

# Five-year chemical aging profiles of two red and two white wines stored under four closures

Annegret Cantu\*, Mauri Anderson, Nicolas Delchier, Patricia Howe and Andrew L. Waterhouse

\*University of California Davis, Viticulture and Enology Department, One Shields Avenue, Davis, CA 95616

## PURPOSE of the STUDY

- Effect of different closures and their respective oxygen transfer rates (OTRs) on wine aging has been an ongoing research effort globally.
- We compared the effects of three different OTR regulating closures and a natural cork on the aging characteristics of 4 commercially available quality wines.
- How did the different OTR closure affect the different wine styles and their chemical profiles over time?
- Closure consistency based on final SO<sub>2</sub> consumption levels?

## BACKGROUND



**Oak Forest**  
San Vicente di Alcántara, Spain



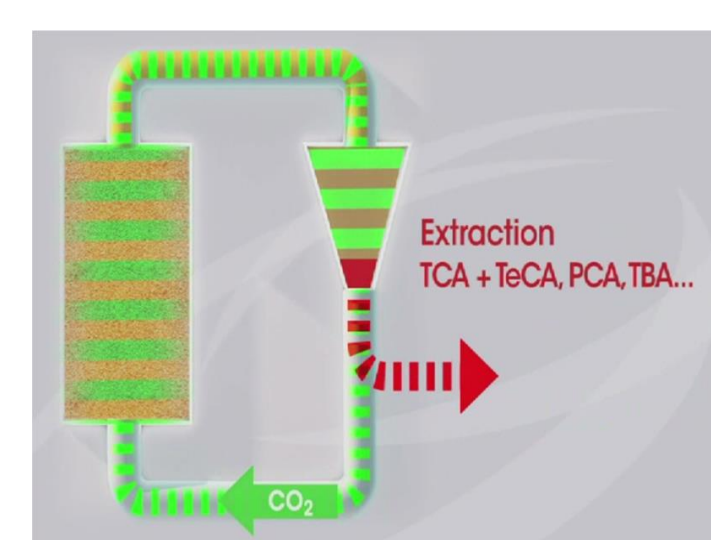
### Natural Cork Harvest

May-August at tree's most active growth phase



### DIAM Cork Production and DIAM Process

- To make a TCA free cork

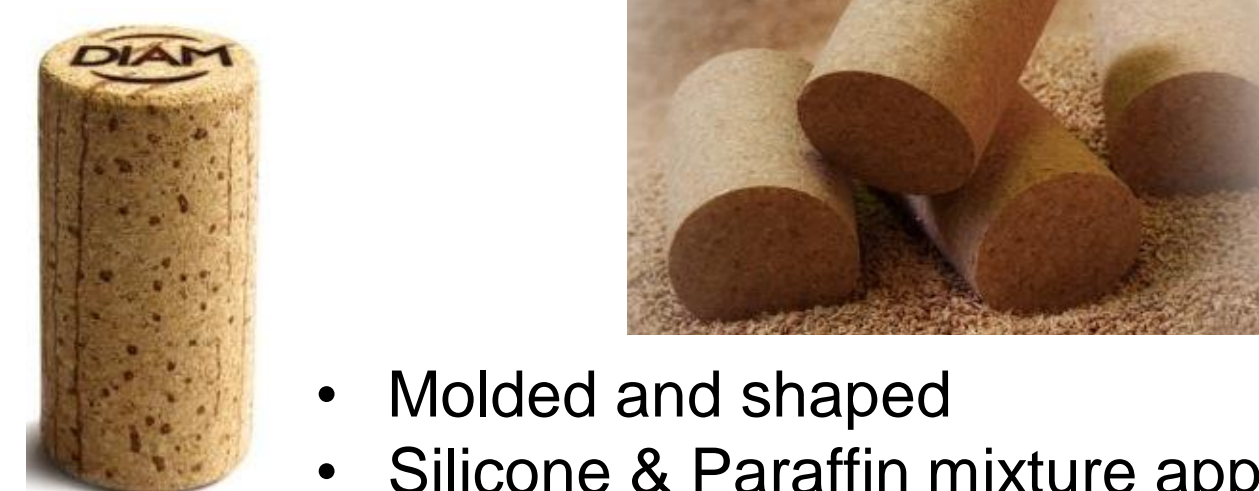
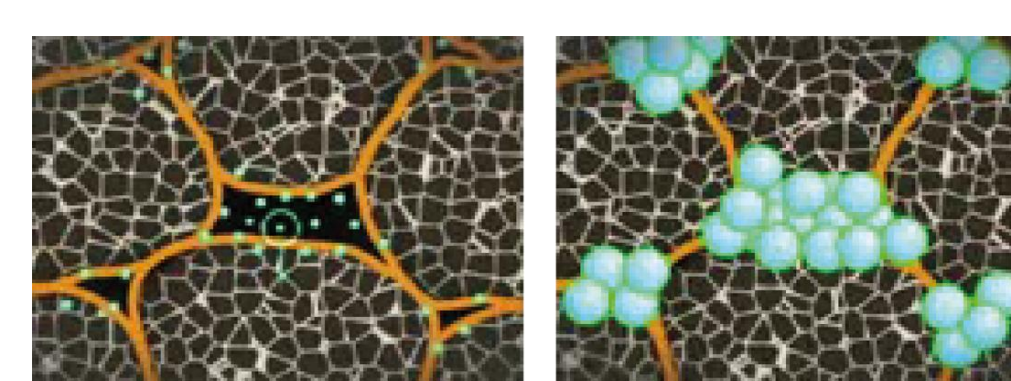


**CO<sub>2</sub> "supercritical state"**  
(specific temperature +high pressure)  
→ Penetrating gas and draining liquid  
→ Developed by DIAM (DIAM process)  
→ TCA, TeCA, PCA, TBA

"Clean" suberin particles + Microspheres



Food grade binding agent +heat



- Molded and shaped
- Silicone & Paraffin mixture applied

⇒ Elasticity and flexibility  
⇒ **Homogenous product**  
⇒ **Oxygen control**

## MATERIAL and METHODS

### Wines

Variety	Origin	Winery	Vintage	pH	TA (g/L)	Alcohol %
Sauvignon Blanc (SB)	Napa	Napa Cellars	14'	3.3	5.8	14.25
Chardonnay (CH)*	Napa	Grgich Estate	13'	3.3	6.6	14.3
Pinot Noir (PN)	Clarksburg	Sebastiani Sons	14'	3.75	5.4	14.3
Cabernet Sauvignon (CS)	Alexander Valley	Napa Cellars	13'	3.7	6.1	13.8

\* barrel-aged

### Closures

- 49 mm natural punched Cork (NC), OTR: n.a.
- DIAM 3\* (D3), OTR: 0.6 mg/ year
- DIAM 5\* (D5), OTR: 0.4 mg/ year
- DIAM 10\* (D10), OTR: 0.3 mg/ year



\*The numbers are related to DIAM shelf-life guarantee in years

### Chemical Analysis

- Free and Total SO<sub>2</sub> after ~ 5 years (65months) of aging is highlighted in this poster presentation using flow injection analysis based on the aeration oxidation method.

### Statistical Analysis

- **Closure consistency:** Free and Total SO<sub>2</sub> levels 12 bottles each variety/closure treatment were measured after ~5 years of aging and analyzed with descriptive statistics (variance, n-1) and Bartlett's test to determine homogeneity of variance and a pairwise comparison to show significant differences among closures. \*Same letters in bar graphs indicate no significant differences in variance at p<0.05. and the opposite.

## RESULTS

### Sauvignon Blanc

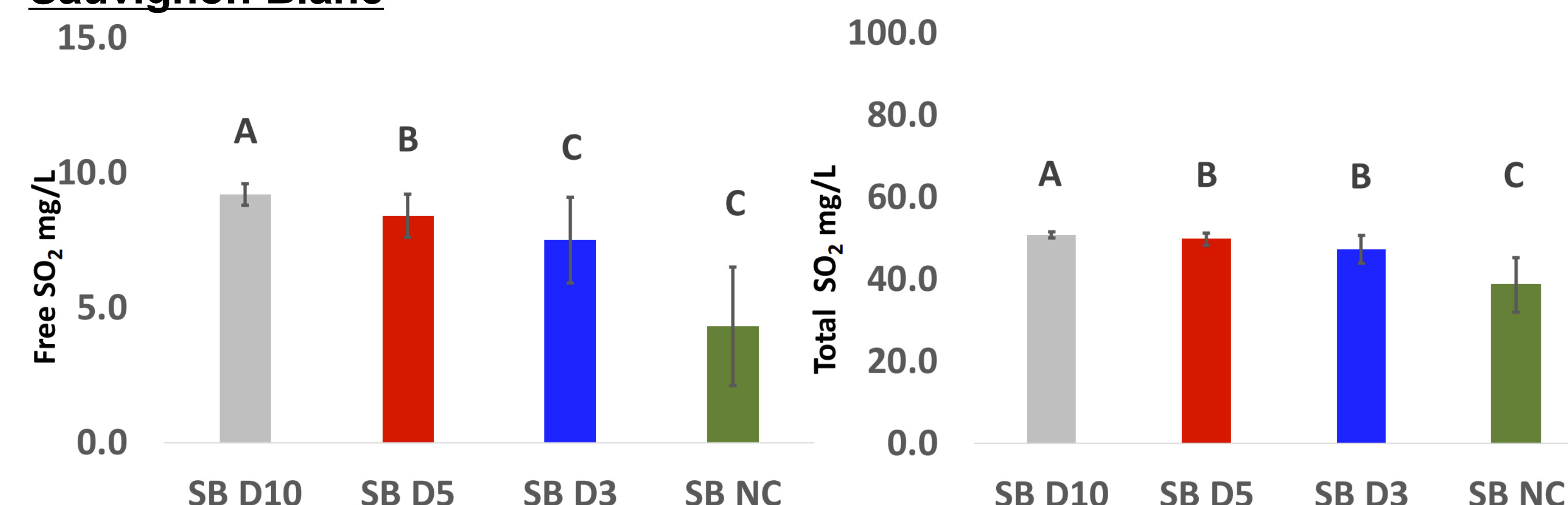


Figure 1: Free (left) and Total (right) SO<sub>2</sub> levels in mg/L after 65 months of SB aging of 12 bottles and their respective variances at p<0.05. Letters indicate significant similarities or dissimilarities in variance.

## RESULTS

### Chardonnay

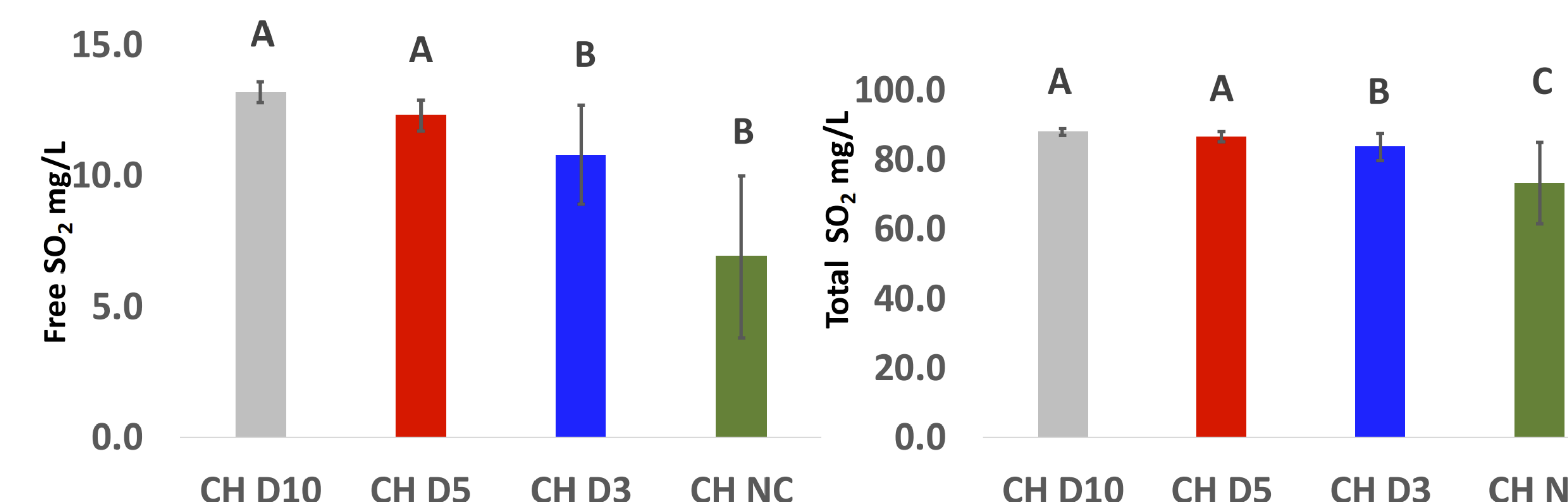


Figure 2: Free (left) and Total (right) SO<sub>2</sub> levels in mg/L after 65 months of CH (barrel-aged) aging of 12 bottles and their respective variances at p<0.05. Letters indicate significant similarities or dissimilarities in variance.

### Cabernet Sauvignon

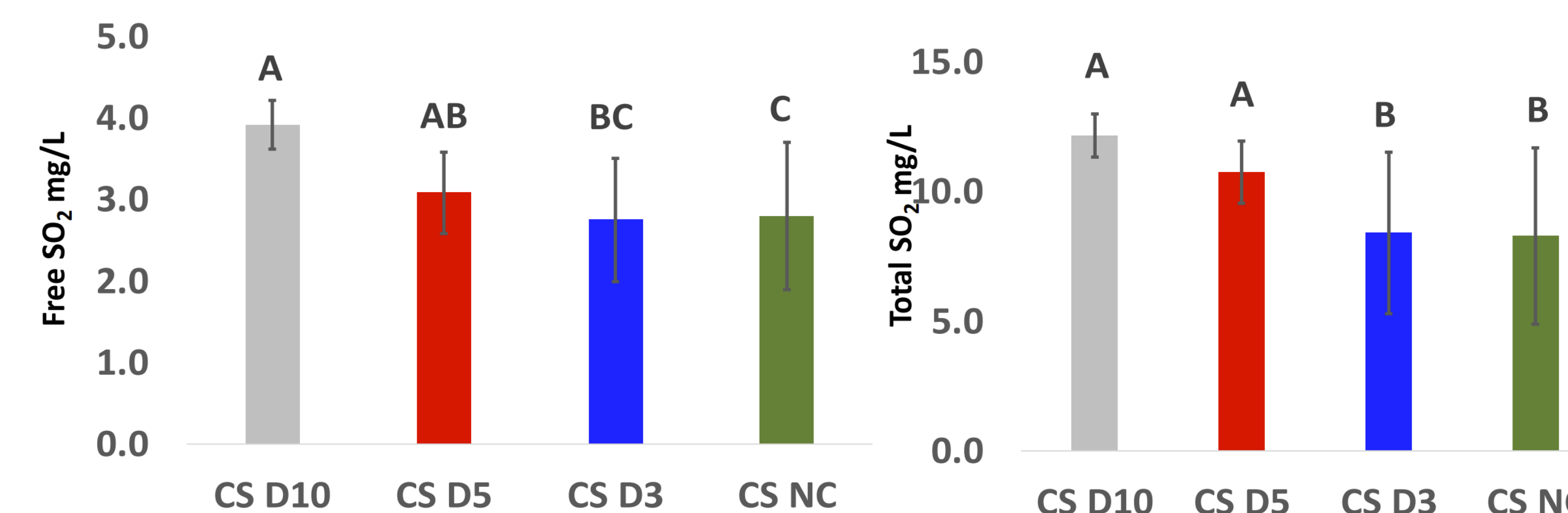


Figure 3: Free (left) and Total (right) SO<sub>2</sub> levels in mg/L after 65 months of CS aging of 12 bottles and their respective variances at p<0.05. Letters indicate significant similarities or dissimilarities in variance.

## CONCLUSIONS

- For the Pinot Noir, free and total SO<sub>2</sub> levels were at the detection limit and are not reported. However, over the time course of 5 years, we could see that NC had significantly lower free and total SO<sub>2</sub> levels than all three investigated DIAM closures.
- The presented bar graphs in Figure 1-3 of the free and total SO<sub>2</sub> levels indicate that D10 and D5 closures had more consistent performance in retaining SO<sub>2</sub> levels than NC and D3 after 5 years of aging.
- From the annual time course data (n=3 per wine closure/treatment, data not shown), we can conclude that NC had the most impact on SO<sub>2</sub> consumption for all closures.
- More detailed results and discussion will be presented soon.

## ACKNOWLEDGEMENTS

- Funding source: DIAM Bouchage
- Thank you to Foley Wine Estates, Napa Cellars & Grgich Winery for wine donations
- And a special thank you to ETS laboratories in Napa for helping with the chemical analysis