



Itrax XRF Core scanner versus hand-held XRF

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Cox Analytical Systems has conducted a comparison between a hand-held XRF unit, Thermo Niton XL3t Gold, Itrax Core scanner and Itrax XRF Scanner MC from Cox Analytical Systems. The handheld measurements were performed at **SP Technical Research Institute of Sweden**.

Two different Standard Reference materials were used;

1. NIST SRM 1834, Fused Simulated Ore for XRF Fluorescence Spectrometry.
2. USGS Green River Shale SGR-1 sediment standards

The SRM 1834 is a silica base glass disk which is supposed to be used as XRF standards for analysing rocks, ore and clay samples.

The SGR-1 is a powder sediment standard from the Mahogany zone of the green River Formation which is a petroleum – and – carbonate-rich shale.

For the analysis with handheld XRF, the two standards were analysed by a Thermo Niton XL3t Gold hand-held instrument, provided and carried out by SP Technical Research Institute of Sweden. The instrument was used in “mining” mode and each sample was exposed for 20 seconds in four different modes of tube voltage and tube anodes (in total 4x20, i.e. eighty seconds) to cover all elements from Al up to U. The instrument was held

in close proximity with the sample surface during measurements. The exposed area was estimated to about 0.5 cm².

The Itrax data were recorded with two different Itrax Scanners where the standards were exposed for 2 (two) seconds. The exposed area was about 0.012 cm² for Itrax Core Scanner and 0.08 cm² for Itrax XRF Scanner MC. Itrax Core Scanner can determine elements down to Al or Mg, depending on choice of x-ray tube anode material. In this case a x-ray tube with Molybdenum anode was used, and therefore Mo was not determined. The Cr tube gives somewhat lower higher detection limits for heavy elements, and much better detection limits for the lightest elements, but was not included in this test. Contact us if you are interested in data on this.

The Itrax XRF Scanner MC was added to this comparison at a later time. It uses a s.c. dual excitation x-ray source to boost up the sensitivity for light elements, and can determine all elements in the Na-U range. Na was detected by this instrument, but not included in this comparison since the reference standard is not certified for that.

Table I shows the estimated concentrations recorded from the handheld XRF instrument and Itrax Core Scanner together with the certified concentrations for Standard reference sample NIST 1834. Table II shows the detection limits for the handheld XRF instrument, the Itrax Core

Scanner and also the Itrax XRF Scanner MC together with the certified concentrations for Standard reference sample NIST SGR. The tables also show the estimated Detection Limits (D.L), in concentrations, for the two/three instruments, respectively. The D.L.'s were estimated from the spectral peak/area ratio and calculated from the standard definitions given in XRF spectrometry (**Handbook of X-Ray Spectroscopy" 2'nd edition, ed; R van Grieken, A.Markowicz, Marcel Dekker, Inc 2002**).

As seen from Table I & Table II the Itrax scanners provide somewhat more precise analytical data, especially for light elements (where the hand-held instrument seems to give a systematic deviation) and also for heavy elements ($Z > 20$) in low concentrations. For heavy elements in higher concentrations ($> 2\%$) all instruments give reasonably good estimates. It is also apparent from table I & II that the hand-held instrument has lower detection limits for light elements like Al and Si. For all heavier elements the Itrax scanners are comparable or superior, and Itrax in total detects many more heavy elements (see tables). Two reasons for this difference are that the Itrax XRF Scanners expose a

smaller surface, and that shorter time was used for the Itrax analyses. The hand-held instrument was recording over an area of about 0.5 cm^2 during 80 seconds, while the Itrax used only 2 second over an area of 0.012 cm^2 . This means that the Minimum Detectable Amount (at a fixed measuring time) for the Itrax will be several orders of magnitude lower than the hand-held instrument for any given D.L in concentration. In practical work, this difference can show up e.g. when detecting fine laminations. The sample throughput is very much higher for Itrax thanks to the shorter time for analysis.

	Table I				
#1834	Thermo		Itrax		
element	calc. conc (%)	Det. limit (%)	calc. conc (%)	Det. limit (%)	certified conc (%)
Al	10.211	0.1400	21.6283	0.7523	20.700
Si	16.240	0.0430	23.1469	0.1934	20.200
P	0.178		Not detected	0.0601	
S	0.034		0.1176	0.0222	
Cl	Not detected		0.0602	0.0096	
K	0.282		0.4357	0.0027	0.420
Ca	0.106		0.0997	0.0017	0.095
Ti	0.970	0.0045	1.1873	0.0009	1.110
V	0.009		Not detected	0.0007	
Cr	0.015		0.0237	0.0006	
Fe	0.308	0.0012	0.3477	0.0005	0.320
Co	Not detected		0.0024	0.0005	
Ni	Not detected		0.0028	0.0005	
Cu	Not detected		0.0023	0.0005	
Zn	Not detected		0.0071	0.0005	
Ga	Not detected		0.0030	0.0005	
Se	Not detected		0.0007	0.0005	
Rb	Not detected		0.0010	0.0005	
Sr	0.098	0.00023	0.1108	0.0005	0.153
Zr	0.044		0.0299	0.0004	
Nb	Not detected		0.0004	0.0004	
Ba	0.041		0.0623	0.0013	0.062
La	Not detected		0.0073	0.0012	
Ta	Not detected		0.0062	0.0007	

	Table II						
SGR	Thermo		Itrax		Itrax XRF scanner MC		
element	calc. conc (%)	Det. limit (%)	calc conc (%)	Det. limit (%)	calc conc (%)	Det. limit (%)	certified conc. %
Na					Determined but not certified		Not certified
Mg	Not detected				2.72	0.17	2.67
Al	1.098	0.22	3.0631	2.1724	3.44	0.07	3.450
Si	9.350	0.05	12.9398	0.8031	13.04	0.035	13.1700
P	0.071		0	0.2495	0.19	0.017	0.1430
S	1.223		1.4928	0.0932	1.59	0.010	1.5300
Cl	0.007		Not detected	0.0411	0.045	0.04	Not certified
K	0.912		1.4901	0.0121	1.43	0.005	1.3700
Ca	5.098	0.009	6.0455	0.0079	6.10	0.005	5.9900
Ti	0.103		0.1393	0.0044	0.156	0.004	0.1510
V	0.011		0.0133	0.0036	0.015	0.004	0.0130
Cr	0.005		0.0051	0.0032	0.0063	0.004	0.0030
Mn	Not detected		0.0297	0.0029	0.0235	0.004	0.0267
Fe	1.417	0.0025	2.1630	0.0028	2.18	0.004	2.1180
Ni	Not detected		0.0084	0.0027	0.0057	0.004	0.0029
Cu	Not detected		0.0106	0.0028	0.0072	0.004	0.0066
Zn	0.004		0.0088	0.0028	0.0077	0.004	0.0074
Ga	Not detected		0.0032	0.0028	0.0014	0.004	Not certified
As	0.004		0.0055	0.0029	0.0055	0.004	0.0067

Se	Not detected		0.0007	0.0029	0.0005	0.003	Not certified
Rb	0.002		0.0080	0.0028	0.01	0.003	Not certified
Sr	0.016	0.0008	0.0319	0.0027	0.043	0.003	0.0420
Y	Not detected		0.0004	0.0027		Not included	Not certified
Zr	0.002		0.0025	0.0026	0.005	0.004	Not certified
Nb	Not Detected		0.0009	0.0026	0.0046	0.004	Not certified
Mo	Not detected		0.0033	0.0027	0.004	0.007	Not certified
Ba	Not detected		0.0761	0.0169	0.0031	0.007	0.0290
W	Not Detected		0.0172	0.0058	Not included	Not included	Not certified
Pb	0.002		0.0042	0.0053	0.038	0.006	0.0038

Welcome to contact us if you have further questions or comments

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