THE ANALYTICAL GEOCHEMISTRY OF PLATINUM GROUP METALS IN CRETACEOUS/TERTIARY BOUNDARY CLAYS

A Thesis Presented in Partial Fulfilment of the Requirements for the Degree of Doctor of Philosophy in Chemistry at Massey University

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ABSTRACT

The Cretaceous/Tertiary boundary controversy is discussed. The importance of the platinum group metals (PGM) as markers of extraterrestrial material in sediments is explained.

The use of inductively coupled plasma source mass spectroscopy (ICP-MS), and graphite furnace atomic absorption spectroscopy (GF-AAS), to determine PGM in geological materials, was investigated. Both techniques require the analyte to be substantially separated from the geological matrix before instrumental analysis is performed. Separation schemes involving fire-assay, ion exchange chromatography, solvent extraction, and coprecipitation, were investigated.

A standard ore (PTC-1) was successfully analysed for Rh and Pd using a separation scheme involving Te coprecipitation followed by dissolution and determination by ICP-MS. The same ore was successfully analysed for Pd using GF-AAS after a separation procedure involving solvent extraction of a Pd- ammonium pyrrolidine dithiocarbamate complex.

Sedimentary rock samples were collected from a newly discovered K/T boundary site (Flaxbourne River) in New Zealand. Determinations of Pd in Flaxbourne River sediments were made using GF-AAS after matrix separation using solvent extraction.

Elevated levels of Pd at the K/T boundary were found contiguous with elevated levels of Ir. Besides these PGM, a further twenty elements were determined in Flaxbourne River K/T boundary sediments. The results of this geochemical survey are discussed with respect to the impact and volcanism theories (theories which seek to explain the palaeontological, geochemical, and geological changes occurring at the K/T boundary).

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