TRACE ELEMENTS IN NEW ZEALAND OILS
THEIR SIGNIFICANCE FOR ANALYTICAL CHEMISTRY, GEOCHEMISTRY AND OIL CLASSIFICATION

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ABSTRACT

This work is a study of trace elements in New Zealand and some overseas oils. Trace elements have been successfully used in previous studies to distinguish marine oils of different origins, to identify groups of related oils in individual regional areas and to establish migration patterns.

This is the first study of trace element concentrations and variations in New Zealand crude oils. A wide range of oil samples of different origins and geographical regions was analysed and the obtained trace element concentrations enabled a comprehensive comparison of trace element contents in terrestrial, lacustrine and marine oils. Over 120 oil samples of various marine and terrestrial origins were analysed for 42 elements and the resulting trace element concentrations were subjected to correlation and principal components analysis.

The trace element concentrations in New Zealand oils are very similar to those in other terrestrial-derived crude oils. Elements, associated with clay minerals had a high mutual correlation and were present in concentrations, comparable with, or exceeding those in marine oils. The origin of these elements and their implications to the classification of Taranaki Basin oils are discussed.

Trace elements in the asphaltene fractions of some New Zealand and overseas oils, in extracts of coal from the Pakawau Group and in ashed coal samples were determined to obtain additional information about the origin of Taranaki Basin oils.

In this study, 42 trace elements were determined by instrumental neutron activation analysis, graphite furnace atomic absorption and inductively coupled plasma emission spectrometry. Instrumental NAA was used to quantify a wide range of elements in undiluted and untreated crude oils. Graphite furnace AAS is a more sensitive method for some elements and was used to determine trace elements that were not detectable by INAA.

The analysis of organic oil solutions was difficult due to the complex organic oil

matrix. Various ashing, low temperature ashing, acid oxidation and extraction techniques were investigated and were considered to be unsuitable for the quantification of low amounts of elements in crude oils. A mixed-solvent system, using toluene and isopropanol, enabled the use of ready available aqueous standards and allowed the quantification of trace elements other than those present in the standard oil solutions. The close matching of standard and sample solutions was essential for the accuracy of the trace element results. Various analytical techniques, their use and suitability for the analysis of crude oils are discussed in detail.

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