PART II

Do corks breathe?

Origin of post-bottling sulfides

BY Alan Limmer

Another dramatic illustration of the effects of very small amounts of oxygen, and their influence on sulfur-like odors (SLO) was demonstrated in the Australian Wine Research Institute's (AWRI) experiment showing relative amounts of sulfide character under three closures: glass ampoule, screw cap, and cork.[1]

The ampoule is completely anoxic and demonstrates high sulfide levels, with the screw cap near anoxic and intermediate levels, and the cork sample showing almost nil, but higher oxidative levels. This also suggests the scalping theory is not the explanation for variation in SLO occurrence between screw cap and cork. The screw cap wine should have had the same amount of SLO as the ampoule.

By this chemistry, the nearer one approaches a state of anoxia, the more one can expect to encounter SLO. The redox chemistry of sulfides predicts this, and the excellent AWRI sensory work demonstrates the effect. Early development of screw cap barriers also encountered this problem.[4] When a tight sealing aluminium barrier was used, the wine went reductive, but other barriers did not have the same effect. The redox potential under the aluminum barrier dropped sharply, about twice as far compared to the others.

Changing the barrier under the screw cap will alter these results. The AWRI trial results relate to the low ingress metal foil-type barrier.

This reduction effect is not, or should not be new to winemakers. How many times have you cleaned a wine up with copper(II) fining or filtration in preparation for bottling, only to see it lose some of the vibrant varietal notes while stored under gas in tank? A further copper fining restores the original vibrant notes. This is a clear case of reducing redox potential producing more deleterious sulfide notes from an otherwise "clean" wine. There is no difference between this scenario and that experienced under screw cap — except you can't get at the wine again.

Clean wine status

This explanation has significant implications for the use of screw caps. First, it is incorrect to blame poor winemaking for all instances of SLO. Many, if not most, of the wines may well have been (probably were) clean at the point of bottling. But a definition of clean depends on the redox state of the sulfides.[9] Scrupulous cleaning up of the copper-treatable sulfides is no guarantee against SLO. It requires the ascorbic acid/copper(II)/carbon treatment to remove disulfides (and then with limited efficacy).

Second, the commonly attributed benevolence of cork to these characters is actually a manifestation of the altered state of redox potential. This will be impossible to reliably replicate under screw cap without resorting to a range of permeabilities for these closures.

Third, the history and sulfide composition of a wine, plus a host of other antioxidant factors will vary from wine to wine, year to year. To predict which SO_2 level for a particular wine is likely to mitigate the effects of SLO is likely to lead to erratic and often, unfortunate results.

The alternative is to simply raise the degree of oxygen ingress. This will maintain the disulfides in their current form, and, in fact, oxidize any thiols into disulfides. (But the post-ferment thiols [and H_2S] really should have been cleaned up beforehand).

It may well be time to look at a range of oxygen transmission rates (OTR)s for wine closures. Certainly they are going to be near the low (anoxic) end of the scale, but generally, likely to be above the current range of low-ingress screw caps.

The notion that every producer, and wine should subscribe to one minimal OTR-closure is like saying all wines have a particular style.[5] Once there is enough OTR to cross the anoxic/sulfidic threshold, how much more ingress will be a stylistic choice. In the same way a winemaker chooses how much barrel ageing etc, and whether a wine is bottled more advanced or reserved as a style.

There are limitations at the moment, in choice, but closure manufacturers should be aiming to provide winemakers with a range of useful options, given this factor has such an influence on the post-bottling outcome. The lower the OTR of a closure, the more precise the wine parameters have to be met, regarding the competing oxidation/reduction to achieve a successful outcome. From that viewpoint, one could conclude it may be better to build in some latitude to mimic the cork's approach.

Available options

Figure II (courtesy of Oeneo Closures Australasia — formerly Sabate) shows a low OTR range for two closures — the P10 and P1. Oeneo Closures have the P1 and P10 in the market as Diamond (liquid CO_2 washed) and Reference (steam wash). The P1 has an OTR quoted as four times that of screw cap while the P10 is ten times that of the P1. There was under trial a lower grade of OTR — P0, which was equivalent to foil screw caps. But this is not going to market. It did not score as well as P1 in sensory evaluation. The P0 formulation and OTR is the same as the one used for Altec corks in the original AWRI closure trial.

In the original AWRI closure trial, Altec corks scored as badly as screw