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Tracing Historic Industrial Lead Emissions Using Lead Isotopic Compositions in Red Wine

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Extended Abstract

Analysis and assessment of past industrial lead emissions into the Australian environment is hindered by the limited availability of historic data and records. Australia's mining history dates back to the 1840's and leaded petrol was introduced to Australia in 1932 (Cook and Gale, 2005) however, monitoring of lead-in-air was not implemented in Australia until the 1980's. Bio-monitoring of lead in wine is explored to provide evaluation for use as a proxy of atmospheric lead.

The nature of winemaking, with yearly harvests and bottling, allows for the sensitive and accurate capture of past atmospheric conditions. Measurement of lead concentrations in wine and correlation to available lead in air data will be used to extrapolate a longer data set of lead in air levels in Australia. By applying the environmental fingerprinting tool of lead isotopic composition analysis to Australian wines, the historical lead emissions can be measured and traced. This was shown to be successful in the Bordeaux wine region, France (Medina et al, 2000) and across the Czech Republic, where the lead isotopic composition of wine followed the lead isotopic composition of the atmospheric.

The lead concentrations and isotopic compositions of single vineyard wines in two wine regions in South Australia dating back to the 1960s were analysed and measured. The lead isotopic compositions of possible contributing industrial sources and of the local vineyard soils were also measured for comparison. This allowed for the apportionment of contributing sources of lead in wine, whether they are industrial pollution or naturally occurring from soil.

The lead concentrations measured in the wine from South Australia show a similar trend to available lead in air data for Adelaide despite being 35 km to the south. The lead isotopic compositions in the wine reveal changing lead compositions through the decades and are inconsistent with local vineyard soils. No significant influence from local small scale mining activities is seen, however, leaded petrol is a strong contributor to lead in wine from the 1960s until the 1980s. Leaded petrol is still a major source of lead in wine in the 1990s, but in similar levels to the local vineyard soils. Wines dated after 2000 show a lead isotopic signature becoming increasingly similar to local vineyard soil lead isotopic compositions.

References

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