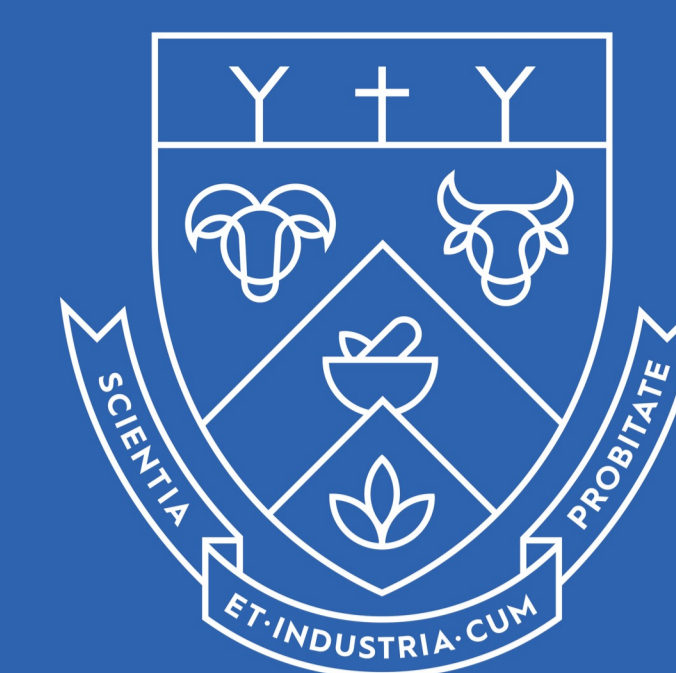


# Analysis of polymeric phenolic materials separated from 22 Pinot noir wines of a single producer

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## Introduction

The colour and mouthfeel of red wine are strongly influenced by its phenolic composition, particularly polymeric phenolic materials (PPMs), which contribute to pigment stability and astringency. While the role of PPMs in wine quality is well recognised, their evolution during ageing and relationship with wine grade remains underexplored, especially in Pinot noir. In this study, 22 Pinot noir wines from a single New Zealand producer, spanning ten vintages and multiple quality tiers, were analysed to characterise the colour properties and tannin content of PPMs. By removing monomeric anthocyanins and isolating PPMs, we examined changes in colour absorbance under different pH conditions and quantified bleachable pigments and MCP tannins. Notably, we observed a clear decline in the A520 pH 1.0/pH 3.4 ratio with wine age, reported here for the first time in Pinot noir. This work highlights the dominant effect of wine age on PPM colour properties, offering new insight into phenolic development in aged Pinot noir wines.

## Materials & Methods

Twenty-two commercial Pinot noir wines produced by a single New Zealand winery (Pernod Ricard Winemakers) were selected, spanning ten vintages (2002–2018) and six quality grades. Polymeric phenolic materials (PPMs) were separated from each wine by selectively removing monomeric anthocyanins using isoamyl alcohol extraction. The colour characteristics of the isolated PPMs were measured using a modified Somers assay, including absorbance at 420 and 520 nm at pH 3.4 and pH 1.0, and SO<sub>2</sub>-resistant pigments. Bleachable pigments and their degree of ionisation were calculated using sample-specific correction factors. Tannin concentrations of the PPMs were quantified using the methylcellulose precipitation (MCP) assay and expressed as epicatechin equivalents. Statistical analysis included ANOVA and hierarchical clustering to evaluate the influence of wine age, vintage, and grade on PPM composition and colour metrics.

## Results

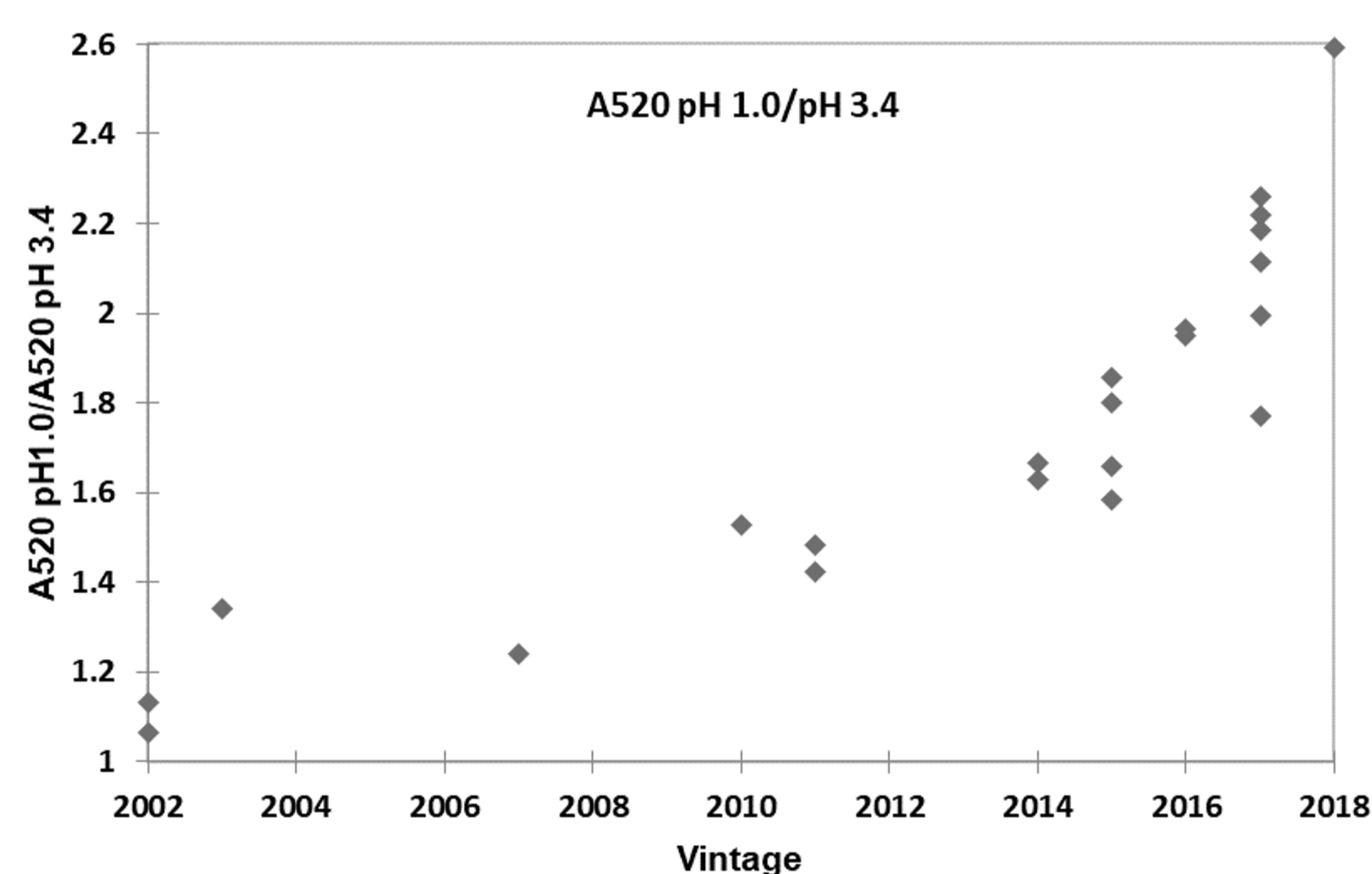


Figure 1. Scattergram of the ratios of absorbance at 520 nm (pH 1.0/pH 3.4) in PPM extracted from 22 wines

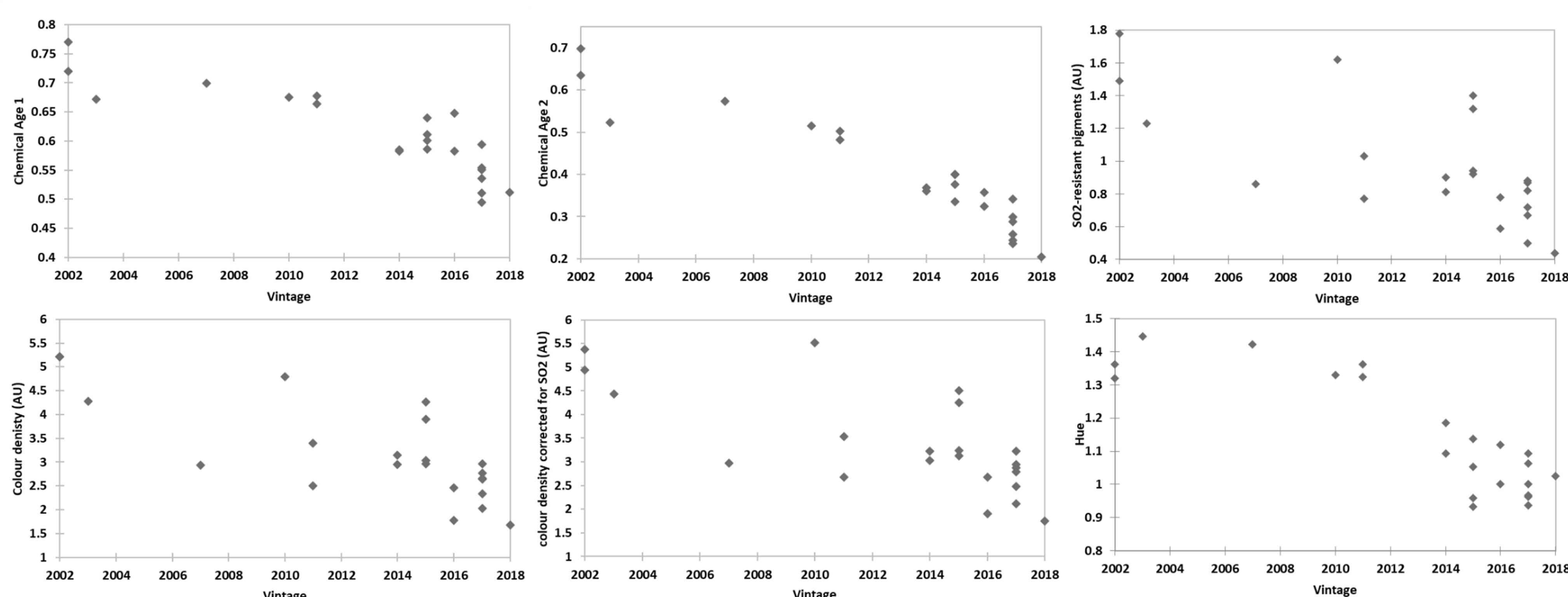


Figure 3. Scattergrams of colour parameters, total phenolics and tannin concentrations of PPM against vintage, and hue against wine grades

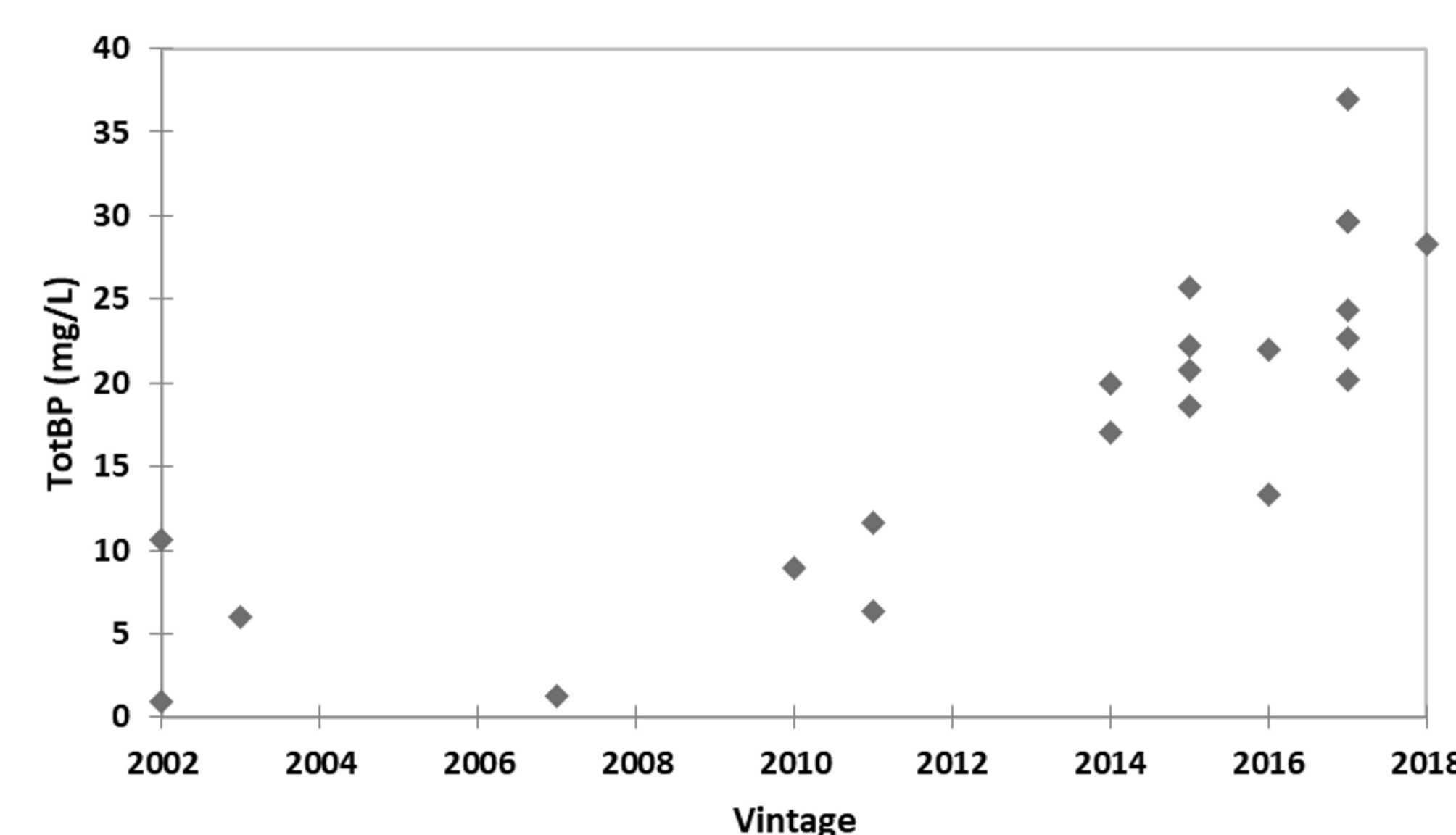
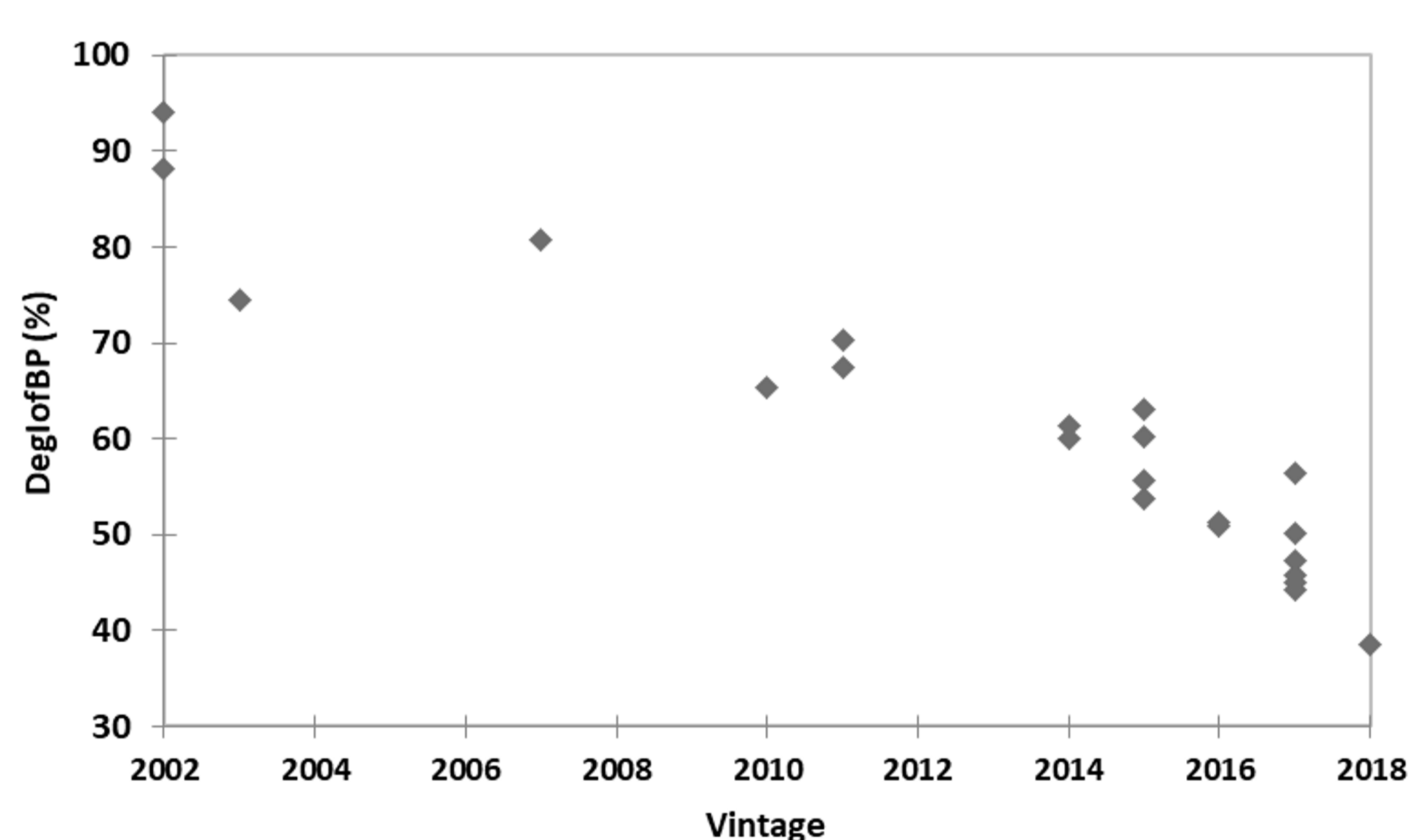


Figure 2. Scattergrams of the degree of ionised bleachable pigments (DegIofBP) and total bleachable pigments (TotBP) of PPM.

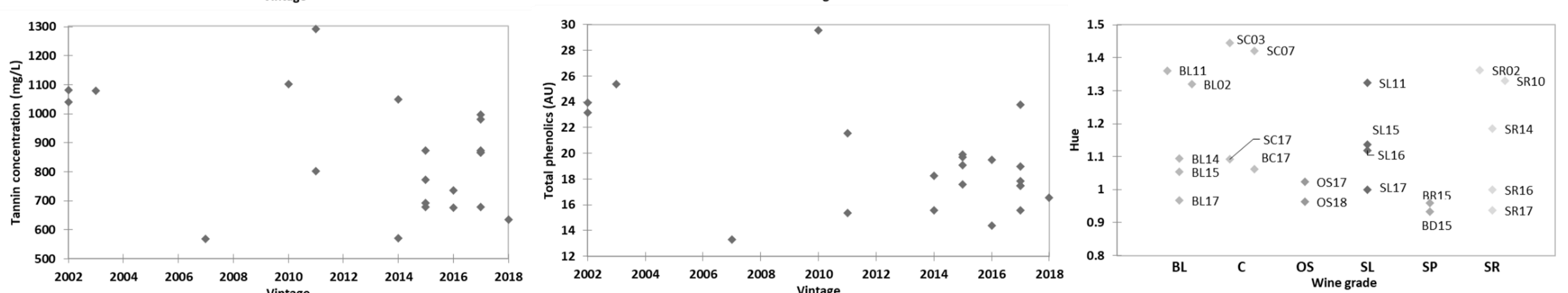


Figure 3. Scattergrams of colour parameters, total phenolics and tannin concentrations of PPM against vintage, and hue against wine grades

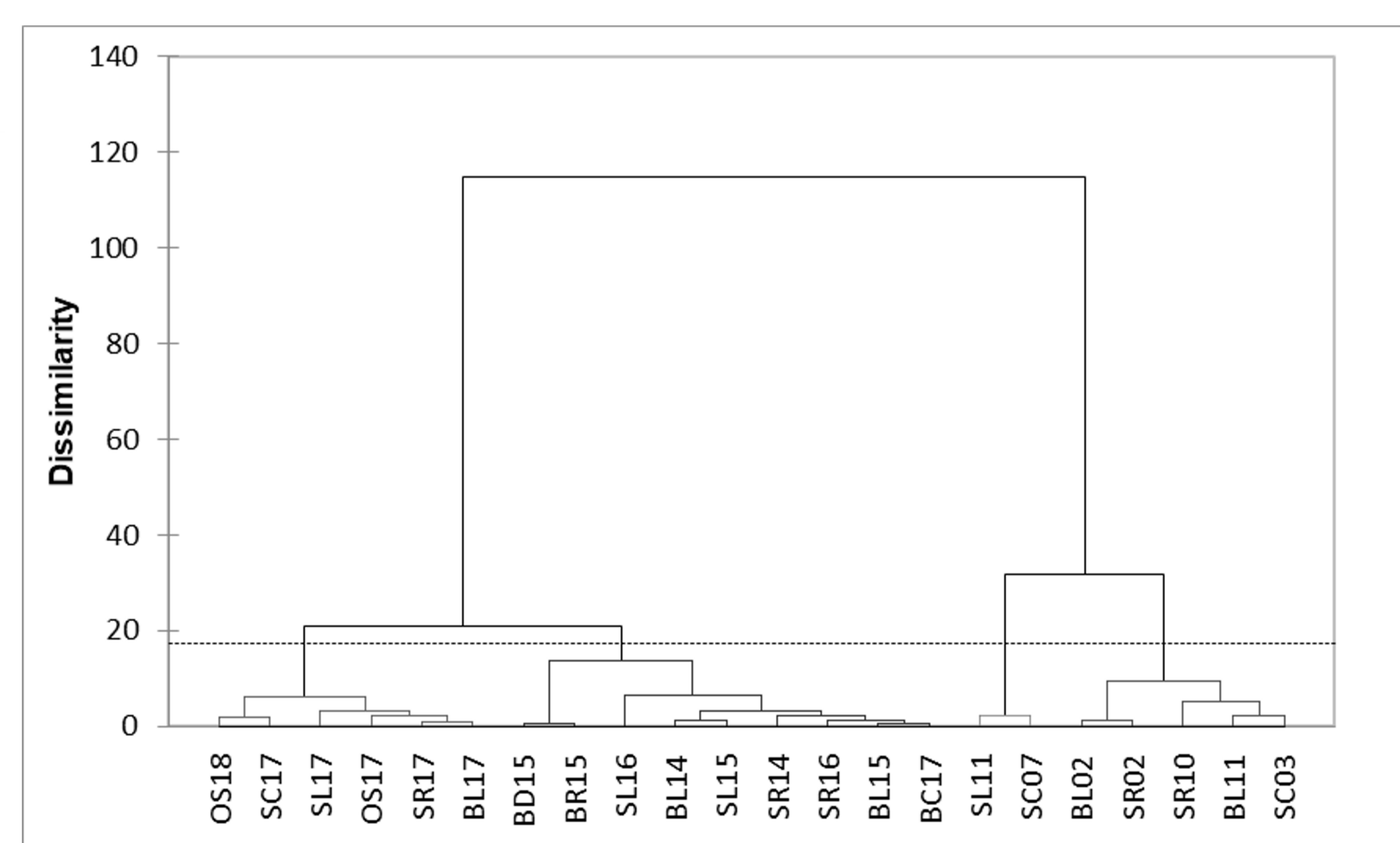


Figure 4. Dendrogram resulting from Agglomerative Hierarchical Clustering (AHC) of analyses of PPM from 22 study wines.

## Conclusions

- The ratio of absorbance at 520 nm (pH 1.0/pH 3.4) in PPMs decreased from 2.6 to 1.1 with increasing wine age, indicating reduced pH sensitivity of wine colour over time.
- Bleachable pigments were present in PPMs, and their degree of ionisation increased with age, contributing more colour at wine pH in older wines.
- Tannin concentrations in PPMs did not follow an age-related trend but were more strongly associated with vintage.
- Hierarchical clustering showed wine age as the dominant factor shaping PPM colour characteristics, more so than vintage or grade.
- These findings provide new insight into the evolution of polymeric phenolics and their contribution to colour stability in aged Pinot noir wines.

## References

- Zhao, M., Harrison, R., Frost, A., & Tian, B. (2023). Colour properties and tannin concentrations of polymeric phenolic materials extracted from Pinot Noir wines of a single NZ producer. *International Journal of Food Science and Technology*, 58(9), 4761-4769.