THE TANGLED WORLD OF TUFF, TUFA, TUFO, AND TUFFEAU

From Rome to Eger, and Saumur to Campania, Alex Maltman traces the complex intertwined etymology and geology of the soil types named after—but not necessarily synonymous with—the original Roman *tophus*

Tuff at Chiaia di Luna, Ponza, Lazio, Italy (photo) / De Agostini Picture Library / G Roli / Bridgeman Images

Tangled indeed. And to these tricky "t" words, I could add tuf, tufi, tofa, tuft, and others. We are talking, of course, about names for geological materials—names that, because most of them occur in vineyards around the world, appear in the literature on wine. You may have seen the kind of thing: "The cellars, as is typical of the Eger region, are cut into the soft tufa"; "Saumur—the capital of tuff"; "the soils are primarily clay above volcanic tuft"; "the ground consists of calcareous tuff"; "the Classico zone of Orvieto consists of tufo, similar to the tuffeau of parts of the Loire."

So, what's the problem? Well, to a geologist all of those quotations in one way or another are wrong. In geology, each term refers to a material of a specific nature, with a meaning that doesn't fit with those quotations. Outside geology, however, these "t" words tend to be used loosely, even synonymously and interchangeably. Thus, there's a difficulty; their meaning in wine writing is often unclear. But neither are things tangle-free within geology—for instance, there's another rock in the frame, the celebrated travertine, that geologically is closely related to tufa but awkward to distinguish. More of that later.

The root of the confusion lies back in classical Roman times. When the architects and builders of the infant empire began to construct grand buildings worthy of its new status, they found to hand, right there in the capital, material that was easy to extract in blocks well suited to this monumental style. They called it *tophus*, sometimes *tofus*. We now know that in Rome some of it consisted of rocks derived from the fine ejectimenta of the region's volcanoes—what geologists would now call tuff—and some from matter precipitated from flowing springs, which includes the tufa of modern geologists. It was all blurred together.

Then, as blocks of building stone became employed across the expanding empire, they, too, were referred to as *tophus*, irrespective of what the rock was. And to complicate things further for us today, the word became variously transmuted into the local vernaculars. Thus, for example, *le tuffe* evolved in French, and tuff in English. In Britain, the word tuff long held sway for any porous, softish building stone that wasn't obviously, say, limestone, sandstone, or granite. By the 18th-century, however, when the British stone dealers of the day learned that their Italian counterparts were using the word *tufa*, they took the opportunity to try to convince architects that this exotic sounding word was preferable to old-fashioned, Anglo-Saxon-sounding tuff. So, now we had two words in English, tuff and tufa, being used for convenient building blocks irrespective of the kind of rock.

Geologists, however, saw during the 1800s, as their science was growing, that this was unhelpful to understanding and a consensus evolved that the name "tuff" should be restricted to volcanic material. Consequently, for well over a century now, geologists have used tuff to refer only to volcanic rocks, and tufa for a calcareous rock formed by localized precipitation from cold groundwater. Outside geology, however, the lack of distinction still hangs on, and hence the confusion. Surely,

if we are to understand vineyards, how rocks and soils might affect the growing vine and perhaps the wine that results, we have first to be reasonably systematic with the terms we are using. So here's an attempt to untangle the situation.

The Eternal City and its tuffs

The Romans were not the first to use these kinds of stone for building, though the evidence from earlier times is slender. There's plenty of tufa (the calcareous precipitate) occurring naturally in Greece, and it was used, for example, in the Temple of Apollo, near Corinth. Some etymologists have suggested that the Greek word *tophiōn* is a predecessor of *tophus*, but written records are sparse. The Etruscans built with tufa; there are funeral stones made of it, and another etymological suggestion has the word *tupi*, found on an Etruscan tombstone next to a figure heaving a huge rock, as a *tophus* forerunner. But really it's in Rome where the story begins.

The city is founded on volcanic tuff. The rock makes the fabled seven hills, and by the 6th century BC it was being quarried for the solid stone blocks that befitted buildings of the empire's growing status. Several writers mentioned it, including Strabo, Ovid, and Virgil. Pliny remarked that this local *tophus* weathered badly and needed protection—for instance, by applying a lime wash. Apparently it was the same in Carthage, North Africa, where the local *tophus* was so vulnerable to the salt air that it had to be coated with pitch. Thus, quipped Pliny, while in Rome pitch was used to seal the insides of wine amphorae, the Carthaginians used "pitch for their houses and lime for their wines." But it was the great architect Vitruvius who documented in some detail the *tophus* found in and around Rome and its suitability for construction.

First, though, let's be clear what modern science means by tuff. The molten rock sitting below an active volcano may be relatively thin and runny, such that if internal pressures force it to erupt, it will quietly ooze out as lava, as we often see in video clips, say, of Hawaii. But if its chemical composition makes it thick, viscous, and gas-rich, it may break out with explosive force, resulting in a violent mixture of gases, lava, and fragments of already solidified rock. Much of the coarser material will accumulate around the eruptive vent, with time building up a cone shape as in the popular image of a volcano. Finer material will travel greater distances, either by racing across the land surface as incandescent clouds or dispersing high in the air as fine ash. Eventually even the finest materials will come to a rest, typically settling in layers and, with time, hardening into rock. This is tuff. Incidentally, geologists have a word that covers the full range of debris ejected from volcanoes, and curiously enough it's another "t" word! Tephra, however, is related to the Greek word for ashes, *téphra*, rather than the *tophus* line, and it doesn't seem to have entered the populist confusion.

To be called tuff, the component particles have to be no larger than a couple of millimeters or so, and the whole thing must have been discharged from a volcano. The degree of layering varies, and its colors and textures depend on the mix of geological minerals involved. The minerals themselves are composed of silicon and oxygen held together by elements such as potassium, sodium, iron, and magnesium; importantly, they are silicate minerals, the kind that make most rocks. In other words, tuffs are volcanic and siliceous in composition. And this, as we will see shortly, contrasts with the calcareous precipitates that make tufa. No volcano in the world erupts calcareous rocks.

Back to Vitruvius. He noted that stone for the early buildings of Republican Rome was quarried from places more or less in the city, such as the red tuffs just to the north at Fidenae (where, according to one account, "tolerable wine" was made) and the moderately good (*temperatae*) stones of nearby Tivoli, some of which we would now call tufa. Then, as the Romans extended their influence over nearby lands they were able to access more durable varieties of *tophus*, first from the Monti Sabatino volcanic deposits just to the north, and later the harder tuffs to the southeast that came from the Albani volcano. Quarries remain at Albani today—for example, at Tuscolo in the present-day Frascati DOC and Marino in the Colli Albani DOC. Incidentally, the most recent eruption of the Albani volcano was 36,000 years ago. That may seem an immense time to us, but we are reminded that it's geologically trivial by the recent spate of minor earthquakes in the region and the appearance in 2013 of a steam vent near Rome's Fiumicino airport.

Tuffs from farther afield

The expanding Roman Empire soon took in Naples and its environs, so with all the products of Vesuvius and the other volcanic centers of the Campi Flegrei, it's not surprising that tuffs were much used in this region also. They are seen today in many of the city's old buildings, and they dominate the natural skyline. The conspicuous hill that is capped by the San Martino monastery, for example, since 1700 with a vineyard clinging to its vertiginous slopes, consists largely of different kinds of tuff. Just to the west of Naples are numerous other volcanic centers, almost all with vineyards sited on tuffs, such as Averno, Astroni, and Pozzuoli, and the islands of Ischia and Procida.

But just as in Rome, another kind of *tophus*—tufa—was also used for building. The ruins of Pompeii, for example, are chiefly made of tuff—albeit called in many accounts tufa—but the foundation blocks of some of the houses together with the decorative stonework in their alcoves are of true, geological tufa. For even in this highly volcanic area there are calcareous rocks around—say, underground just to the east of Pompeii at Scafati and Mariconda, in the cliffs of Sorrento, and out beneath the sea to Capri.

Tuff is found across Campania, but a noteworthy example, known now in its Italian form as *tufo*, occurs by the River Sabato about 6 miles (10km) north of Avellino. Here, in about the 10th century, the underground workings of this quality building stone and associated sulfur deposits were greatly enlarged; consequently, the nearby town grew and eventually was to take its name from this desirable rock: tufo. In turn, the vines that had grown there for centuries absorbed the name, and so we now have the grape Greco di Tufo. It's an unusual instance of the contribution of geology to wine.

There's tuff in all the other Italian volcanic areas—Vulture, Soave, and Etna, for example. It's important on volcanic islands such as Santorini, Madeira, and the Canaries. France's Côtes du Forez in the volcanic Massif Central, Germany's Kaiserstuhl in Baden-Württemberg, and Hungary's Eger and Tokaj regions all contain tuff, albeit of very varied kinds. The highlands bordering the Napa and Sonoma valleys in California contain a great deal of tuff, as does the northeast part of Barossa Valley and the area around Auckland. Some of the oldest vineyards we have, in Georgia, Armenia, and Turkey, are also sited on tuff.

But tufa is quite different

Having looked at the nature of tuff and examples of its occurrence, I turn now to another part of the original *tophus* in Rome: tufa. Despite having the same etymological origin, tufa is geologically quite different from tuff, being made of calcium carbonate, the mineral calcite—hence, it's calcareous, it's a particular kind of limestone, and technically it's a precipitate.

Here's how that works. Natural waters may have a substance happily dissolved in them, but if they encounter some new circumstance, perhaps a drop in temperature or pressure, or the arrival of certain organisms, they may no longer be able to hold the substance in dissolved form. So, it precipitates out, and we call the resulting solid a precipitate. It happens particularly with calcium carbonate because calcite is more soluble than the silicate minerals that make most rocks. But just how well it dissolves depends on things like the temperature and especially on the amount of carbon dioxide that may be in the water. Most natural waters contain some of this gas because it's all around us in the air, and microbes and other organisms living in and around the water strongly influence its carbon dioxide content.

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All this is why most caves are in limestone, the result of the constituent calcite having been dissolved away, but it's also why stalagmites and stalactites, made of calcium carbonate, may now be precipitating out. It's why objects hung up in so-called petrifying wells become "turned to stone" or, more accurately, coated by calcite that's being precipitated. And it can happen around springs, as the underground water emerges and, for one reason or another, finds it can no longer sustain dissolved calcium carbonate. The precipitated calcite deposit is called tufa.

It's typically a softish, porous, pale rock and often contains fossilized remnants of organisms, the very ones that may have had a role in the precipitation. More relevant for vineyards than localized mounds of tufa around a single spring are the more sheet-like occurrences that can cover substantial areas. For example, tufas can be precipitated from rivers, especially where there is limestone or other calcareous material in the vicinity, as happens in the Ebro and Duero valleys in Spain. Perhaps the world's most spectacular tufa deposits, albeit some way from important vineyard areas, are the river terraces and associated cascades at the UNESCO-listed Plitvice National Park in Croatia.

Sheets of tufa can also arise from springs spread along hillsides. This happens in the Val di Noto, Sicily, where caves have been dug into the soft calcareous rock (but called by some guidebooks "volcanic tufa"). The Aglianico grape is said to thrive in tufa, which is fairly widespread in Puglia, as at Laterza and Castel del Monte. There are small plateaus of tufa sheets in Tuscany's Val d'Elsa, southeast of Montepulciano, as at Sarteano. Tufa deposits are known around the world; some 500 sites have been noted in Hungary alone. Other European examples include Touttour in Provence, Montpellier and Cabreres in the Languedoc, and Tournus in Burgundy; in Spain, at Beceite to the northeast, Checa and the Dulce River in Guadalajara, and Priego in the Montilla-Moriles DO. A number of US states have tufa deposits; it forms in some upstate New York lakes, for example, and in Virginia rivers along the Eastern Appalachians, including the Shenandoah Valley AVA. In Australia, tufa deposits are scattered from Queensland right down to Victoria.

Does the tufa/tuff confusion matter?

It's unfortunate that tuff and tufa, both widespread in the wine world but geologically different materials, continue to be confused. But does it actually matter in practice? For many rock types, their differences have only subtle effects on grapevines,

Opposite: The grandeur that was Rome; the city's imperial buildings were made from *tophus*, whose suitability for construction was by noted by Vitruvius.

since most weather to provide well-drained soils yet offer some means of retaining sufficient water, and most can satisfy, together with the soil's humus, the relatively modest nutritional needs of vines. But the differences between tuff and tufa are more marked and may at least affect a grower's methods.

Both kinds of materials are likely to give well-drained soils, stony in the case of tufa; tuffs weather to give water-holding clays, and a tufa bedrock may well be full of tiny fissures and holes that allow some water retention. But tufa, like other calcareous materials, yields soils that are distinctly alkaline. Some cultivars seem to prefer alkaline conditions, and certainly a grower will have to think carefully about the most appropriate rootstocks. The availability of soil nutrients varies with pH, and above values of 7.5 or so, access to such essential nutrients as iron, manganese, boron, and zinc falls away. Thus the yellowing leaves indicative of iron deficiency is well known with calcareous soils. But then, growers routinely correct any shortages in one way or another, and it's telling that there are instances of growers grinding up tuff and spreading it on tufa soils to enrich their nutrient content!

It's all very different with tuffs. Along with lavas, these porous volcanic materials are famous for yielding fertile soils not too long after an eruption. Provided nitrogen and phosphorus are available in some way, as they are sparse in rocks, the warm humid conditions of tropical lands can foster luxuriant growth on relatively fresh volcanic soils, ideal for crops such as tea, bananas, and pineapples. It's no accident that the world's great coffees are produced from volcanic areas. But such conditions, even in a more Mediterranean climate, may not be good for grapevines; it's pretty much axiomatic that a meager nutrient availability is best for quality grapes. Although in the Naples region the Romans talked of the Campania Felix—the "fertile country"—those vines on volcanic soils scrambling high over trees and yielding three grape harvests a year probably didn't lead to fine wine.

But the pH is likely to be on the acid side, which will temper the nutrient uptake somewhat. So, provided the potentially vigorous growth in these fertile soils can be managed, the vines should yield fine grapes. It has to be said, though, that along with the good availability of essential nutrients comes a range of elements that are not so desirable. Anomalously high concentrations of such potentially harmful elements as cadmium, chromium, mercury, and arsenic are reported from volcanic soils, together with higher levels of natural radioactivity.

The differing colors of the soils may to some extent affect their thermal behavior—producers in Sicily's Val di Noto report a difference in grape ripening between vines on the white calcareous deposits and those on the adjacent dark volcanic materials. And presumably such influences on vine performance may affect in some complex way the taste of the eventual wine, though there's still little scientific substantiation of this. There is, however, a growing belief that tuff bestows certain flavors on wine—part of the fashionable concept of "volcanic wine." (It's hard to see, though, how such a commonality can arise, given the great variability in physical and chemical properties of tuffs, let alone all the other kinds of volcanic rocks and soils.) Similarly, although there are plenty of conflicting opinions, there is a widespread conviction that limestone, and therefore presumably tufa, somehow imbues wine with certain qualities One commentator contrasts Sicily's Vittoria DOC wines from calcareous tufa ("lighter, fresher, more structured," he says) with the more "tannic, unctuous, and mineral" wines from nearby volcanic tuff (though he calls it tufa). Confusingly, though, while growers with tuff soils assert that they bring greater minerality to their wines, producers with tufa and other limestones extol the enhanced minerality that their soils give.

Above: The river terraces and associated cascades at the UNESCO-listed Plitvice National Park in Croatia, some of the world's most spectacular deposits of tufa.

Travertine, tuffeau, and other "t" words

Having emphasized the differences between tuff and tufa, what about those other "t" words I mentioned at the outset? First, it's worth mentioning that *tufa* did exit as a Latin word but referred not to building stones but to the little feathers—tufts—that some soldiers wore in their helmets. As for *tufo*, the word that derived from *tophus*—it's used these days by Italian geologists as the word for tuff. But tufo is seen in English, too, in populist travel accounts of Italy, but often with unclear meaning. *Tophus*, however, seems obsolete in English.

Sir William Hamilton, erstwhile British ambassador to Naples and married to Emma, Horatio Nelson's storied mistress, gave several descriptions of the geological materials around Naples. But curiously, in exactly the reverse meaning of today, he defined tufa as a mix of volcanic ashes and pumice, and the porous stone associated with encrustations from water as "tuf" (sic). Several Victorian topographical accounts refer to a rock called tufi, but these almost certainly are misprints.

But there's a "t" word to consider that's wholly bona fide: travertine. It doesn't sound similar, but it's so intimately related to tufa that geologists have long debated how best to define the difference. And it's a familiar material, creamy white and polished, with irregular dark holes—think of the façades of a well-known restaurant chain with golden arches. Most tile suppliers stock travertine. Many a grand building in Europe (the shining white of Sacré-Coeur in Paris) and North America (New York's Pennsylvania Station, Chicago's Union Station) are at least faced with travertine. Mediterranean towns were built with it, such as the Italian Marche's Ascoli Piceno or Turkey's Pamukkale. You may have slipped on the shiny, shoe-buffed streets of towns such as Rovinj or Dubrovnik, paved with gleaming travertine.

Travertine, just like tufa, forms from the precipitation of calcite. However, it's usually associated with hot water. This leads to greater amounts of calcium carbonate being dissolved, and when the waters emerge as springs and soon cool down, the calcite is forced to precipitate out rapidly. Substantial thicknesses can accumulate, and the result is a rock normally denser than tufa, and hence it takes a better polish. In fact, it's sometimes dubbed a marble, because it can shine just about as much as true marble (a limestone that became buried deep in the Earth's crust, compacted by heat and pressure). The warm waters also allow a lot of carbon dioxide to be dissolved in them, which on cooling comes out as a gas, which prompts the precipitation of calcite and, together with decayed organisms, gives rise to the irregular cavities and holes that are typical of much travertine.

Once again the heartland is the area around classical Rome. The material was listed by Vitruvius as *Lapis Tiburtinus*, after Tibur, then a town about 15 miles (25km) northwest of Rome. Several Latin writers described Tibur—Horace mentioned its fruit fields, which presumably included grapevines—and they noted its very important quarries. It grew to become the town of Tivoli, these days a popular day trip for tourists visiting Rome. The Tiburtinus stone became *tivertino* in Italian, at first, and then *travertino*. And then travertine in English. The travertine quarries were active at the time of Vitruvius, and they're still busy today. One modern author calculated that 100,000 tons of travertine were extracted from the quarries at Tivoli just for Rome's Coliseum! Later, Michelangelo used it to face St Peter's Basilica and its dome; Bernini used travertine from the nearby Guidonia quarries for the splendid Colonnades that arc around St Peter's Square. Today, destinations for the rock are less rarified; along with the quarries at Terme di San Giovanni near Siena, modern quarrymen are toiling to produce facing stone for the McDonald's restaurants of the world.

The name travertine, or its equivalent in other languages, appears on a number of wine labels, such as in Abruzzo's Colline Pescaresi and Tuscany's Grance Senesi and Monteregio, in Pouilly-Fumé and St Pourçain-sur-Sioule in the Auvergne; it's the name of a winery in Australia's Hunter Valley. As with tufa, being calcareous, travertine will tend to yield well-drained but alkaline soils, with all that means for vine nutrition.

So, what's the geological difficulty with distinguishing travertine? It's the question of on what basis and where to "draw the line" with tufa. Overall, travertine is precipitated from hotter waters, but if the material is ancient, to learn the water heat we have to interpret tricky analyses of isotopes and even then agree at what arbitrary temperature the terms should change. Other criteria have been suggested, including the fewer organic remains, greater hardness, and better polish of travertine, but these vary inconsistently. The problem is well illustrated at one of the world's best-known travertine deposits, Mammoth Hot Springs in Yellowstone National Park, Wyoming. They're constantly changing, and from time to time some of the waters are cold, producing what by most definitions would be called tufa, as well as deposits that are "in-between." So, what to call them? That's a debate for geologists, and because all these materials weather to give pretty similar, alkaline vineyard soils, this distinction wouldn't seem to be important for vines.

The dramatic Mammoth Hot Springs in Yellowstone National Park, Wyoming, USA, whose waters produce travertine when they are warm but tufa when they are cooler.

Finally, there's a plethora of variations on these "t" words in the other European languages that don't need to concern us here—except one. The French word *tuffeau* is now thoroughly absorbed into English. The term applies to the layers of the softish, calcareous, but somewhat sandy rocks that are found in southern Belgium and northern France, including the eastern Anjou and Touraine AOC areas. It is, of course, mentioned often in accounts of the vineyards and wines of those regions.

The lowest tuffeau strata, deposited in the warm shallow seas of the time, are referred to in French as the Tuffeau Blanc or Tuffeau de Bourré. It's a famed building material, used for Loire châteaux such as Chambord, Blois, and Amboise, as well as grand buildings further afield—in Nantes and Rennes, for example. Bourré is a little village along the River Cher, a tributary south of the Loire, right by the illustrious Château Chenonceaux. These days the town is a magnet for tourists curious about troglodytes and mushroom growing in the caves that the quarrying made available. The layers of rock hereabouts are 3–6ft (1–2m) thick, ideal for extracting large blocks for building stone, and sometimes they yield superb fossils. They are still extracted today for architectural stone. Interestingly, in view of the current vogue for praising the mineral taste of some of the wines produced here and elsewhere, I must note that promotional material for this stone in the building trade extols its soft, warm, velvety texture and emphasizes that it's "not at all cold and mineral."

The strata that were deposited on top of the white tuffeau, now eroded away around Bourré but easily seen in the cliffs along the Loire itself, say between Tours and Saumur, are a much more yellowy color. Although essentially limestone, a third or more of the content consists of sandy quartz grains together with mica and a potassium-iron rich mineral called glauconite, which weathers to give the ochrous look. The French term for these rocks is *tuffeau jaune*. There are abundant fossils, but a characteristic is that many are broken up, the result of frequent storms disturbing the shallow seas at that time.

The point of giving these descriptions is to emphasize that tuffeau is a sedimentary rock, areally extensive and stratified in layers due to accumulations through time of submarine debris. It is not a chemical precipitate. Thus, although the word tuffeau may sound like tufa, the nature of the two materials and their geological origins are different; tuffeau is not a synonym for tufa.

The "tangled world" today

I've explained how the confusion that surrounds these terms is historical, but presumably because of the similar sound of the words it persists today. As further examples of the tangle, Italy's Piemonte wine region is made of calcareous and other sedimentary rocks, but numerous accounts have it that the UNESCO-designated cellars in places like Canelli and Monferrato are "dug into tuff." Conversely, in the volcanic hills of northern Hungary, extensive underground cellars have been carved into the soft tuff that abounds there—in Eger, for example. Jagged volcanic fragments are easily visible in the cellar walls, yet in the publicity material of a prominent winery, a leading travel guide, and throughout at least three books in English on Hungarian wine, the material is referred to as tufa.

As a final example of the confusion, I go back to the area where we began. The old volcanoes of Vico, Vulsini, and Cimini—for some, the land that inspired Dante's *Inferno*—lie to the north of Rome and erupted material that spread northward over the boundary of Lazio into southern Tuscany and Umbria. All of it is siliceous, and much of it is tuff.

Vignanello wines, for example, are produced from vines growing on tuff thrown out of the Vico volcano, but according to one account they grow in a "land made of tufa." In the village of Vignanello itself, the wine cellars are "dug out of tufa stone." The site of the Vulsini volcano is now occupied by the waters of Lake Bolsena; and important for the vineyards of the surrounding Est! Est! Est! wine region, some descriptions say, is their "tufa soils." Even more jumbled, the southern half of the Maremma Toscana DOC includes "hillsides with a calcareous volcanic tufa soil structure." English tourist literature on the region trumpets the "Land of Tufa" centered on Pitigliano—the "Queen of the Tufa Towns." Its Bianco wine is "typical of tufa soils," which are "particularly suitable for white grapes." (But the official description of the soils at Pitigliano is "acid or neutral, and free of carbonates"). Ash from the Vulsini volcano got as far east as Orvieto, and the photogenic hilltop town apparently has something like 1,200 caves excavated into its foundation of soft tuff. But several wine guides call it tuffeau, the sandy limestone of the Loire.

Calling siliceous volcanic soils by the geological words for calcareous rocks might not matter too much if, as we saw earlier, there weren't important implications for viticulture and, according to some, an influence on wine flavor. But it's not possible to tell from descriptions such as those quoted above which kind of soil is really being meant. Nor can we simply read tufa as meaning geological tuff and vice versa because, of course, there are plenty of accounts that are geologically correct. And we also have to be careful because vineyards in volcanic regions can be sited on localized tufa and travertine. There are examples at Torre Alfina and Sarteona in southern Tuscany; at Saturnia, just 7 miles (12km) west of Pitigliano and its tuffs, travertines cover an area of more than 6 sq miles (15 sq km). Up at Bagni San Filippo in the Val d'Orcia, the travertine masses are over 130ft (40m) thick and still active; several centimeters have to be scraped away each day from the swimming pool in the local spa.

So, that's the problem. Unless we have prior knowledge, reading that a vineyard's soils "consist of tufa" or that a wine was "grown on tuff" doesn't guarantee what the geological material actually is, let alone what the wine might be like. And it gets yet more tangled! In some vineyard commentaries, tufa and travertine are called "sinter," a term that geologists restrict to precipitations of silica. These are nothing like as widespread as the more soluble calcareous equivalents, but they're important in certain places—and guess what: In addition to the word sinter, the material is given names such as silice, silcrete, silicium, silex, and sarsen. It's a glimpse of a parallel world of confusing "s" words—a whole other story! ■