Introduction

Wine authentication is an extensive concept that includes verifying wine age, geographical origin, varietal differences, and wine production practices that alter wine composition. A robust analytical method to determine the geographical origin of Australian wine is urgently needed for use within the supply chain to guarantee the provenance indicated on the label and provide an assurance of quality.

This project aims to understand the compositional characters that are inherent in varietals from Australian wine regions.

Material and Methods

- **Cabernet Sauvignon wines**: Wines from 2015 vintage from Coonawarra (n=30), Margaret River (n=19), and Yarra Valley (n=21) were benchmarked against Bordeaux wines (n=10).
- **Principal component analysis (PCA)** and support vector machine discrimination analysis (SVMDA) were performed for data interpretation.

ICP-MS analysis

- Dilution of wine samples 10-fold with 2% HNO₃
- Oxygen, helium and without gas conditions were applied
- Total of 65 elements were analysed

A-TEEM analysis

- Wine samples were diluted 200-fold in 50% ethanol and adjusted to pH 2 (HCI)
- UV-vis and fluorescence spectra acquired and measures determined:
  - Absorbance: hue and intensity
  - Transmittance: CIE chromaticity

Excitation emission matrix (EEM): phenolic composition

Together, the data (Figure 1) were applied to evaluate regional or varietal markers as previously proposed.

Results and Discussion

- **In A-TEEM analysis**, wine samples were classified into 6 groups relating to their geographical origin as well as variety (Table 1).
- **SVMDA** is an effective method in this analysis, assigning models unique to each class (Figure 2) as the loadings have a higher granularity for component classification.
- **Confusion matrix of SVMDA (Table 1)** has shown overall high prediction ability, with >90% correct classification overall. It is interesting that Bordeaux blends were perfectly classified, yet poorer performance for Yarra valley and Margaret River blends were observed. Also Coonawarra that were misclassified were deemed to be Yarra Valley 100% CS.
- However, the model could have been improved with the addition of extra samples.

Conclusions and Future Work

- **ATEEM analysis and suitable modelling** allowed effective and sensitive differentiation of classes, which shows that this could be applied for both geographical and varietal authentication of Australian Cabernet Sauvignon wine.
- The next step will involve hundreds of wine samples from the 2019 vintage for ATEEM analysis.
- Identification of potential chemical markers by different methods is planned. Data fusion of the data blocks with chemometrics will be further explored to derive a robust method for authentication.

References