The closure issues

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1999 Semillon wine bottled using 14 different closures

Range of color 28 months after bottling

OD$_{420}$ ≈ 0.14 au  OD$_{420}$ ≈ 0.19 au

14 different closures ⇒ 14 different wines!
PCA ‘map’ of 63 month aroma data (1999 Semillon wine)
Wine ‘development’

- is closely connected with oxidation–reduction phenomena (redox reactions)

- depends on a whole series of factors relating to the wine’s composition and storage conditions

Post-bottling: depends on wine composition, storage conditions and the properties of the closure
Wine composition
- Dissolved oxygen
- Ascorbic acid
- SO₂
- Phenolic compounds
- Metal ions
- Flavour compounds
- Oak phenolics
- Fermentation-derived compounds (thiols)
- .......

Bottling
- Dissolved oxygen
- Oxygen in headspace
- Oxygen permeability of closures
- Filling height
- SO₂

Wine storage
- Permeability of closures (transfer of gases in and out of the bottle, closure type, storage position)
- Flavour scalping
- Temperature
- Time
- .......

Wine ‘development’ oxidation/reduction, and consumer satisfaction
AWRI ‘commercial closure trial’
bottled September 2002

ROTE (Auscap, tin liner) - four treatments at bottling

“Low” filling height
(48mm ullage,
Free SO$_2$ 38 mg/L)

“High” filling height
(30mm ullage,
Free SO$_2$ 39 mg/L)

“Low” filling height + SO$_2$
(47mm ullage,
Free SO$_2$ 54 mg/L)

“High” filling height + SO$_2$
(29mm ullage,
Free SO$_2$ 59 mg/L)
Relationship between free SO$_2$ and ‘struck flint’ aroma score: 24 months storage

Free SO$_2$ (mg/L) vs Struck flint aroma score for 24 months storage.
Sulfur equilibrium in wine

- Methanethiol: 1.5 μg/L (CH₃S-H)
- Dimethyl disulfide: 10 μg/L (CH₃S – SCH₃)
- Methyl thioacetate: 40 μg/L (CH₃C – SCH₃)

Processes:
- Reduction
- Oxidation
- Acetylation
- Hydrolysis
Relationship between free SO$_2$ and ‘struck flint’ aroma score: 24 months storage (n=4)
Free SO$_2$ concentration and ‘rubber’ aroma score: 63 months storage
Free SO₂ concentration and ‘struck flint’ aroma score: 63 months storage
Wines bottled with low oxygen permeation closures are more likely to develop *reductive* character in bottle, if those wines have a propensity to become reductive.
Panel mean scores for the attribute *reduced*
Panel mean scores for the attribute TCA

- Semillon Sauvignon Blanc
- Sauvignon Blanc
- Chardonnay

Attribute mean score vs Bottle number.
Panel mean scores for the attribute *oxidised*

- **Chardonnay**
- **Sauvignon Blanc**
- **Semillon Sauvignon Blanc**

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Legend:
- Green: Semillon Sauvignon Blanc
- Light green: Sauvignon Blanc
- Yellow: Chardonnay
Panel mean scores for a 2003 Chardonnay wine sealed with natural cork closures

4 ng/L of TCA
Panel mean scores for a 2004 Shiraz wine sealed with screw cap and cork closures

Attributes
- TCA
- Oxidized
- Reduced

Screw cap sealed bottles

Cork sealed bottles
Impact of closure type and ascorbic acid addition on oxidized score after 3 years

Impact of closure type and storage position on a Chardonnay wine aroma after 3 years

Commercial closure trial: 2002 Semillon – different closures & times post-bottling

2004 Chardonnay wine sealed with ‘membrane’ corks: 24 months post-bottling

Attributes
- Oxidized
- Reduced

Bottles stored in an upright position for 18 months post-bottling
Impact of closure type, including glass ampoules, on wine aroma after 4 years

Wines bottled with closures with low oxygen transmission rates (OTRs) are more likely to develop reductive character in bottle, if those wines have a propensity to become reductive.

It is therefore incorrect to say that low OTR closures CAUSE reductive character.
• Oxygen at bottling is consumed within weeks

• Reductive characters, probably thiols, are formed over months or years

- Oxygen to oxidize the thiols is that permeating through the closure

- Increasing the headspace volume is oxygen at the “wrong” time
Fermentation management

- Yeast strain

- Problem or stressed fermentations are more likely to contain higher concentrations of thiols and their precursors.

- These wines will cause greater problems with post-bottling reduction
Fermentation management

- Better yeast preparation, particularly during re-hydration, and aeration of the culture
- Avoid temperature shock
- Add air and nitrogen one third of the way through fermentation
After fermentation

- Know what the sulfur compounds are before aerating wine after fermentation - copper cadmium test

- Add copper if necessary, but be aware that copper can impact on longevity as it is a catalyst for oxidation
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