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The grapes of rock

Winemakers in the United States are increasingly calling on the services of geologists to help refine their products. **Alexandra Witze** meets the scientists who are treading a path to the past.

There's more to it than just the taste of tannins, the hint of blackberry, the overlay of toasted oak — and the gentle enticement to intoxication. "Every time you have a glass of wine you're drinking 100 million years of Earth history," says David Howell, a geologist at Stanford University in California.

Consider, for instance, a glass of fine wine from California's Napa Valley. Its taste depends on the grapes from which it is made, the water and climate encountered by the vines that bore those grapes, their pruning and harvesting by the field workers and the craft of the vintner. But it also draws on the fertile alluvial soil that spreads in fans down from the hills — hills that are themselves made of ancient oceanic crust, the remains of a collision between tectonic plates.

Of the many views one can take of a glass of wine, geology looks furthest back in time. And in recent years a number of geologists have turned this view into a way of offering professional services to the wine business, from helping select the best sites for planting to providing remote-sensing imagery of growing grapes. Next March, many of this new breed will gather at the University of California, Davis, for a leisurely three-day conference on the science of wine — followed, naturally, by two days of field trips through Napa and Sonoma county vineyards. Tastings are practically mandatory.

The focus of these geological considerations, *terroir*, is somewhat fuzzy. At its simplest, it is the combination of physical factors — soil, climate, environment — that help shape a wine's taste. At its most complex, *terroir* is an interplay involving cultural preferences and a long history of working the land. It can be applied to other products, such as cheeses, that come from a particular and distinctive landscape. It is a concept that can shade into mysticism, or cynicism. Emphasizing the characteristics of a wine's place of origin rather than the grape variety, as the French do, can hint at a unique geological attribute that might be seen as justifying a premium price.

Going deep

"There's a fair amount of black magic involved," says Kenneth Verosub, a paleomagnetism expert at the University of California, Davis, and organizer of the March conference. And that is where he thinks geology can help. Howell likes to see the concept of *terroir* as a means to an end. "It's a way of letting people know that there's more to wine than just the grapes and the roots and the soil," he says.

Soil has always been a major part of wineries' worries. Soil scientists advise on the best places to plant vines, and hydrologists suggest how best to water and nurture them. But introducing pure geology — reaching down to the bedrock itself — is a relatively new phenomenon for US wineries.

Often the geologists help by mapping contacts between different geological units, each of which has its own characteristics for growing grapes. Or they might help winegrowers to understand the three-dimensional picture of a vineyard: vine roots can penetrate many metres down, potentially tapping a deeply buried soil type that differs from that at the surface. That is especially important in the United States, where many wineries are set atop thick alluvial deposits on valley floors, unlike the traditional hillside plantings of European vineyards.

And in general, the winemakers seem happy to get scientific advice. "They are extraordinarily interested in learning as much as they can about the land in which they grow," says Jonathan Swinchatt, a Connecticut geologist who has collaborated with Howell.

One example is Warren Winiarski, owner of Stag's Leap Wine Cellars in Napa Valley. Winiarski says that he appreciates the insights of science without feeling that he needs to understand every last equation. "An athlete doesn't have to know physiology in order to run the race," he notes.

Winiarski called in geologists because he wanted to understand why wine made with

grapes grown in neighbouring vineyards tasted so dramatically different. Two of his vineyards, Fay and Stag's Leap itself, sit side by side and yet identical vines planted in each yielded very different wines. Investigating, Swinchatt and Howell traced the difference back to geology: Fay and Stag's Leap rested on separate alluvial fans spilling down from the mountains. With that information, Winiarski has modified his vine selection and growing practices for each plot of land.

Geological studies such as this first became well-known in Napa after the aphid-like insect phylloxera, scourge of vineyards worldwide, began to devastate California grapes in the mid-1980s. The massive die-off caused many winemakers to re-evaluate their land and what should be planted on it. Before that, says Swinchatt, "nobody in Napa would talk about *terroir*. If you talked about *terroir* it would be like giving the French some recognition."

But now *terroir* is becoming a West Coast buzzword. Wine marketers see it as a way to individualize each product and stamp it with regional distinction. "They really appreciate that their geological history makes their vineyards different from vineyards in Kansas or in Italy," says Larry Meinert, a geologist and wine consultant at Smith College in Northampton, Massachusetts.

FOX SEARCHLIGHT PICTURES

Ah, the shale: wine-lovers in the film *Sideways* enjoy bottled geology in California's Santa Ynez valley.

Ground control

Geology is even making it on to labels and into the names of the wines themselves. Columbia Crest, the largest winery in the state of Washington, has introduced a new brand called Torrent: its back label describes the ice-age floods that poured through the scablands of western Washington, scouring the landscape and fashioning the gravels in which the grapes are now grown. Another Washington winemaker has dubbed his land Loess Vineyard, after the air-deposited soils of the region.

For Alan Busacca of Washington State University in Pullman, this marks a welcome new accuracy in such matters: he is tired of seeing wine labels that tout the 'rich volcanic soils' of the Pacific Northwest. "The volcanic stuff is actually a trivial fraction," he grumbles. "Most of the soils in the northwest are formed from outburst flood deposits, with a mantle of reworked glacial material."

Terroir as a marketing tool is also catching on outside the United States. Five large new wineries in Patagonia that sit on gravels washed down from the Andes plan to market their geological and geographical characteristics aggressively, says Meinert. In New Zealand, the Gimblett Gravels appellation is defined by a single stratigraphic unit: to bear the Gimblett label, at least 95% of the grapes must be grown on that particular kind of gravel. "That's a very satisfying thing," says Meinert.

But sometimes, the geology references can degenerate into a deluge of transferred epithets. "I've heard a winemaker correlating the explosive taste of his wine with the explosive nature of the rocks in which it was grown," says Swinchatt, "or talk about red spicy flavours reflecting the red soil." A different form of literalism has inspired Randall Grahm, winemaker at California's renowned and eccentric Bonny Doon winery, to experiment with putting smashed-up rocks into wine as it ages.

To some, such attempts are an unwelcome geological reductionism. "The most important thing about this idea of *terroir* comes from learning how to grow grapes and make wines in particular environments," says Warren Moran, a geographer at the University of Auckland in New Zealand. "Every region where wine is grown has interesting stories about the way the region developed. That's much more interesting and powerful than any simple environmental determinism." In some locations, traditional viticultural appellations — the formalized descriptions of particular grape-growing regions — happily ignore local stratigraphy. To Moran and other geographers, *terroir* encapsulates far more of the notion of territory than it does of geology.

L. MEINERT

The roots of the matter: Alan Busacca examining the soil in a Washington state vineyard.

But the geologists are sure they have something to offer — and, they are happy to admit, something to gain. "I work for wine," says Terry Wright, a retired field geologist and vineyard consultant in Sonoma county. Consulting fees regularly include a bottle of wine or cases at employee discounts. A few scientists have got so deeply into wine that they have made a second career of it: Busacca, for instance, will leave his university in a few months to start a vineyard consulting business.

For geologists, soil scientists and hydrologists looking to get into the field, Meinert advises that they start by learning how sites are chosen for various grapes. "Drink lots of wine and pay attention to what's going on physically," he says.

And for those who do not want to work in wine, but just enjoy it, geology can also help, says Swinchatt. "If you know the provenance of a painting, it can mean a lot more than if you didn't know anything about its history," he says. "I think the same is true of wine. If you know where it came from, how it was produced, what kind of care went into making it, it makes a huge difference to how you appreciate it." ■

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