THE SPIN WE'RE IN

It should be increasingly clear by now that screwcaps aren't all they've been cracked up to be. A growing body of evidence suggests that they're as potentially faulty, albeit in different ways, as either corks or synthetic stoppers, and as much a downward spiral as a glorious revolution. So argues **Paul White** after a detailed investigation of screwcaps and beyond

Before I dig myself any deeper into this hornet's nest, let me declare that I have absolutely no preference for cork over screwcap or whatever. I've had both magnificent and absolutely dreadful wine sealed under both cork and screwcap. Like most consumers, all I want is to have wine delivered to me fault-free with a degree of consistency. If it's wine intended for early consumption, I would want it to be fresh and ready to drink without being disjointed or excessively harsh. And where it's a fully matured, bottle-aged wine, I would hope for the sublime heights of the finest old wines under the best corks.

Having said that, what I'm never very happy about is deception and overpromise. Bearing this in mind, many of the claims for perfection that have been bantered about over the last few years by screwcap advocates are beginning to ring hollow. Let's take a typical set of claims found on one of that industry's main promotional pages (www.screwcap.co.nz). Consumers there are offered four promises: 'Total confidence that you will receive wine in premium condition – alive, abounding with flavours and a pleasure to drink. No bottle variation – each bottle of a given wine will be just as good as the one before. Elimination of cork taint and similar mould flavours that can contaminate wines bottled with other closures. Dependable cellaring – the elimination of random, premature wine oxidation.'

Although these bold assertions suggest nothing less than perfection, they are no more optimistic than what we've been told by the vast majority of the wine press the world over. Not only has this lulled consumers, retailers and sommeliers into a false sense of security where Stelvins are concerned, but without doubt it has led to situations like the one that I ran into a few weeks ago in Wellington, New Zealand. After ordering a

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Screwcaps have an alarming tendency towards reduction

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bottle of wine at a smart restaurant there, the sommelier ceremoniously snapped off its cap, filled the glasses around my table, promptly sat the bottle down and left without another word. As he passed by later, I asked why we hadn't been offered the opportunity to try the wine and either accept or reject it. His response was that any wine sealed under a screwcap was delivered in perfect condition, so there wasn't any need to seek our approval.

Although that bottle did indeed drink very well, as have many other wines under screwcap, I've known many others that haven't. While screwcap advocates can accurately boast that wines sealed that way are free of cork-derived TCA, they can't honestly claim that they are free of other faults.

Don't believe the hype

My suspicions were first aroused two years ago, during a blind tasting of 30 newly released 2002 New Zealand Gewurztraminers that I was surveying with two other professionally qualified judges. To our amazement, we eliminated four of the eight screwcapped wines for being seriously malodorous. Two were badly reduced, exhibiting reduction's telltale rubbery, rotten egg-like characters; a third had an undefinable, quasi-reduced grubbiness; and the fourth was obviously oxidised. This 50% failure rate was shocking compared to the 3–10% cork-taint rates commonly presumed to pertain then.

A few months later, with another group of professionally qualified judges, I blind-tasted a pair of Jackson Estate Sauvignon Blancs 2001, one of which had been bottled under cork, the other under Stelvin screwcap, to demonstrate the effect of each over time. This was part of an ongoing trial sent to journalists by the New Zealand Screwcap Initiative in an attempt to demonstrate the superior ageing capacity of wines under screwcap over those under cork. In theory, the Stelvin-sealed wine should have been younger and fresher, the cork-sealed wine less fruity and more developed.

Contrary to expectations, however, the wine under screwcap showed signs of oxidation and considerably more forward development than the cork-stoppered wine. Previously I had seen instances of dented or creased screwcaps, but this time I found no visible sign of leakage or damage to the capsule. 'What is going on?', we all wondered. None of this was supposed to happen from what we had been told back in September 2001, at the original launch of the New Zealand Screwcap Initiative. We had been assured that not only had Stelvin seals totally eliminated the risk of TCA taint forever, but a special bevelled corner fit between cap and glass made oxidation and leakage a thing of the past. After questioning the anaerobic (oxygen-free) nature of screwcaps and wondering whether this could create reduction issues, I was told that this was a manageable 'teething problem' and that reduction would never be a problem in future. A year and a bit down the track, screwcaps didn't seem to be living up to these promises.

When it comes down to it, faulty levels of oxidation and reduction are just as unacceptable as corkiness. Unfortunately, explaining these problems accurately requires some mind-numbingly complicated chemistry dealing with the interplay between amino acids, redox potential and micro-oxygenation. A grossly oversimplified, but still scientifically valid, explanation might run as follows.

Reduction is essentially the mirror image of oxidation. Both alter the purest expression of fruit. And just as with brettanomyces or volatile acidity (VA), a little can add complexity, while too much will permanently destroy a wine's aromas and flavours. Unfortunately, both oxidation and reduction can easily reach unacceptably ruinous levels. So, as oxidation imparts an unfresh, caramel-like, Sherry character, reduction lends an even more negative sulphurous smell reminiscent of struck flint, burned match, rubber, cabbage or rotten eggs.

The reductive process revolves around a sulphur compound called hydrogen sulphide (H_2S), which is formed in the absence of oxygen by yeast during fermentation. Unchecked by oxygen (O), hydrogen sulphide tends to hang around tenaciously, stinking things up. This is not to be confused with 'free' sulphur dioxide (SO_2), which winemakers use to sterilise and preserve wine and which dissipates more readily.

Normally the presence of oxygen forms a barrier that keeps hydrogen sulphide from reducing further into negative, rotten egg-like characters. However, in anaerobic environments, any hydrogen sulphide left over in wine at the time of bottling will become a permanent part of the wine's aromas and flavours. Once these 'reduced' characters are 'locked in' like this, no amount of aeration after the bottle is opened will get rid of them.

The only preventative measure is to add copper before bottling, which pulls sulphur back out of the wine and cleans it up. After a reduced wine is poured from the bottle, the only remedy is to drop in an old penny and hope for the best. This is bad luck for Australasians, who stopped minting copper coins years ago.

The risk of reduction is greater with screwcaps, because of their airtight nature. Dr Alan Limmer of New Zealand's Stonecroft Winery, whose doctorate is in chemistry, explains: 'As soon as a wine starts to look a bit reductive in barrel, the traditional and logical response is to give it some air. Racking helps blow (volatilise) hydrogen sulphide off, and copper will do the rest. The problem comes when the more intractable (complex) sulphides have formed, or if all the sub-threshold (undetectable) hydrogen sulphide is not removed. With Stelvin's lack of oxygen, you have a recipe for further reduction, whereas under cork a

Cork-derived TCA is a problem that may run to a couple of bottles per case

small, constant input of oxygen acts as an intermediate barrier to the formation of more intractable and smelly compounds.'

After judging at the Australian Alternative Varietals Wine Show (AAVWS) in November 2003, it was clear that the same problems were still dogging screwcaps. This time, faultiness was discovered while blind-tasting with a panel of professionally qualified, Australian show-circuit judges. After the show, I cross-referenced my colleagues' discussions concerning faultiness back to specific closure types.

Six of 18 Stelvin-sealed Pinot Gris at the AAVWS were faulty. Two of these suffered from oxidation, another reduction, while three others had faults related to VA and bacteriological taint. The failure rate for Stelvin-closed Pinot Gris ranged from 16 to 33%, depending on whether VA and bacteriological contamination are considered to be closure-determined faults, as the Australian Wine Research Institute (AWRI) suggests below. Using similar criteria, non-Stelvins failed in 6 to 11% of cases. Of the 15 Pinot Gris under other closures (cork, synthetic and so on), one was oxidised and another had VA. In other classes (admittedly involving fewer samplings), Gewurztraminer, Sangiovese and Tempranillo under Stelvin failed between 25 and 50% of the time – reduction again being the principal culprit, with only one case of VA.

I could easily adduce further anecdotal evidence of faultiness from tastings over the last couple of years. All of the problems encountered above have been – and are still being – actively discussed in academic and winemaking circles.

A long-term issue

Clinical investigation by the AWRI (published in its *Technical Review*, 142, February 2003) strongly supports evidence emerging at street level. Tests on screwcapped Semillons at 18 and 36 months, revealed that 'wine bottled with the ROTE (Roll-On Tamper-Evident, or screwcap) closure was rated significantly higher in a character that was defined as "reduced" or "rubber" than all other closures, including natural corks. This was due to chemical reactions of sulphur compounds in the relatively anaerobic environment of the ROTE seal.'

As part of the same study, the AWRI randomly pulled a large, commercial sampling of Rieslings from retail shelves and found that a quarter of those under screwcaps also showed reduced characters. The AWRI concluded that 'after a period in the bottle, some commercial wines can develop this [reduced] aroma, and it seems most common in wines bottled under screwcap closures.' Clearly, screwcaps' airtightness was a primary factor in the emergence of reduced characters over time and, at the very least, it was exacerbating the problem more than other enclosures.

Reading between the lines, this raises some fairly profound questions. We must assume that the Semillons and Rieslings in the study were made by competent winemakers who had screened the wine for any residual sulphide problems before bottling. It is likely that undetected – or, possibly, even undetectable – levels of sulphides were the cause of the problem. Although perceived to be sound at bottling, these wines were actually ticking away like time bombs and eventually developed reduced characters a year or more down the line. All of which makes long-term cellaring problematic. Where corkiness may ruin a couple of bottles per case, Stelvin's tendency towards reduction offers a chance of screwing up the whole lot.

The AWRI concluded that reduced aromas were unlikely to be a significant issue in 'screwcap closures for white wines intended for early consumption, where all stocks of the wine would be sold and consumed in the year of release.' But they were careful not to endorse long-term cellaring of any wine, red or white.

An article on screwcaps by the oenology staff at Charles Sturt University (CSU) in New South Wales, published in *Australian & New Zealand Grapegrower & Winemaker* (March 2004), notes the intensity of discussions within CSU and the industry at large as to whether both white and red wines should be placed under screwcap. Concerns raised there deal with reduction, the need for oxygen ingress and whether well-matured reds should end up tasting like newly bottled wine.

One of the earliest adopters of screwcaps, Brian Croser, has expressed similar concerns about screwcapped reds he made between 1978 and 1982. In an article by Tim Atkin MW in *The Observer* (25 April 2004), Croser is quoted as saying: 'The wines are developed, but they're tinny and flat; like stale jam. The best wines sealed with a natural cork are better than all the screwcap wines.' And, in a significant move, one prominent Stelvin-user in New Zealand has gone back to using corks on his reds after trialling one vintage under the newer closure. All things considered, he's not likely to be the last.

Adding to the debate, the AWRI noted in its 2003 Annual Report that it had uncovered a raft of quality-control issues surrounding Stelvin-bottling practices. Most of the problems related to failed seals, which led directly to oxidation, bacteriological contamination and excess VA in a number of different screwcapped wines.

After interviewing several winemakers who use Stelvins, it's clear to me that unexpected problems with bottle calibration, fill levels, head space (specifically what gas to fill it with), capsule application pressure, transport and storage have led to much more oxidation and spoilage than is being reported. Whole batches of wines have been rejected because of mechanical failure, and I have seen enough uncrimped capsules, incomplete or non-existent serrations, detached foils and other problems with seals to suggest that more than a few individual faulty seals are getting through the system.

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The weight of all these faults suggests that Stelvins are not delivering what they promised. There is bottle variation, wines are ageing prematurely and have been tainted with bacteria. Reduction and oxidation are spoiling wines that are sitting on shelves and resting in our cellars.

The redox paradox

Setting aside mechanical failures, why are Stelvins particularly vulnerable to reduction, and to a lesser degree, oxidation? The crux of the issue revolves around whether wine ages reductively or oxidatively. This is crucial because it determines how wine is treated before going into bottle and how it behaves afterwards.

On one side, Stelvin supporters, citing Emile Peynaud's views, see optimal bottle maturation as essentially anaerobic; on the other side, many academics and winemakers (including professor Roger Boulton of UC Davis) are convinced that bottle maturation is dependent on small amounts of oxygen seeping through the cork into the wine. So far, no definitive scientific studies have determined the precise nature of post-bottling chemistry. A lot of long-term research is still needed to resolve the issues surrounding bottle maturation. Until we have more answers than questions, nothing is certain.

Alan Limmer gives this explanation of the current dilemma: 'Once you decide to store your wines anaerobically instead of oxidatively (screwcaps vs cork), this has huge repercussions for subsequent wine development. It would be wrong to think of the Stelvin environment as neutral. Wines have what is called "redox potential". They are born with it and it reflects the winemaking process that has gone before. Think of it as a pendulum. On one side is the oxidative phase, where wine oxidises in a short time after exposure to air. On the other side, sealed off from air, is the reductive phase. The wine swings between these phases depending on what process is occurring.

'Fermentation is hugely reductive (yeasts have an enormous appetite for oxygen). This is where most of the sulphide issues originate. What happens to the wine after fermentation has a lot to do with what happens to the sulphides. Racking and barrel-ageing shift the wine slowly towards the oxidative phase, so the redox potential moves from reductive to oxidative. After about eight months (about the time it takes for barrel breathing to neutralise the reductive potential of a ferment), the wine's redox potential is neutral, but moving towards oxidative. Much has been written about this measurement in wine-chemistry literature and there are many complex papers on the subject. Even with a [doctoral] degree in chemistry, my head hurts reading them sometimes. But most winemakers don't even know what I'm talking about when I mention redox measurements.

'The point is, the wine is set up for a number of reactions subsequent to bottling driven by the redox potential. Until now, it has probably not been so significant, as wines appear to have been stored oxidatively under cork, and any issues from a reductive environment have been treated benevolently under this regime. Our New World winemaking is largely reductive – gas-blanketing and so on – to escape much of the Old World syndrome of oxidative winemaking. So then suddenly to switch to reductive storage of wines long term was always going to have some repercussion on the wine's post-bottling behaviour.'

Some Stelvin advocates postulate that the best corks are anaerobic in nature and behave no differently from Stelvins. They believe that the supply of oxygen needed to stave off reduction in cork-stoppered wines is contained in the cork itself (about 2–3ml) and doesn't come through it. Knowing that a reservoir of oxygen is required to keep reduction at bay, some producers are filling the head space with this amount of oxygen. This practice is the antithesis of the normal New World technique, where fear of oxidation has winemakers doing everything possible to protect the wine from oxygen at bottling.

Limmer takes up the other, more screwcap-sceptical, side of the debate: 'Everyone I know is at pains to bottle anaerobically under cork – to stop oxidation at bottling by preventing any shock oxygen doses. We know from a study conducted by CSIRO/SCORPEX [Commonwealth Scientific & Industrial Research Organisation] that over a lifetime of, say, three to five years, the wine will consume about five times (or more) as much oxygen as is contained inside the cork – about what you see in two to four weeks of barrel-ageing. The oxygen available under cork differs fundamentally to the dose Stelvin users are adding before bottling. Although both are relatively small in the scheme of things, the difference is that, after bottling, a cork bleeds oxygen over a period of time, which does have a beneficial effect on the chemistry – a micro-oxygenation technique as distinct from a macro-oxidation, which gives the equivalent dose all at once.' Limmer suspects that over and above the problems with leaky seals, this one-off dose may account for some of the oxidation currently showing up under screwcaps.

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Echoing the boast most often made of screwcaps, Limmer concludes: '"The perfect seal"? Maybe – but only if you know exactly what is going on and can have complete confidence in the post-bottling redox process. We are a long way from that.'

Copper magic

So with oxygen issues still unresolved, what about the other main defence against reduction – copper fining? Considered by some to be a heavy-handed last resort for sulphide problems, coppering does not sit comfortably with artisans who like to follow non-interventionist winemaking philosophies. Nor is it an ideal solution for winemakers intent on building in lees

The new Zork closure can be ordered with variable degrees of oxygen permeability

character for complexity (lees are rich in sulphides). Why go to all the trouble of carefully working in this character, only to risk stripping it out later?

Moreover, certain varietals are more susceptible to copper fining than others. While Riesling is a relatively safe bet, Pinot Gris, Syrah, Pinot Noir and Sauvignon Blanc can be more problematic. Limmer summarises what I've also heard from many other winemakers: 'Most winemakers know that Sauvignon Blanc has always been a knife-edge proposition regarding use of copper – knowing when it is clean and how much is too much before the wine becomes sterile. Certainly much of Sauvignon's character is sulphide-driven, and recent French research has shown that thiols contribute largely to aromatics. Thiols are one of the compounds routinely fined with copper to reduce stink in wines – after hydrogen sulphide they are probably the most prevalent. Trouble is, there are nice thiols as well as stinky ones. Unfortunately, copper doesn't discriminate – the good ones are taken out with the bad.'

This stripping of thiols may explain the puzzling stylistic differences among Marlborough Sauvignon Blancs 2003 sealed with Stelvins. Across the board, vintage conditions seem to have delivered some fairly intense, classic, sweaty, 'cat's pee', herbaceous aromatics. While a number of Stelvin-sealed wines have captured these qualities beautifully, others seem flat and denatured, lacking herbaceous characters and the edgy style that put Marlborough on the map. One has to wonder whether this is not the result of the heavy-handed coppering Limmer describes. It may well be that certain varietals will prove to be unsuitable for screwcaps – even in the shorter term.

The new generation

On a more positive note, the current rivalry between Stelvins, synthetic corks and natural corks has forced a scientific approach to bottle maturation, which had previously been little more than a black art. One thing is quickly becoming clear: no single closure is likely to dominate for the foreseeable future. We should welcome this as a good thing, thanking Stelvins and, before them, synthetics, for blowing the field of competition wide open. No single stopper can ever rest on its laurels again. All must strive to perfect their design. Here's a summary of how they currently stand.

Zork is a new, hybrid design that cleverly incorporates screwcap's ease of opening with the magical 'pop' consumers have come to expect from a cork being pulled. Looking a lot like an expensive sealing wax capsule, Zork is both free from TCA taint and much more robust than Stelvin, so should suffer less oxidation from transportation and storage. It also works on any bottle, freeing it from the naff 'one size fits all' bottles that screwcaps are locked into. Most importantly, this closure can be ordered with variable grades of oxygen permeability, offering a viable alternative to screwcap and cork advocates alike.

Improved cork products are already pointing to the day when TCA is a thing of the past and stoppers play an active role in bottle conditioning. The reconstituted granules in Sabate's new Diamond technical cork are treated with a supercritical carbon dioxide (CO_2) wash process that penetrates like a gas and then cleanses like a liquid. AWRI studies have already certified these as showing 'no evidence for trace levels of TCA', with better performance than screwcaps in terms of reduced characters. Bottle variation should be negligible. These closures also come in several grades of oxygen permeability.

Pro-Cork takes a prophylactic approach, placing a two-way, Gore-Tex-like membrane between the wine and a natural cork. This filters out any trace of TCA and other impurities, while allowing the wine continually to rehydrate the cork for a tight seal. As with Zorks and Diamonds, this is designed with graded oxygen permeability and reduced bottle variation in mind.

Natural cork is rallying, through a fundamental shake-up of industrial processes. Steps like taking a holistic approach, the introduction of quality control, smarter storage, improved pre-washes and rejection of the most likely contaminated part of unworked bark have already lowered the total background incidence of TCA taint in pre-manufactured cork compared to the situation a couple of years ago. Portugal's largest producer, Amorim, has a new procedure called ROSA (Rate of Optimal Steam Application), which has already demonstrated significant reduction of TCA taint and other impurities in their agglomerate technical corks and sandwiched disk design (Twin Tops). The next stage of development will focus on graded permeability and reduced bottle variation, allowing wine to mature in a more predictable way under cork.

While affording the option of either anaerobic or oxygen-driven bottle maturation is an obvious element in all these designs, the next leap forward will be to match closures to particular grape varieties and styles. Sabate's Dean Banister explains the strategy behind Diamond cork: 'We see bottle development as influenced by differences in grape variety, soil type and climate. The advantage of the individually moulded cork is that we also control density and uniformity, and through this can control oxygen permeability.' This flexibility allows winemakers to fine-tune the enclosure to all these parameters. Banister continues: 'Extreme examples might be New Zealand Sauvignon Blanc compared to Barossa Shiraz, where each could require different permeability ratings to aid or minimise bottle development.'

The knock-on effect of all this is that in future it's very likely that consumers will play an active role in choosing from a variety of stoppers, each of which will offer exactly the sort of bottle-conditioned characters desired of any given wine. ■

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