In situ laser ablation ICP-MS analysis of Ruthenium in chromite

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The strongly chalcophile platinum-group elements (PGE) are of high interest because of their importance as petrogenic tracers. A PGE-depleted signature could be interpreted to reflect interaction with a sulfide liquid, and the degree of depletion might point the way towards sulfide segregation. However, PGE content and distribution in melts are the result of a complex range of factors and the interpretation of whole-rock PGE signatures is often ambiguous. Rather than determine absolute levels of PGE depletion or enrichment using whole-rock compositions, a more effective way to recognise evidence of sulfide segregation is to understand PGE fractionation in magmatic systems using mineral compositions. The approach taken in this study is to establish the geochemical relationships between the PGE contents and other compositional parameters in minerals that record the magmatic evolution.

In the first stage of this study we have investigated the role of chromite in the fractionation of Ru in ultramafic melts by analysing more than 200 chromite grains from komatiites of the Yilgarn Craton in Western Australia. *In situ* analysis using laser ablation ICP-MS shows uniform Ru concentrations in chromites on a grain- and sample scale, with an overall range from < 75 ppb (LLD) up to several hundred ppb. Carius tube digestion and Isotope Dilution ICP-MS analysis of chromite concentrates confirm the accuracy of the *in situ* method. CT-scans using a Synchrotron beamline have identified the presence of minute PGE-bearing inclusions in chromites from more evolved systems, i.e. komatiitic basalts. However, PGE-bearing inclusions have not been recognised in the analysed komatiitic chromites and this combined with the *in situ* data suggests that Ru exists in solid solution in chromite. These results provide the basis for a better understanding of the role of chromite in the fractionation and concentration of Ru in ultramafic systems.

Discriminating Fe sources in a pine plantation using SOM

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An integrated approach to data analysis and interpretation is often required when investigating geochemical processes involving numerous, diverse variables. We investigate the environmental geochemistry of iron (Fe) in a forested coastal catchment (SE Queensland, Australia) and consider the effect of catchment morphology, geology and land-use (e.g. exotic pine plantation and natural bushland) on the distribution of readily mobilised Fe. This information is of interest due to concerns that plantation forestry activities may be contributing towards increased Fe export from coastal areas, which is associated with the risk of toxic blue-green algae blooms. To achieve this aim, data analysis methods based on Kohonen's self-organising maps (SOM) have been employed.

Geoscience data are not always suitable for traditional statistical analysis and modelling, and the integrated analysis and interpretation of such data remains a challenge. However, SOM can facilitate an analysis of complex multivariate datasets and identify relationships or trends within geochemical, ecological and geomorphic data.

In addition to the physicochemical characteristics of 120 forest soil samples, the land-use, geomorphic and geological attributes (including slope, elevation, topographic wetness index, rock type and radiometric data) of the sampling locations were included in the analysis.

The use of SOM has provided a means to identify which of the diverse variables are most strongly related to readily mobilised Fe in the study area.

Based on the SOM output, we split the dataset into 7 clusters, of which two clusters in particular suggest distinct, elevated Fe occurences. These clusters show that high available Fe concentrations (>690 mg/kg) are a result of a) lepidocrocite formation due to cyclic redox conditions in seasonally saturated, clay-rich soils, as well as the occurence of high-Fe illite-smectite and illite, and b) the accumulation of mechanically comminuted Fe-rich sediment in streams, most likely coupled with their microbial reduction. Of the land-use groups investigated, only stream sediments are consistently high in available Fe. Plantation forestry does not appear to contribute towards high available Fe concentrations.