

## SRS 3400

# THE ANALYSIS OF GEOLOGICAL MATERIALS

### Background

For many years X-ray fluorescence spectrometry (XRF) has been used as a research tool for the analysis of major and minor trace elements in geological materials.

XRF results have been used extensively in geochemical mapping programmes and mineralogical research.

However, recent developments in environmental legislation has ensured that there is now a growing demand for XRF analysis in both industrial and public health sectors.

New XRF application areas are emerging including the analysis of soils from contaminated land, monitoring of waste from mining processes, and the suitability of raw materials prior to being used in a manufacturing system.

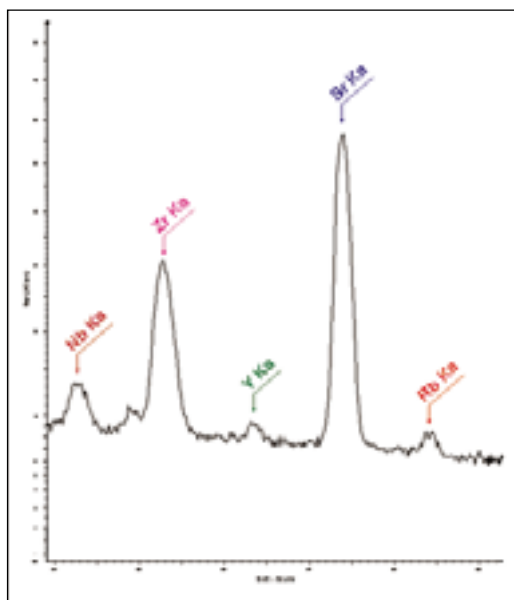


Figure 1. A Typical Soil Sample Spectrum



### Instrumental

The BRUKER AXS SRS 3400 (shown above) is a high performance Sequential Wavelength Dispersive XRF spectrometer. It is fitted with a 4kW end window Rhodium X-ray tube, up to ten primary beam filters, up to four collimators and up to eight analysing crystals.

Flow and scintillation counters can be used either independently or in tandem. All of this is coupled with BRUKER's superb goniometer technology.

A wide range of sample changers is available, from 1 to 200 positions, and these can be directly linked into automated sample handling systems.

### Software

Perhaps the most outstanding feature of the SRS 3400 analytical system is the inclusion of the SPECTRA<sup>plus</sup> software package. This is a fully interactive program that uses the Windows NT platform for maximum speed and stability.

It comes complete with a standardless analysis routine, a rapid data retrieval system and full networking capability.

## Calibration and Results

A measurement method was developed with care taken to select appropriate peak and background positions.

The instrument was calibrated using fifty five geological international standards. This standard set was composed of many material types including limestones, feldspars, granites, soils, sediments and ore-grade deposits.

In total forty two analytes were calibrated. An excellent set of regression lines was produced. Figure 2 gives the Rubidium line as an example.

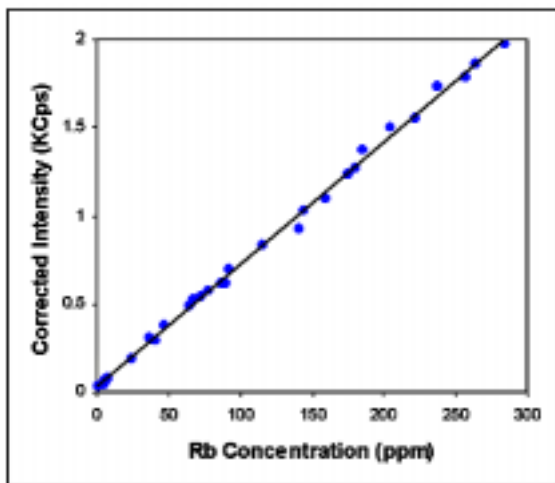


Figure 2. Rubidium calibration curve

An example of the calibration results is given in table 1. It clearly demonstrates the high level of accuracy attainable - even with materials of markedly different compositions.

This accuracy is only achieved with the "variable alphas" matrix correction model, which is an integral part of the SPECTRA<sup>plus</sup> software package.

Analyte	Range of Conc.	Calibration Accuracy	Precision 2 sigma
MgO	0.01 - 44.72 %	0.24 %	<0.01 %
CaO	0.04 - 47.80 %	0.15 %	<0.01 %
TiO <sub>2</sub>	0.01 - 3.77 %	0.02 %	<0.01 %
V	1 - 500 ppm	4.6 ppm	2.0 ppm
Zn	1 - 760 ppm	4.7 ppm	0.8 ppm
As	1 - 3970 ppm	3.8 ppm	1.5 ppm
Rb	1 - 1300 ppm	3.5 ppm	0.6 ppm
Sn	1 - 900 ppm	0.7 ppm	0.8 ppm
La	1 - 355 ppm	3.9 ppm	2.0 ppm
Pb	1 - 730 ppm	1.4 ppm	1.2 ppm

Table 1. Examples of calibration data.

This model is based on the philosophy of individual matrix correction for every standard and unknown sample that is analysed. A single calibration line for a wide range of matrices is then possible.

This ends the need for the traditional empirical alpha correction programs, which were prone to analytical errors when routine samples of a slightly different composition were measured.

The precision data quoted was collected over a twelve hour period. Long term stability and detection limit data is available upon request.

## Conclusion

This application note has summarised the outstanding performance of the BRUKER SRS 3400 in the field of geological analysis.

By utilising the unique features of SPECTRA<sup>plus</sup> a whole range of sample types can be plotted on single calibration lines with superb levels of accuracy.

The instrumental precision data shown has demonstrated the excellent stability of the spectrometer.

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