Core Scanner specifications

X-ray source with 3 kW/60 kV high power X-ray tube with Cr anode as standard (also Mo and others available). Time to switch tube is about 10 minutes. Low cost tube with 3-4.000 hours expected life time.

XRF (X-ray Fluorescence) element analysis determines Al and heavier elements (Mg can also be analyzed but is not recommended for XRF). The X-ray beam that is projected onto the sample is a rectangular 20x0.2 or 20x0.1 millimeter. Larger step coverage is achieved by scanning over the surface with the beam while measuring, thereby attaining full coverage and a good average of each step.

The XRF detector produces ≤ 133 eV resolution as FWHM resolution for Mn Kα. Normal count-rate input when analyzing marine sediments is 60.000-80.000 cps (counts per second).

Light element enhancement by (helium-free) vacuum system for best sensitivity, contact free analysis, and lowest running cost.

Digital X-ray radiography has 16 bit image format and variable lateral resolution down to 20x20 micrometers. The image width is 20 millimeters. Shows changes in a sediment core sample matrix as small as ~1%, or lower.

Optical, digital RGB 3x2000 pixels scanning line camera with high color definition and 50 microns pixel size. Allows for pixel binning. Offers up to 1.000 true grayscale steps plus contrast enhancement for improved sample detail visibility.

XRF, radiographic, and optical measurements are non-destructive and are performed without contact to the sample surface. The sample surface height profile is measured along the sample, and adjusted for during analysis. This allows flat samples as well as samples with varying height to be analyzed with good results. Magnetic susceptibility measurement (optional equipment) is done in contact with the sample surface.

Measurements can be done with, or without plastic film covering the sample surface.

Maximum core length is 1.75 meters as standard.

Sample thickness range is 30-60 millimeters for split cores as standard, i.e. 60-120 millimeters full circle. We can provide a modified Itrax that accepts cores with diameters from 40 up to 150 mm on request. Slabs and U-channels, wood samples, and flat slices of other sample types can also be analyzed. One U-channel holder is included as standard.

Scan time: Down to ~0.5 s/point for radiography, and ~1.5s/point for XRF, which refers to total time per point including analysis, as well as overhead time for sample re-positioning, data storage, etc. The overhead time between measurements is ~0.5 sec. for XRF/~0.2 sec for radiography.

All time examples are given as actual time (not system live time).

Software: Itrax Navigator software is for instrument operation with graphical user interface. It is easy to learn and use. Sets of analytical parameters can be stored and re-called for fast set-up of standardized analyses. XRF data are available as spectra, and as peak areas or element concentrations in table format. Raw analytical data from each point are stored as spectra for quality assurance reasons. Data can be exported to e.g. Excel. Calibration for quantification is based on standards and fundamental parameters. The ReDiCore software for data display and evaluation greatly simplifies data interpretation, as well as image and graph production, applying a copy-and-paste function.

Itrax is delivered with a one year warranty including Internet support. The warranty time can be extended to up to three years.

The Itrax Core Scanner dimensions are ~4500x820x1570 millimeters LxWxH with a weight of about 1000 kilos. Different voltages and frequencies may apply.

The Itrax is a complete plug-and-play delivery with all that you need, including hardware and software, computers, and a low noise water-to-air instrument cooler.

The instrument fulfils radiation safety requirements with interlock safety switches etc., and it is completely safe to work close to the instrument without limitations.

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Instrument reliability

The Itrax corescanner is a proven workhorse. Most of the installations are in use several thousand of hours per year, many on a 24-7 basis. In spite of this heavy workload, these instruments have very little down-time. This has three reasons; one being a reliable construction, the others are the effective service offered by Cox and our Internet support, which is a quick way to get answers. Our users can confirm this (a complete customers list is available through Cox).

The Internet support with shared computer desktop view allows for very fast and efficient problem solving. The service staff at Cox see what the user sees, whether on the computer screen or through a web camera. The first contact with someone in our service team can often be made within minutes, leading to immediate help when in doubt. Support is given in English as well as in Chinese (Mandarin).

Add-ons

Available optional equipment include but are not limited to:
Magnetic susceptibility sensor, Bartington MS2E type.
On-board ship and mobile installations.
UPS (Uninterrupted Power Supply) for unstable power grids.
We also offer service contracts, Internet support contracts, Reproducibility Testing contracts, Service training for technicians, etc.

Detection limits

Element	*Cr tube (ppm)*	*Mo tube (ppm)*
Mg	11000	-
Al	1000	7700
Si	250	1950
P	96	890
S	47	245
Cl	27	112
K	9	36
Ca	6	24
Ti	3	14
Mn	130	7
Fe	25	7
Br	12	5
Sr	15	5
Ba	20	43
Pb	24	13

The detection limits of the Itrax corescanner are highly competitive. A great advantage for high resolution work is that they apply regardless of selected analytical resolution. The elements that can be detected range from Al (Aluminum) and all the way up to U (Uranium). This list contains only a short selection of elements, contact us for a complete list. The values are all based on a 100 second analysis and refer to a clay matrix. Detection limits for two different x-ray tubes are listed, where Cr is the standard tube and the Mo tube applies when heavier elements are in focus. All elements listed are determined simultaneously and in one analysis for each tube type, without further restrictions, changes or special settings. The elements that are most commonly detected in an unpolluted, clay based sediment sample are Al, Si, S, Cl, K, Ca, Ti, Cr, Mn, Fe, Ni, Cu, Zn, Br, Rb, Sr, Zr, Ba, and Pb.

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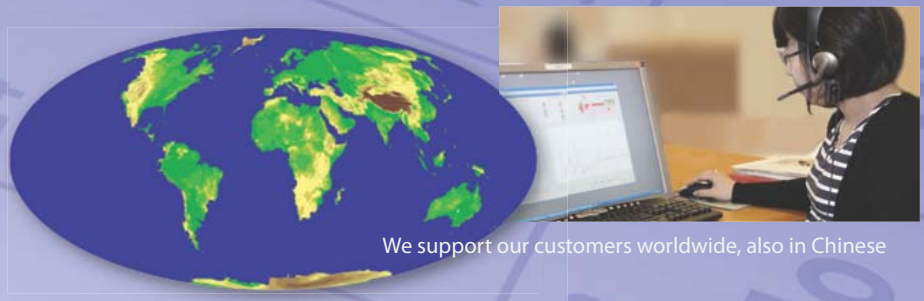


We support our customers worldwide, also in Chinese

A firsthand choice for detailed rock and sediment core investigations

Offers XRF, radiographic and optical scanning of variable resolution

Whole and slabbed cores can be scanned in short time

Sample information is obtained non-destructively

Straightforward operation and reliable analyses

ITRAX CORESCANNER

UNIQUE MULTI-FUNCTION SCANNER

FOR CORE EXAMINATIONS

Some Itrax Corescanner features:

- Scanner for sediment cores, rock cores and other samples
- Offers XRF multi-element analysis of Al to U including Rare Earths
- The XRF can analyze down to the PPM level for most metals
- Digital radiography for improved sample interpretation
- Scanning, digital RGB line camera for sample imaging
- Can analyze one meter of core in less than 10 minutes
- Accepts flat surface samples as well as those with varying height

- Produces data with high accuracy and reproducibility
- Offers best available analytical sensitivity and precision per time unit
- Scans with any step size from centimeter down to 0.1 millimeter
- Shows the same superior detection limits at any step size
- Analyzes non-destructively and without sample contact
- Optical image enhancement for improved sample information
- Reliable construction and quick service minimizes instrument downtime

Sediment core scanning offers many paleoclimate proxies

- Biogenic silica
- Oxic/anoxic conditions
- Grain size related fractionation effects
- Tefra layers and detrital clay
- Metal pollution signatures
- Shallow water aragonite formation
- Sediment grading
- Paleo-redox conditions
- Provenance studies
- Reconstruction of past conductivity from element ratios in carbonate sediments
- Estimation of past weathering, leaching and erosion intensities and primary productivity
- Sub-mm scale analysis and counting of fine laminations.
- Seasonal changes and temperature estimates

and more should come

Camera technology that sees more

High quality sample images are essential for a core scanner, and the Itrax offers superb digital RGB images with down to 50 microns pixels. Not only are the images clear and detailed, but they can also reveal much more than the eye. With digital image processing, also minute changes become clear, offering the user a new dimension for looking into the samples. This new technique combines well with the radiography and XRF to disclose the sample secrets. These images show an example of how a sediment image (left) can be enhanced (right) to reveal increased detail that can help in an understanding of the sedimentary processes.

X-ray radiography adds confidence

Radiographic images can help in verifying whether an XRF peak is to be interpreted as a e.g. a grain or a lamination. These x-ray images show distribution of chemical structures that often are invisible by eye and optical cameras.
The integration of radiography and XRF into a single instrument guarantees that radiographic data matches exactly the positioning of XRF. This matching is often critical, for instance to reveal migration of elements in relation to sedimentary layers. An example of combined XRF and radiographic data is shown in image 1. to the right *(Sr/Ca ratio overlaid on a magnified radiographic image of a lake sediment).*

Slit-free XRF offers advantage

ITRAX offers downcore resolution ranging from centimetre scale and down to 100 microns, using a system setup that is unique and very efficient. The detection limits, speed of analysis and repeatability of cutting edge class are thereby maintained regardless of the selected resolution, unlike the standard XRF slit solution.

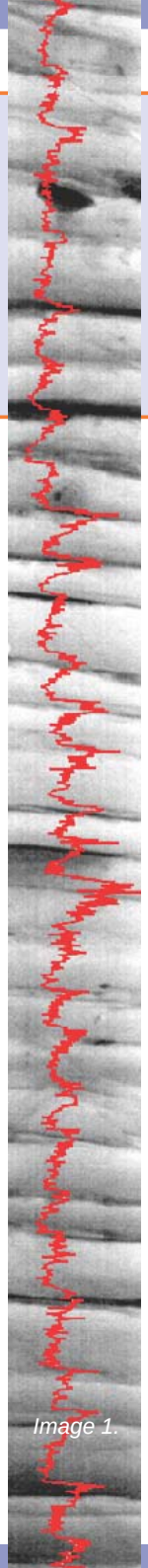
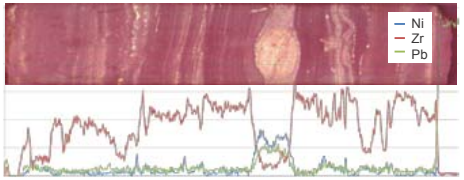


Image 1.

An example of rock core analysis

Itrax profiling has shown to provide valuable information in studies of rock cores as exemplified by results obtained on this Paleoproterozoic laminated carbonaceous shale, rich in pyrite. Note Zirconium variations in individual beds tracking the grain-size changes, and enrichments of Nickel and Lead in the thick pyrite layer.



This 27 cm long core section was analyzed using 0.2 mm step and 30 s counting time per point.

Unsurpassed speed combined with superb reproducibility

The Itrax can analyze as fast as 1 second per point at any down core resolution, providing reasonable precison. At 10 seconds per point you can reach high precision. Please note that this diagram shows two scans per element, so a total of 8 graphs are plotted! The high speed and high data quality make Itrax a really high capacity instrument.

Reproducibility values for 15 sec. analysis:

Al shows a typical reproducibility of <4% (1 S.D.) at 10% Al.
Si shows a typical reproducibility of <2% (1 S.D.) at 10% Si.
Ca shows a typical reproducibility of <1% (1 S.D.) at 1% Ca.
Ba shows a typical reproducibility of <7% (1 S.D.) at 0.01% Ba.

Table 1. Typical reproducibility (Cr tube, 15 seconds anaysis).

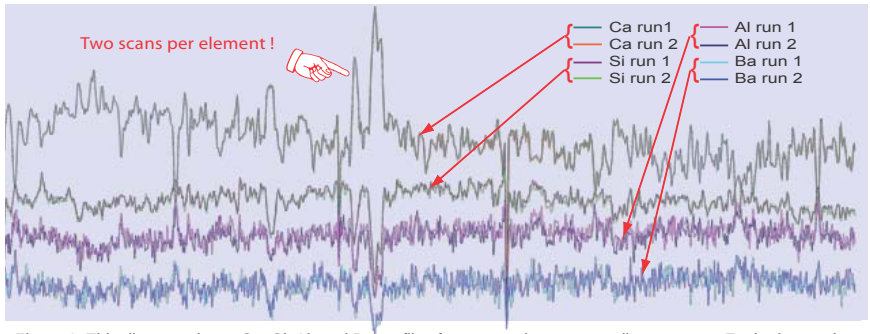


Figure 1. This diagram shows Ca, Si, Al, and Ba profiles from two subsequent sediment scans. Each element is represented by two graphs. Time was 15 seconds per point, clay rich lake sediment (arbitrary scale). Sample kindly provided by Prof E. Bard, CEREGE, Aix-en-Provence, France.