Environmental and geochemical applications of inductively coupled plasma spectrometry

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Over the last 25 years, inductively coupled plasma (ICP) spectrometry, initially with optical (Thompson & Walsh, 1989) and subsequently with mass spectrometric (Jarvis et al., 1992) detection, has become a major analytical tool in the environmental and earth sciences. It is capable of generating data on a scale and of a quality only dreamed of a few decades ago. It has provided information, especially about trace constituents, that has greatly enhanced our understanding of fundamental geological processes. This has aided our search for new mineral resources and is increasingly helping us to assess the impact of man's activities on the

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environment. ICP spectrometry is widely used for environmental protection in studies of urban and industrial pollution of soil and water, and in investigations concerned with the disposal of the ever growing quantities of stable and radioactive waste we generate.

Both ICP-AES and ICP-MS are ideally suited to the direct analysis of solutions and the capabilities and limitations of the two techniques, including elemental range, detection limits and matrix interferences, will be discussed. For the analysis of solid geological and environmental material, dissolution of samples is usually required. Problems associated with analyte recovery, contamination, interferences and total solute content during this stage of the analytical process will be highlighted.

The direct analysis of solid materials by laser ablation ICP-MS is a particularly powerful tool in geochemical and environmental investigations. It can provide information about elemental and isotopic associations in individual solid phases at high spatial resolution. Examples of the use of LA-ICP-MS in studies of pollution from coal fired power stations will be presented.

Recent advances in instrumentation have expanded the potential applications of ICP spectrometry considerably by coupling an ICP ion source to single or double focusing magnetic sector mass spectrometers. Depending on the particular configuration, these can provide either very high mass resolution, enabling signals from interfering polyatomic ions to be resolved from those of analyte isotopes occurring at very similar m/z ratios, or true simultaneous measurement of isotope ratios using multiple collectors. Examples of applications of MC-ICP-MS will be discussed.

References

JARVIS K.E., GRAY A.L. & HOUK R.S. 1992 — Handbook of Inductively Coupled Plasma Mass Spectrometry. Blackie, Glasgow.

THOMPSON M. & WALSH J.N. 1989 — Handbook of Inductively Coupled Plasma Spectrometry. Blackie, Glasgow.