wine family encouraged them and arranged for a vineyard expert to evaluate the property, the dream of planting winegrapes and making wine took hold. The expert confirmed what the couple instinctively felt during the seven years they'd owned the property: There was something special about this mountain site.

The Krauszes are committed to excellence in the vineyard and winery as well as being respectful stewards of their land. While early winery design efforts contemplated conventional construction, they also included significant use of underground facilities. When Magorian Mine Services joined the project in 2004, the firm made the case for replacing much of what would have been built above ground with caves. A key component of the owner's original building design was to process grapes at the surface level and drop them into tanks in a basement below. After early design meetings with Magorian, the basement became a cave (at a deeper level) beneath the crush pad and was large enough to accommodate a fermentation hall, maintaining the goal of moving fruit to tanks by gravity.

Highlights

- A new 26,000-square-foot cave in Napa Valley is optimized for Arkenstone's winemaking and custom crush operations.
- The facilities operate on two levels beneath a crush pad feeding fruit and must to tanks by gravity.
- The cave has six separate temperature-humidity zones, computer-controlled fermentation tanks and numerous other innovations.

The cave design process was an evolution that began in the fall of 2004 and continued through cave construction, which began in spring 2005 and was finished in August 2008.

As the project progressed, it became clear that a winery staffed and equipped to support winemaking at the highest level would need to be larger than originally planned for Arkenstone's limited production. Incorporating top-tier custom crush services in a collegial setting also was seen as a synergistic solution.

To accommodate a winery capable of producing 20,000 cases per year with minimal impact to the natural setting, a decision was reached that most of the winery expansion would occur underground.

The Krauszes worked with Arkenstone fruit in a variety of custom crush settings, and the experience taught them what worked and what didn't work in a custom crush situation. In spring 2006, winemaker Sam Kaplan joined the Krauszes in producing the 2006 Arkenstone wines, the first vintage to be released under the winery's label. Kaplan brought extensive experience to the job, having worked at Pine Ridge Winery and spent many years with ZD Wines. The custom crush experience with Kaplan yielded additional insights about the need for flexibility in custom crush, where it can be necessary to change processes quickly to facilitate a smooth workflow.

Going underground

Don Magorian, owner of Magorian Mine Services, brought many years of experience with wine cave construction to the team, helping translate the conceptual ideas of the owners into a unique cave design. Kaplan and the Krauszes provided insight that helped refine the design, as did Jon Lail of Lail Design, whose experience with winery construction helped validate the program requirements.

Arkenstone's cave allowed Magorian to utilize the architectural ideas he had reserved for a client who was willing to collaborate in the process. As Magorian explains it, "Only the owner knows what he likes and what his goals are. He is the one who drives the design process. Things look different underground from a person's above-ground perspective, and one of my strengths is to take what is beautiful, functional and buildable and integrate this with the owner's ideas and goals."

A key concept of Magorian's was to include a deck to divide the largest cave

W.A. FUCHS

During construction, the large barrel storage room looks mammoth. It is only slightly smaller now that it is finished with floors and a final coat of shotcrete.

into the main fermentation hall and the second-year barrel storage room. The elevated deck (dubbed the "mezzanine" in working sessions) connects the ends of a smaller tunnel that crosses the upper portion of the larger cave. *(See photo on page 44.)* The mezzanine is reached via a winding staircase from the crush pad area above, arriving at a door in a cut rock face. Entering from that doorway (technically portal No. 3 but universally called the "Hobbit Hole,") a visitor proceeds down another stairway inside the small tunnel, arriving onto the mezzanine. From there, the mezzanine overlooks tanks to the north and barrels to the south.

The design also included adjustments such as the location of a building on top of the cave, a change in portal location required by a road set-back as well as ADA (Americans with Disabilities Act) and safety considerations. Many of the alterations occurred while cave excavation was in progress.

Several geotechnical investigations preceded construction, and this author geologically mapped the property as well. All of the rock at Arkenstone is made from the Sonoma Volcanics, a 3 million to 5 million-year-old formation that yields some of the best wines from Napa Valley. One early plan included a long section of the cave that extended in an entirely different direction from the current orientation. However, mapping indicated that low ground cover and hard rock would be encountered, requiring underground drill-and-blast tunneling methods close to the surface and near a house under construction. While the latter issues could be addressed, the lack of groundcover would have deprived the cave of much of its thermal efficiency, a key objective of the project.

Whereas the excavation process is similar to underground mining, the rest of the cave installation is more like construction.

Starting the job

Although relatively close by, the location where the desired cover could be achieved, and where the cave was ultimately built, presented very different conditions. If the prior rock type was too hard to be ideal, the conditions quickly became too soft, comprised of a white tuffaceous rock. While pre-construction drilling showed this rock to be very soft in places, the true impact of its nature was not appreciated at the time. The rock looked deceptively dry as it was being cut, but the dust could turn into a wet, sloppy soup the minute it hit the ground. This discovery necessitated a major change in the excavation technique and some changes to the cave support. In this case, an arched subinvert (similar to completing a circle radius) was put beneath what was to be the final concrete floor for the larger rooms, with smaller excavations requiring a thickened, permanent sub-grade flat slab.

One of the similarities between tunneling and mining is the use of an "engineer-as-you-go approach," which is often the best way to reduce construction costs and maximize the value to the client. Magorian Mining Services tested and corroborated its construction decisions through an ongoing peer review process, which included Scott Lewis and his colleagues at Condor Earth Technologies.

After the initial entrance portal was put in, an excavator-mounted rotating cutter went to work, literally carving out the

We build caves with distinction for discerning clients where quality & value are not only important, they're the foundation of everything we do!

Don Magorian

Magorian Mine Services

Building Quality Caves

www.magmineserv.com

P.O. Box 8015 Auburn, California 95604

530-269-1960

Lic. # A-723890

cave as it advanced. The spinning cutter head moves side to side and up and down, chewing out the rock material. Sometimes cutting was easier on one side of the tunnel than the other, or easier on the top than the bottom, as different volcanic formations and faults were traversed. The process required attention to ever-changing geologic and storm-related conditions as well as proper surveying and safety concerns. In the large winery, the excavation rate of advance, including support, averaged four feet per day. Considering the large cross-sectional size, the rock type and the full invert required for this large cave, this was better than what could reasonably be expected.

When cutting and hauling out the cave spoils had advanced to the point where structural support was required, the shotcrete crew moved in to spray the walls with concrete. When necessary, a quick-setting dry shotcrete was utilized for quick initial support throughout the day, followed by wet shotcrete supplied from concrete mixer trucks near the end of each day. The wet shotcrete was applied in two-inch-thick increments in order to ensure even coverage, and the larger cave sizes ended up with 10-12 inches of shotcrete thickness. Large sheets of welded wire fabric (an open grid of structural steel) were added to give the liner additional structural support. Whereas the excavation process is similar to underground mining, the rest of the cave installation is more like construction; good cave builders blend the two processes in a seamless manner.

When you walk into Arkenstone's cave from its main working portal, you enter one of the most utilitarian and hardworking areas of the cave, yet the experience is almost as breathtaking as descending through the Hobbit Hole onto the mezzanine. You enter a 16-foot wide arched cave and immediately have

Machinery cuts into volcanic flow rock, which lays above red-orange tuff.

a view down a darkened 150-foot section leading to the main fermentation hall. It is an eerie but awe-inspiring feeling. A short distance in are two opposing cross caves—one containing restroom, shower and locker facilities, the other providing a glass-fronted break room with a small lab beyond. This is the spot where serious blending and tasting occurs. Further into the cave are additional cross-caves: one containing a workshop/storage room, and the other beginning part of the first-year barrel storage cave.

The long entry tunnel is a true multi-purpose space, its use changes depending on the winery production cycle. While at crush it accommodates a line of small, portable stainless steel fermentation tanks plumbed to the glycol system installed by Refrigeration Technology and connected to the computerized tank monitors, it is also the staging area for bottling, receiving new barrels and surges in shipping. As you reach the end of the entry tunnel, you enter the large fermentation hall. The cave widens to 30 feet, and the ceiling quickly rises to 22 feet. The crush pad, above ground, is 40 feet above the floor of this fermentation hall. Nine shafts, spaced along the centerline of the hall and reaching through the ceiling to the floor of the crush pad, allow fruit to slide gently down large-diameter hoses to the tanks below. A fruit processing line is easily moved from one shaft to another, though a certain amount of coordination goes into the task when, as this past year, two lines are operated at the same time to accommodate a surge in grape deliveries.

The tanks themselves, constructed by J.V. Northwest to meet winemaker Kaplan's specifications, are all the ornamentation the cave requires. The winery currently holds 37 stainless steel tanks and one concrete tank (future expansion is planned.) Two- and three-ton tanks hug the mezzanine, as four- and six-ton fermentation tanks run along both cave walls for the balance of the fermentation hall. Underneath the mezzanine reside two 10-ton square fermentation/blending tanks. Vin Wizard is responsible for the tank temperature controls as well as pump over and charting technologies.

The cave lighting is an eclectic blend of classic period industrial fixtures, art glass and modern task lighting, providing both a functional working environment and a welcoming ambience; many fixtures are lamped with LED bulbs, and all are carefully controlled by motion sensors or programmable switches to reduce energy consumption.

W.A. FUCHS

The gray outside is shotcrete support.

The scalloped catwalks are designed to take advantage of the shape of the cave and tanks, giving excellent accessibility to each tank. Punch down rails run down each side of the hall supporting the pneumatic punch downs, which supplement the pumps attached to each tank. The punch down setup and all crush equipment was custom made by Burgstahler Machine Works of St. Helena, Calif., with design collaboration between Wayne Burgstahler and Kaplan.

Separate pumps for the automated pump overs are Graco Model 1040, 1.5" FDA-compliant air-operated diaphragm pumps. These are dedicated to each tank and not only allow ultimate customization of pump over regimens for each fermentation but also reflect the winery's determination to avoid mistakes—there is no opportunity to accidentally return the wine to an adjacent tank. The punch, pumps and even computer-programmed pump over controls all are operated by compressed air. During crush a surprising sense of calm permeates the fermentation hall, perhaps a result of its insulation from the frenetic activity on the crush pad above. The mezzanine, when not serving as the catwalk for the winery's largest fermentation tanks tucked beneath it, permits visitors an intimate view of winemaking activities.

A second fermentation hall was added to the plans during construction; it is called the "White Room" because during crush it is dedicated to fermenting white wines. Arkenstone's estate white wines are fermented in barrels and concrete; this hall's great surrounding mass and the

cover above the cave crown help provide the steady temperature control that is critical for optimum cold-barrel fermentation. The mass and insulation effects are supplemented by an extensive system of glass doors and "smart" vents built into bulkheads that control the movement of conditioned and unconditioned air throughout the winery cave.

Once the wines have fermented dry and are stabilized, they are removed, and the White Room becomes a very busy barrel workroom. Robust air supply and exhaust ducts, provided to assure safety during fermentation, are ideal for exhausting warm, humid air created by barrel washing. This room is also one of three areas that use radiant heating in the floors for climate control. While primarily a tool for providing a safe dry floor, controlling humidity and/or moving along sluggish fermentations, it is easy to see it being most appreciated if the room is used for a hospitality event.

The doors, air supplies, exhausts and warm floors divide the cave into six separate zones with different temperature-humidity environments. The flexibility to raise or lower the temperature and humidity at various times allows each space to be tuned for its function. For example, the main fermentation hall is maintained at a lower humidity of around 55%; the barrel storage areas should be cool and always humid, while human-only space may be warmer and drier. In all areas, proper air movement promotes the cleanliness Kaplan believes to be critical to careful winemaking. It is rare for caves to accommodate so many varying climates.

If the entry tunnel is transformed into barrel storage, CO_2 can be exhausted through a pre-installed pipe.

In the tunnel connecting the White Room and the main fermentation hall, there is an elevator from the crush pad into the cave floor, which eases workflow. Kaplan has designed the winemaking functions in a sophisticated fashion: At least nine different types of utilities and three separate drainage systems hide behind the walls and in the floor. The automated tanks are of Kaplan's custom design and incorporate VinWizard air-driven controls and individual tank recordkeeping. There is a broad range of tank sizes and types. Materials were selected (for example glass doors and stainless steel waste drain lines), sourced or tested to avoid TCA and TBA contamination. In addition to multipurpose, flexible-use spaces, even larger changes have been planned for: If the owners choose to transform the long entry tunnel into additional barrel storage in the future, fermentation-generated CO_2 from the main fermentation hall can be exhausted through a pre-installed pipe under the tank slab.

The cave at Arkenstone makes it possible to preserve the vineyards and the ranch setting long into the future, setting it apart from many of the buildings being constructed today. W&V

***William A. Fuchs Ph.D.**, California Professional Geologist PG 7695, works for Magorian Mine Services (MMS), which constructs wine caves such as those of Arkenstone. To reach Fuchs, or to comment on this story, e-mail edit@winesandvines.com.*