COX Analytical Systems

XRF scanner for elements in drill cores

ITRAX DRILLCORE SCANNER

Featuring qXRF scan technology

Innovation bringing advantage

Itrax Drillcore scanner

Quick Scan for element average values

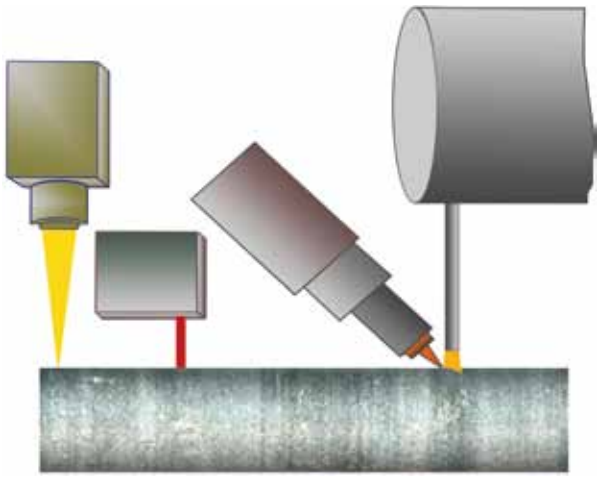
The Quick Scan mode provides rapid chemical concentrations as elemental average concentrations per centimeter of core. Data can be integrated over any chosen length of core up to one core box with the instrument software, to provide average values. The element information can also be exported as spreadsheets.

Data for all elements are available directly after analysis, including REE.

All mineable elements can be determined at any concentration from major element wt% levels down to the ppm levels, with a typical precision in the range of +/- 5% from actual value per core meter. As an example, the concentration of Cu can be expected to be in the range of 0.95-1.05% for a true value of 1%, when averaging over one meter. The XRF value will be closer to the true value as one integrates over e.g. a core box or a whole drill hole, since the measured volume will better represent the true value as the analyzed volume grows. The instrument net throughput for Quick Scan examinations is up to 15 meters of core per hour with one operator, at a scan time of one second per centimeter.

qXRF for reliable analyses

qXRF is the latest technology for XRF analysis directly on drill cores. qXRF has documented, quantitative capacity to analyze directly on unprepared surfaces like drill cores. When applying qXRF, a small x-ray spot is used to scan at close distance to the surface. This gives good control over the measurement and allows for analysis of a more homogenous sample volume in each analysis. On a large sample like a drill core, a scan along a core is split into many small increments that together form good quality data for the whole core length. Data is recorded from each analytical point separately, which makes it possible to describe the variation for each element along the core, to provide good average values, and also phase analyses. In each small area of analysis, the measurement determines all elements present in concentrations above the detection limit.



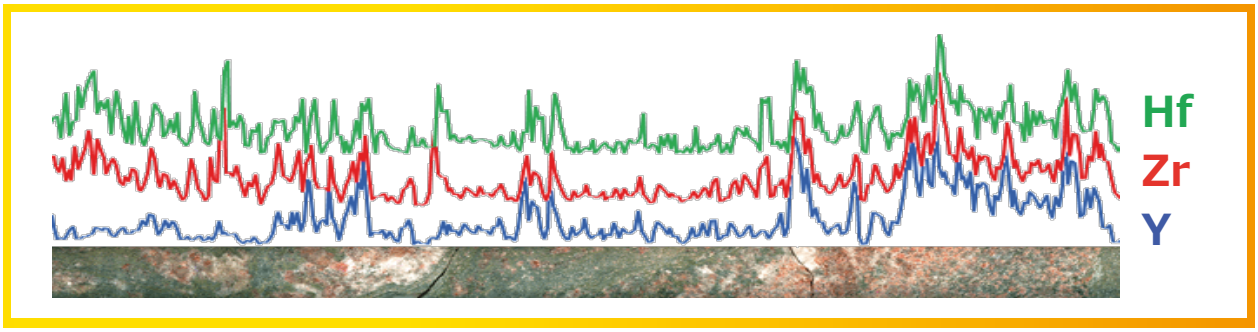
This image shows the schematic setup for qXRF, with from right x-ray tube, XRF detector, distance meter and camera.

XRF with new possibilities

In-depth core information

Itrax also offers in-depth drill core data:

- Distribution of chemical element with one millimeter lateral resolution
- Correlation analysis of chemical elements



In this image is shown a photo of a core from Norra Kärr REE mineralization, Sweden, together with graphs displaying the variation of Hafnium (Hf), Zirconium (Zr) and Yttrium (Y) along the core. The average concentrations for these elements are Y ~ 0,19%, Zr ~ 1,21% and Hf ~ 0,05%. Another 26 elements were determined simultaneously. This scan was performed using one millimeter steps.

In-depth scanning can also provide information about phase distribution for the elements, and how they correlate. As an example, Figure 1 (upper diagram to the right) shows the Zr/Hf correlation from the core example above. From this diagram it can be concluded that Zr and Hf are present in the same mineral phase at a relation of ~1:25. The Figure also shows that each point of analysis gives reasonable precision of the concentrations of these elements, and that the average can be determined with good precision. Figure 2 (lower right) shows the Zr/Y correlation in the same sample. From this diagram it can be concluded that Y and Zr are both present in a single mineral phase. This data set differs from the data shown in the upper figure since Zr is also present in another phase, that contains no Y. The data points that are away from the correlation line contain a mixture of data from the two phases. The amount of Zr can be determined for each phase with good precision.

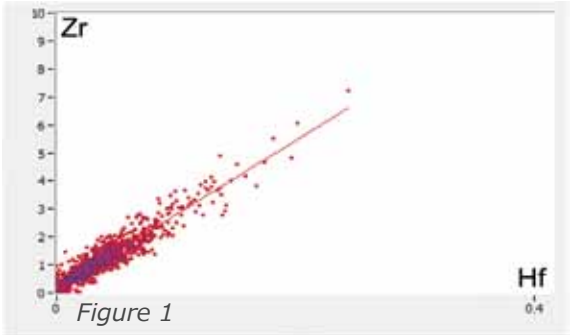


Figure 1

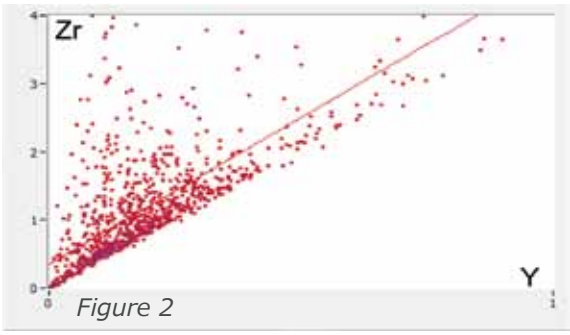


Figure 2

Technical features

General Aspects

The Itrax Drillcore scanner is an EDXRF (Energy Dispersive X-Ray Fluorescence) instrument for determination of concentrations of chemical elements in industry drill cores, as well as for inferring element distribution and element phases.

qXRF Technique

Itrax uses qXRF technique, means scanning the sample surface with a micro beam under precise analytical conditions where a large number of data points are recorded, as opposed to doing just one analysis over a large area like e. g. a whole core box. The advantage of the qXRF technique is that it provides reliable and reproducible quantitative results in all parts of the core where the surface properties are acceptable. The instrument examines the surface and measures only on those parts of the surface that are smooth and free from cracks, since these defects otherwise would generate incorrect data, as would analyzing anything outside the drill core itself.

Samples

The core sample surface should be clean and free from dust. Other than that, no sample preparation is needed.

Measurements

For Quick Scan core average measurements, samples are scanned at a speed of one centimeter (cm) per second at steps of one cm. For in-depth distribution and corrrelation scan, a scan speed and increment size of 1.0 millimeter is normally used, but can optionally be decreased further down to 0.2 millimeter if needed. Regardless of step size, the whole core length is covered, except for areas with cracks or other defects. The x-ray beam footprint of 8x0.2 millimeters scans over the sample surface to make a number of partial analyses on small areas. Concentrations of elements are determined for each step. Scan steps are usually larger than the x-ray beam size and the beam is therefore scanned along the sample while measuring, to cover the whole length of each step and produce a good average.

For every increment, all elements from Al-U are determined, including the REE. The XRF system has a very high count rate capability of up to 1.6 million counts per second input rate, with no loss of spectral quality, which allows for precise determinations of the concentration of each element at every analytical point. More than 50 chemical elements can be determined simultaneously, which normally covers all elements that are present at concentrations that can be determined in a sample. Concentrations are evaluated with a Fundamental Parameter Model, which is calibrated with a set of mineral Standard Reference Materials. Concentrations are calculated as elements or oxides.

The RGB camera offers high image quality with 3x16 bit image format, 72 µm pixels and LED based illumination with crossed polarizing filters for high dynamics, minimized glare and best color representation.

The instrument can be controlled by one person, and can achieve a throughput of up to 15 meters of core per hour. The sample holder can accommodate up to two meters of core of different lengths.

Software

The analytical process is entirely controlled by the computer software, which is a straightforward, user-friendly Navigator that is streamlined for routine analyses. Sample ID can be scanned with a barcode scanner. Results for Core Average concentrations are presented as spreadsheets that can be opened iby common Data Presentation software. Data from Distribution and Correlation scans can be viewed in the instrument software, as well as via export as spreadsheets.

Detection limits for some elements of interest (%)

Al	0.5%	Ni	0.0008
Si	0.15	Cu	0.0007
P	0.05	Zn	0.0007
S	0.02	Y	0.0006
K	0.004	Mo	0.0009
Ca	0.002	Ag	0.013
V	0.001	La	0.0037
Mn	0.0009	Pb	0.0010
Fe	0.0009	U	0.0004

This list contains some of the many elements that can be detected simultaneously. The %-values are based on a 100 second analysis of a mineral matrix sample, applying a 2.2 kW x-ray tube with Rh anode. Please contact Cox for a complete list if you need that.

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