

Thermo

SCIENTIFIC

Niton XL3t GOLDD+

Thermo Scientific Niton XRF analyzers deliver accurate elemental analysis with unmatched efficiency of companies across all stages of mining and exploration.

Shipping samples off site is simple too slow, expensive, and time consuming. Thermo Scientific Niton analyzers provide lab-quality results with ease and in seconds rather than days, virtually anywhere on site. Time-to-discovery is a real competitive advantage, and now you no longer have to wait for the critical data you need to determine ore boundaries, mine mapping, grade control, and other key operations.



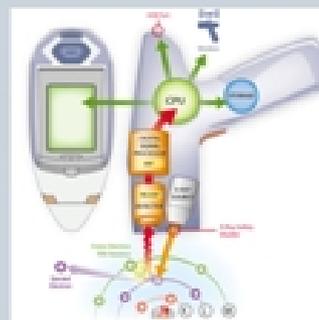
How It Works



How does EDXRF work? Each of the elements present in a sample produces a unique set of characteristic x-rays that is a "fingerprint" for that specific element. EDXRF analyzers determine the chemistry of a sample by measuring the spectrum of the characteristic x-rays emitted by the different elements in the sample when it is illuminated by x-rays. These x-rays are emitted either from a miniaturized x-ray tube, or from a small, sealed capsule of radioactive material.

A fluorescent x-ray is created when an x-ray of sufficient energy strikes an atom in the sample, dislodging an electron from one of the atom's inner orbital shells. The atom requires stability, filling the vacancy left in the inner orbital shell with an electron from one of the atom's higher energy orbital shells. The electron drops to the lower energy state by releasing a fluorescent x-ray, and the energy of this x-ray is equal to the specific difference in energy between two quantum states of the electron.

When a sample is measured using XRF, each element present in the sample emits its own unique fluorescent x-ray energy spectrum. By simultaneously measuring the fluorescent x-rays emitted by the different elements in the sample, handheld Thermo Scientific Niton XRF analyzers rapidly determine these elements present in the sample and their relative concentrations – in other words, the elemental chemistry of the sample. For samples with known ranges of chemical composition, such as common grades of metal alloys, these XRF guns also identify most sample types by name, typically in seconds.



The OSM-TIPS Handheld XRF Analyzer

Niton XL3t 950 GOLDD+



The OSM units are programmed with four modes. Each mode has advantages relative to the materials you are analyzing.

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Niton XL3t GOLDD+





Programmed for optimum accuracy when analyzing earth elements

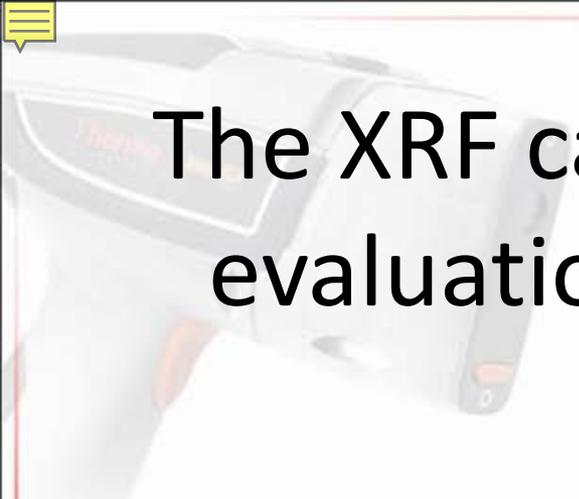


Ele	W1	W2	W3	W4	W5	W6	W7	W8	W9	W10
	-573	482	683	-796	378					

The Niton XL3t 950 GOLDD+
Capable of laboratory accuracy, especially
with a Helium purge of the sensor.



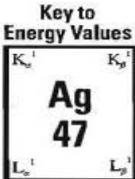
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Niton XL3t GOLDD+



The XRF can be a valuable tool in the evaluation and planning phases of an AML project

The current best use is as a screening tool for:

- Spoil or borrow area assessment.
 - Reconnaissance of soil and spoil resources to reduce laboratory analysis costs.
 - Identification of elements important in environmental evaluation; such as selenium, mercury, and arsenic.
 - Identification of radioactive elements.
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 www.thermo.com/iton																Key to Energy Values 		Americas Billerica, MA U.S.A. Phone: +1 978 670-7480 Toll Free: 800 875-1578 (USA) Fax: +1 978 670-7430 E-mail: iton@thermofisher.com			Europe Munich, Germany Phone: +49 89 3691 380 Fax: +49 89 3691 3830 E-mail: iton.eu@thermofisher.com			Asia Central, Hong Kong Phone: +852 2869 6669 Fax: +852 2869 6665 E-mail: iton.asia@thermofisher.com																																																																																																																																																																																																																																																																																																																																																																																																																																																													
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40</td> <td colspan="2">Nb Niobium 41</td> <td colspan="2">Mo Molybdenum 42</td> <td colspan="2">Tc Technetium 43</td> <td colspan="2">Ru Ruthenium 44</td> <td colspan="2">Rh Rhodium 45</td> <td colspan="2">Pd Palladium 46</td> <td colspan="2">Ag Silver 47</td> <td colspan="2">Cd Cadmium 48</td> <td colspan="2">In Indium 49</td> <td colspan="2">Sn Tin 50</td> <td colspan="2">Sb Antimony 51</td> <td colspan="2">Te Tellurium 52</td> <td colspan="2">I Iodine 53</td> <td colspan="2">Xe Xenon 54</td> </tr> <tr> <td>13.39</td><td>14.96</td> <td>14.16</td><td>15.83</td> <td>14.96</td><td>16.74</td> <td>15.77</td><td>17.67</td> <td>16.61</td><td>18.62</td> <td>17.48</td><td>19.61</td> <td>18.41</td><td>20.59</td> <td>19.28</td><td>21.66</td> <td>20.21</td><td>22.72</td> <td>21.18</td><td>23.82</td> <td>22.16</td><td>24.94</td> <td>23.17</td><td>26.09</td> <td>24.21</td><td>27.27</td> <td>25.27</td><td>28.48</td> <td>26.36</td><td>29.72</td> <td>27.47</td><td>30.99</td> 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Plutonium 94</td> <td colspan="2">Am Americium 95</td> <td colspan="2">Cm Curium 96</td> <td colspan="2">Bk Berkelium 97</td> <td colspan="2">Cf Californium 98</td> <td colspan="2">Einsteinium 99</td> <td colspan="2">Fermium 100</td> <td colspan="2">Mendelevium 101</td> <td colspan="2">Nobelium 102</td> <td colspan="2">Lawrencium 103</td> </tr> <tr> <td>86.11</td><td>97.47</td> <td>88.47</td><td>100.1</td> <td>90.89</td><td>102.8</td> <td>93.35</td><td>105.6</td> <td>95.86</td><td>108.4</td> <td>98.43</td><td>111.3</td> <td>101.1</td><td>114.2</td> <td>103.7</td><td>117.2</td> <td>106.5</td><td>120.3</td> <td>109.3</td><td>123.4</td> <td>112.1</td><td>126.6</td> <td>115.0</td><td>129.8</td> <td>118.0</td><td>133.1</td> <td>121.1</td><td>136.5</td> <td>125.2</td><td>141.0</td> <td>127.4</td><td>143.5</td> <td>130.6</td><td>147.1</td> </tr> <tr> <td>12.03</td><td>14.77</td> <td>12.34</td><td>15.23</td> <td>12.65</td><td>15.71</td> <td>12.97</td><td>16.28</td> <td>13.29</td><td>16.70</td> 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36		3.31	3.59	3.69	4.01	4.09	4.46	4.51	4.93	4.95	5.43	5.41	5.95	5.90	6.49	6.40	7.06	6.93	7.65	7.48	8.26	8.05	8.90	8.64	9.57	9.25	10.26	9.89	10.98	10.54	11.73	11.22	12.50	11.92	13.29	12.65	14.11	Rb Rubidium 37		Sr Strontium 38		Y Yttrium 39		Zr Zirconium 40		Nb Niobium 41		Mo Molybdenum 42		Tc Technetium 43		Ru Ruthenium 44		Rh Rhodium 45		Pd Palladium 46		Ag Silver 47		Cd Cadmium 48		In Indium 49		Sn Tin 50		Sb Antimony 51		Te Tellurium 52		I Iodine 53		Xe Xenon 54		13.39	14.96	14.16	15.83	14.96	16.74	15.77	17.67	16.61	18.62	17.48	19.61	18.41	20.59	19.28	21.66	20.21	22.72	21.18	23.82	22.16	24.94	23.17	26.09	24.21	27.27	25.27	28.48	26.36	29.72	27.47	30.99	28.61	32.29	29.80	33.64	Cs Cesium 55		Ba Barium 56		Hf Hafnium 72		Ta Tantalum 73		W Tungsten 74		Re Rhenium 75		Os Osmium 76		Ir Iridium 77		Pt Platinum 78		Au Gold 79		Hg Mercury 80		Tl Thallium 81		Pb Lead 82		Bi Bismuth 83		Po Polonium 84		At Astatine 85		Rn Radon 86		1.89	1.75	1.81	1.87	1.92	2.00	2.04	2.12	2.17	2.26	2.29	2.40	2.42	2.54	2.56	2.68	2.70	2.83	2.84	2.99	2.98	3.15	3.13	3.32	3.29	3.49	3.44	3.66	3.61	3.84	3.77	4.03	3.94	4.22	4.11	4.42	Fr Francium 87		Ra Radium 88		La Lanthanum 57		Ce Cerium 58		Pr Praseodymium 59		Nd Neodymium 60		Pm Promethium 61		Sm Samarium 62		Eu Europium 63		Gd Gadolinium 64		Tb Terbium 65		Dy Dysprosium 66		Ho Holmium 67		Er Erbium 68		Tm Thulium 69		Yb Ytterbium 70		Lu Lutetium 71		30.97	34.98	32.19	36.38	55.76	63.21	57.52	65.21	58.93	67.23	61.13	69.30	62.99	71.40	64.89	73.55	66.82	75.74	68.73	77.97	70.82	80.26	72.86	82.56	74.96	84.92	77.10	87.34	79.30	89.81	81.53	92.32	83.80	94.88	4.29	4.62	4.47	4.83	4.65	5.04	4.84	5.26	5.03	5.49	5.23	5.72	5.43	5.96	5.64	6.21	5.85	6.46	6.06	6.71	6.28	6.96	6.90	7.26	6.72	7.53	6.95	7.81	7.18	8.10	7.41	8.40	7.65	8.71	Ac Actinium 89		Th Thorium 90		Pa Protactinium 91		U Uranium 92		Np Neptunium 93		Pu Plutonium 94		Am Americium 95		Cm Curium 96		Bk Berkelium 97		Cf Californium 98		Einsteinium 99		Fermium 100		Mendelevium 101		Nobelium 102		Lawrencium 103		86.11	97.47	88.47	100.1	90.89	102.8	93.35	105.6	95.86	108.4	98.43	111.3	101.1	114.2	103.7	117.2	106.5	120.3	109.3	123.4	112.1	126.6	115.0	129.8	118.0	133.1	121.1	136.5	125.2	141.0	127.4	143.5	130.6	147.1	12.03	14.77	12.34	15.23	12.65	15.71	12.97	16.28	13.29	16.70	13.61	17.22	13.95	17.74	14.28	18.28	14.62	18.83	14.96	19.39	15.31	19.97	15.66	20.58	16.02	21.17	16.38	21.79	16.74	22.55	17.11	23.23	17.48	23.93
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1.89	1.75	1.81	1.87	1.92	2.00	2.04	2.12	2.17	2.26	2.29	2.40	2.42	2.54	2.56	2.68	2.70	2.83	2.84	2.99	2.98	3.15	3.13	3.32	3.29	3.49	3.44	3.66	3.61	3.84	3.77	4.03	3.94	4.22	4.11	4.42																																																																																																																																																																																																																																																																																																																																																																																																																																																		
Fr Francium 87		Ra Radium 88		La Lanthanum 57		Ce Cerium 58		Pr Praseodymium 59		Nd Neodymium 60		Pm Promethium 61		Sm Samarium 62		Eu Europium 63		Gd Gadolinium 64		Tb Terbium 65		Dy Dysprosium 66		Ho Holmium 67		Er Erbium 68		Tm Thulium 69		Yb Ytterbium 70		Lu Lutetium 71																																																																																																																																																																																																																																																																																																																																																																																																																																																					
30.97	34.98	32.19	36.38	55.76	63.21	57.52	65.21	58.93	67.23	61.13	69.30	62.99	71.40	64.89	73.55	66.82	75.74	68.73	77.97	70.82	80.26	72.86	82.56	74.96	84.92	77.10	87.34	79.30	89.81	81.53	92.32	83.80	94.88																																																																																																																																																																																																																																																																																																																																																																																																																																																				
4.29	4.62	4.47	4.83	4.65	5.04	4.84	5.26	5.03	5.49	5.23	5.72	5.43	5.96	5.64	6.21	5.85	6.46	6.06	6.71	6.28	6.96	6.90	7.26	6.72	7.53	6.95	7.81	7.18	8.10	7.41	8.40	7.65	8.71																																																																																																																																																																																																																																																																																																																																																																																																																																																				
Ac Actinium 89		Th Thorium 90		Pa Protactinium 91		U Uranium 92		Np Neptunium 93		Pu Plutonium 94		Am Americium 95		Cm Curium 96		Bk Berkelium 97		Cf Californium 98		Einsteinium 99		Fermium 100		Mendelevium 101		Nobelium 102		Lawrencium 103																																																																																																																																																																																																																																																																																																																																																																																																																																																									
86.11	97.47	88.47	100.1	90.89	102.8	93.35	105.6	95.86	108.4	98.43	111.3	101.1	114.2	103.7	117.2	106.5	120.3	109.3	123.4	112.1	126.6	115.0	129.8	118.0	133.1	121.1	136.5	125.2	141.0	127.4	143.5	130.6	147.1																																																																																																																																																																																																																																																																																																																																																																																																																																																				
12.03	14.77	12.34	15.23	12.65	15.71	12.97	16.28	13.29	16.70	13.61	17.22	13.95	17.74	14.28	18.28	14.62	18.83	14.96	19.39	15.31	19.97	15.66	20.58	16.02	21.17	16.38	21.79	16.74	22.55	17.11	23.23	17.48	23.93																																																																																																																																																																																																																																																																																																																																																																																																																																																				

 **NITON® XL3t™**

K shell range Cl (17) to Ba (56)
L shell range Cs (55) to U (92)

 **NITON® Infiniton™**

K shell range Ti (22) to Dy (66)
L shell range Ho (67) to U (92)
Half life: 432.2 years

 **NITON® XL3t™ 900 Series**

Light Matrix - Application-specific configuration only

Elements Reported by the OSM handheld XRF Analyzers

The OSM-TIPS owned Niton XL3t 950 GOLDD+ handheld analyzers will sample and report all of the elements identified in blue, including the lighter elements with “shaded” coloring.

Detection Limits in SiO₂ matrix

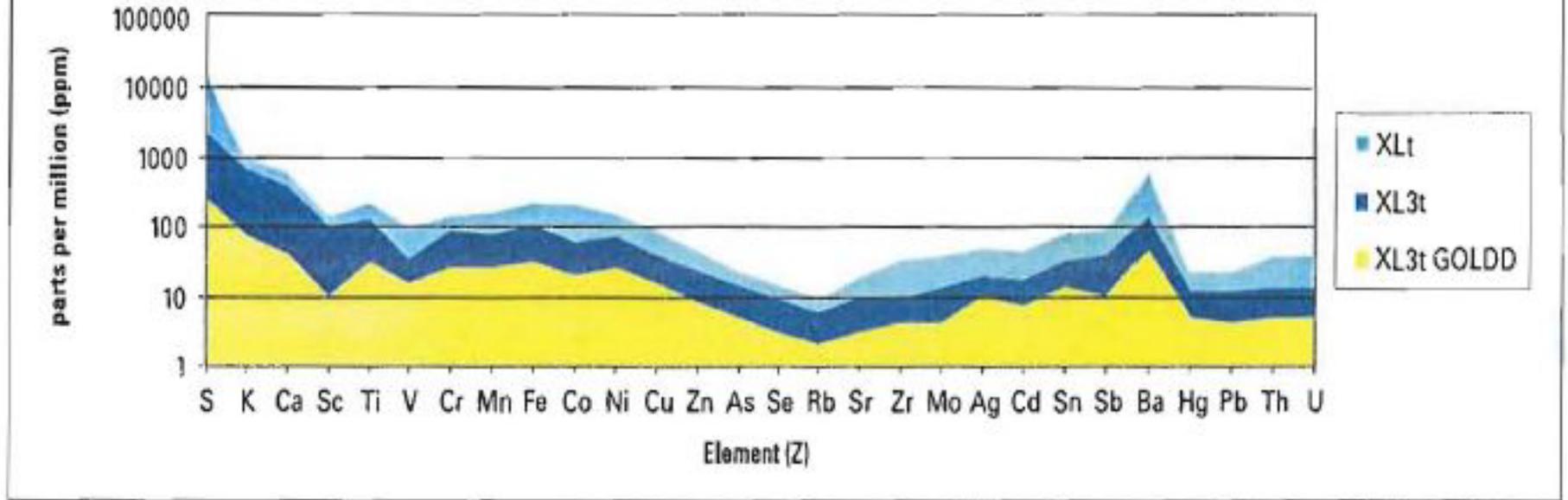


Figure 1. Instrument comparison data for LODs of various elements in an SiO₂ matrix. Note the greatly improved detection limits for XL3t with GOLDD technology.



The
SCIE
Niton XL

The OSM XRF analyzers have the improved GOLDD+ technology with lower levels of detection

The current analyzer is the XL3t 950 GOLDD+ Mining Analyzer:

It has improved LOD's for all the lighter elements without the need for using the Helium Purge.

- Mining Analysis
- SiO₂ Matrix
- 60/sec per filter

All values in ppm

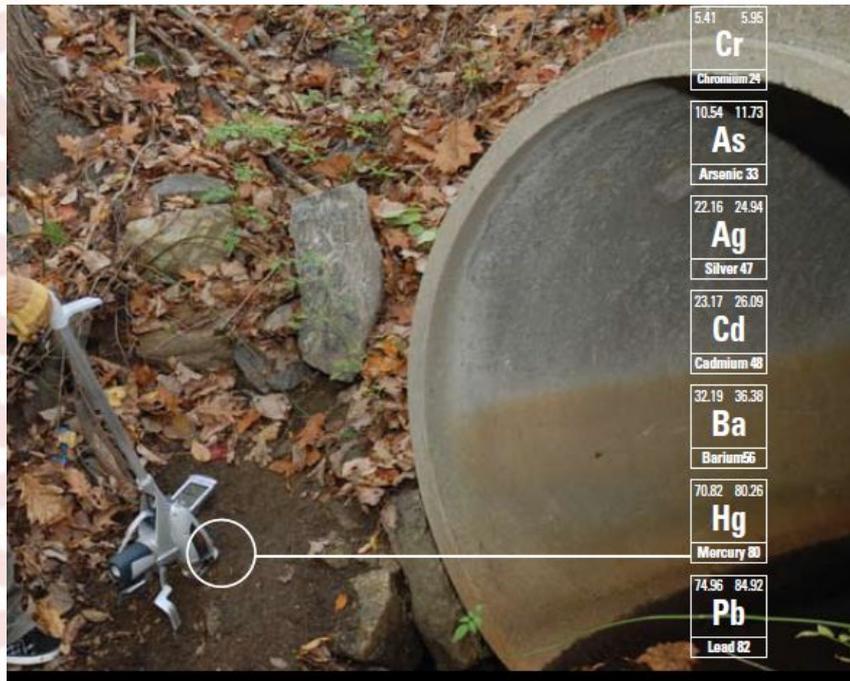
	Niton XL2 GOLDD	Niton XL3 GOLDD+
Ba	75	35
Sb	30	12
Sn	30	15
Cd	25	8
Pd	15	5
Ag	A/S	A/S
Mo	A/S	3
Nb	35	3
Zr	15	3
Zn	15	8
Cu	25	12
Ni	45	25
Co	35	20
Fe	60	35
Mn	75	60
Cr	150	20
V	450	10
Ti	700	10
Ca	65	50
K	125	40
Cl	75	60
S	120	70
P	350	250
Al	750	500
Mg	7500	3500



The handheld analyzers are versatile for on-site use

The instrument will log results, as well as location, while walking over a site.

The instrument may be used with the fully shielded mobile test stand on-site.



The instrument will operate for about eight hours on a fully charged battery.



Once the samples have been prepared and the parameters of the analysis are set, “in the office” measurement of samples becomes an assembly line process.



Analysis of Refuse Samples Prior to Reclamation of an AML Site in Tennessee (continued)

S	T	U	V	W	X	Y	Z	AA	AB	AC	AD	AE	AF	AG	AH	AI	AJ	AK	AL	AM	AN	AO	AP	AQ	AR
Se	Se Error	Ni	Ni Error	Zn	Zn Error	Fe	Fe Error	Ca	Ca Error	Mn	Mn Error	S	S Error	Mo	Mo Error	K	K Error	Cu	Cu Error	Cd	Cd Error	Zr	Zr Error	Sr	Sr Error
1.74	0.94	55.78	13.08	86.85	3.65	32006.32	93.82	9225.71	81.62	377.03	19.91	609.25	98.11	17.29	1.07	27475.19	153.32	215.44	6.16	<LOD	5.32	449.43	2.74	107.31	1.1
<LOD	2.64	<LOD	25.76	83.85	5.33	41590.49	171.81	7782.85	89.31	384.85	35.13	1739.94	52.45	13.93	1.15	21070.16	163.88	244.21	9.32	<LOD	3.99	330.37	2.7	90.74	1.1
<LOD	3.48	<LOD	35.44	2231.64	28.5	28483.43	199.23	2261.78	97.22	429.15	50.71	16841.4	289.01	9.23	1.54	28647.51	253.99	170.5	12.21	<LOD	8.09	152.4	2.91	176.11	2.1
6.84	2.71	40.53	25.86	2224.8	27.03	22666.6	152.68	2388.72	95.74	441.93	39.12	7766.42	309.79	10.55	1.86	35877.26	282.79	173.77	11.51	16.52	5.48	210.01	4.25	216.61	3.1
<LOD	1.47	<LOD	22.92	52.66	4	12034.59	82.26	3611.88	93.98	<LOD	26.57	5953.67	271.44	3.22	1.2	23254.9	226.14	23.3	5.26	<LOD	4.96	86.15	2.05	99.46	1.1
<LOD	2	<LOD	24.79	52.91	4.95	18438.66	130.5	2398.11	63.31	<LOD	59.25	12041.78	113.75	<LOD	2	13182.3	143.32	<LOD	13.42	11.38	2.75	65.58	1.55	87.01	1.1
<LOD	1.5	<LOD	18.41	54.33	4.07	12063.28	82.89	2376.12	64.48	<LOD	43.4	12058.24	113.31	<LOD	1.57	13187.73	145.54	26.26	5.36	7.64	2.69	64.55	1.51	86.85	1.1
<LOD	1.46	<LOD	22.85	62.1	4.18	11760.71	81.04	4110.97	101.97	<LOD	26.78	6654.87	294	<LOD	1.77	25182.91	242.04	28.44	5.31	<LOD	4.83	90.1	2.08	105.45	1.1
<LOD	2	<LOD	24.81	58.28	5.01	17907.13	126.69	2509.92	65.25	<LOD	58.04	11889.85	111.86	<LOD	2	13382.22	146.35	16.05	6.76	10.68	2.68	65.22	1.53	92.59	1.1
<LOD	7.82	<LOD	102.57	54.57	4.13	11800.65	83.12	2453.1	77.76	<LOD	235.45	11821.39	231.25	<LOD	7.63	13243.18	271.74	26.6	5.41	9.25	2.63	88.94	2.13	106.09	1.1
<LOD	1.52	<LOD	23.8	48.97	3.98	12464.09	84.56	3483.22	92.99	<LOD	27.83	6613.79	283.54	<LOD	1.79	22660.53	224.22	25.61	5.41	<LOD	5.17	91.16	2.1	94.13	1.1
<LOD	2	<LOD	19.74	49.74	3.85	18878.18	104.05	2376.51	65.81	<LOD	46.62	12826.92	114.34	<LOD	2	13251.84	146.3	14.84	5.46	8.58	2.75	67.77	1.23	82.5	1.1
<LOD	1.5	<LOD	17.48	48.9	3.69	12426.89	78.56	2392.89	64.52	<LOD	41.04	12972.89	117.45	<LOD	1.5	13201.11	145	23.41	4.98	6.24	2.79	66.25	1.43	82.4	1.1
<LOD	1.46	<LOD	22.59	40.64	3.7	11569.14	80.27	4667.21	106.95	<LOD	27.22	6710.88	299.59	2.24	1.18	24517.5	242.58	24.73	5.19	<LOD	4.76	83.35	2.03	104.98	1.1
<LOD	2	<LOD	24.39	36.74	4.6	17714.68	128.26	2648.16	64.87	<LOD	60.05	12174.89	110.78	<LOD	2	12331.92	140.25	<LOD	13.52	9.11	2.59	61.17	1.52	90.89	1.1
<LOD	1.5	<LOD	18.05	41.1	3.66	11550.77	79.49	2634.04	63.6	<LOD	43.55	12251.51	111.38	<LOD	1.5	12309.85	137.81	20.96	5.07	11.63	2.65	60.23	1.47	92.42	1.1
<LOD	1.48	<LOD	23.22	40.14	3.76	13037.05	86.53	4969.14	111.94	<LOD	28.33	7291.67	315.47	<LOD	1.8	26119.85	254.1	24.22	5.29	<LOD	4.86	93.72	2.14	107.19	1.1
<LOD	2	<LOD	24.47	39.44	4.58	19629.76	133.19	2974.1	68.85	<LOD	59.09	12790.02	116.06	<LOD	2	13448.81	148.17	<LOD	13.2	9.85	2.64	70.79	1.57	91.3	1.1
<LOD	1.5	<LOD	18.26	41.22	3.7	13049.68	84.84	2901.71	68.33	<LOD	44.17	12825.79	115.04	<LOD	1.5	13340.25	146.95	27.94	5.27	7.98	2.65	70.5	1.55	91.02	1.1
<LOD	1.52	<LOD	24.07	37.01	3.77	13291.31	89.04	4879.29	110.84	<LOD	28.76	5858.76	288.62	<LOD	1.83	25698.68	251.39	20.11	5.32	<LOD	4.82	87.56	2.14	107.18	1.1
<LOD	2	<LOD	20.54	36.47	3.82	20029.8	114.09	2908.42	68.18	<LOD	50.19	10353.84	102.2	<LOD	2	13118.34	145.67	13.44	5.66	8.59	2.64	64.46	1.29	94.89	1.1
<LOD	1.5	<LOD	16.54	40.51	3.31	13383.43	77.36	2865.52	67.35	<LOD	40.16	10478.77	102.72	<LOD	1.5	13304.62	144.3	23.35	4.67	10.65	2.67	66.01	1.37	93.82	1.1
<LOD	1.73	34.93	17.88	110.84	5.65	13912.39	96.9	2465.68	86.56	39.28	22.04	7266.2	292.64	<LOD	1.96	25072.2	233.37	41.85	6.3	<LOD	5.58	103.32	2.4	103.49	1.1
<LOD	2	<LOD	28.64	117	6.71	20691.73	148.5	1797.83	66.07	<LOD	70.22	14271.63	127.45	<LOD	2	15037.37	162.46	29.06	7.82	<LOD	5.95	78.49	1.77	90.69	1.1
<LOD	1.5	<LOD	19.84	111.03	5.21	13898.04	89.1	1839.39	63.64	<LOD	47.5	14273.36	127.2	<LOD	1.5	15047.77	155.81	39.74	5.76	<LOD	3.46	79.11	1.63	90.14	1.1
1.86	1.14	27.91	17.35	48.72	4.22	13220.6	91.85	2939.6	88.23	38.91	21.06	7600.16	293.65	3.07	1.29	24669.69	228.15	39.9	6.07	<LOD	5.28	100.93	2.32	109.82	1.1
<LOD	2	<LOD	28.38	49.27	5.23	19754.13	143.09	2030.49	66.35	<LOD	66.82	14919.24	129.47	<LOD	2	14912.54	159.53	21.09	7.52	7.51	2.91	74.26	1.72	95.3	1.1
<LOD	1.5	<LOD	19.48	49.69	4.02	13173.59	86.77	1998.01	65.14	<LOD	46.32	15014.43	128.84	<LOD	1.5	14779.6	155.04	35.33	5.65	<LOD	4.29	73.55	1.6	95.64	1.1
<LOD	1.6	<LOD	24.88	64.57	4.53	14052.91	94.1	2265.36	89.2	<LOD	29.69	8326.03	323.06	<LOD	1.87	25009.22	242.42	31.61	5.75	<LOD	5.22	87.64	2.15	72.67	1.1
<LOD	2	<LOD	26.02	61.37	5.19	21111.74	141.63	1524.88	58.96	<LOD	61.53	14152.56	119.37	<LOD	2	13312.25	145.56	20.61	7.07	9.36	2.81	65.73	1.54	63.72	1.1
<LOD	1.5	<LOD	19.38	62.61	4.3	14090.16	90.44	1494.78	59.36	<LOD	45.52	14151.5	120.2	<LOD	1.5	13377.38	146.23	29.73	5.5	6.47	2.78	65.85	1.52	63.92	1.1

The analyzer can be programmed to report only specific elements of concern and information from the results can be organized into your own customized report.

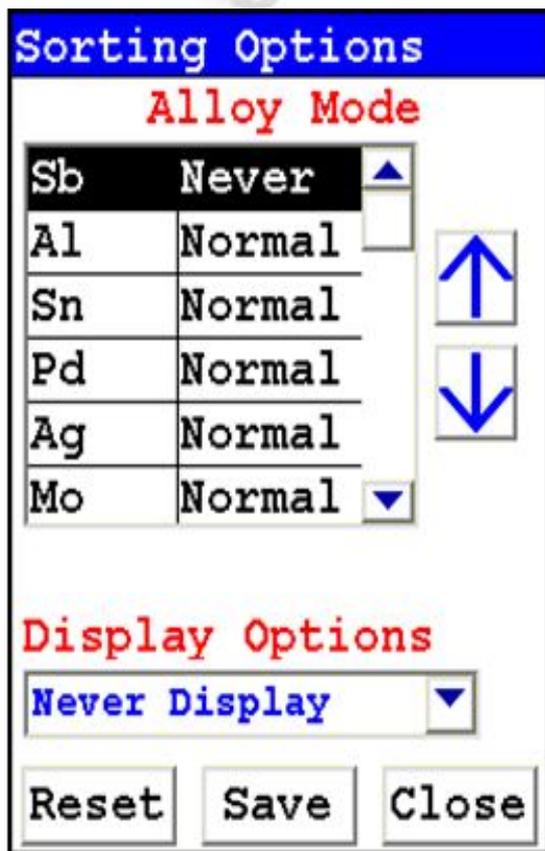


Figure 1-5. Changed Display Option

XRF Analysis

Element	Value, ppm	Reading No	1
Mo	< LOD	Time	10/19/2011 10:23
Zr	< LOD	Type	TestAll Geo
Rb	< LOD	Duration	370.48
Pb	< LOD	Sequence	Final
Se	< LOD	Flags	-8mm
As	< LOD	SAMPLE	Black rock from seep #2
Hg	< LOD	LOCATION	Pine Mountain Mine, Heavner, OK
W	< LOD	INSTRUMENT	Niton XL3
Cu	< LOD	MISC	sample collected 9/29/2011
Cr	< LOD	NOTE	limestone lining channel
Mg	< LOD		
Sb	< LOD		
Sn	< LOD		
Cd	< LOD		
Ag	< LOD		
Pd	< LOD		
Nb	< LOD		
Bi	< LOD		
Re	< LOD		
Ta	< LOD		
Hf	< LOD		
P	< LOD		
Balance	616704	61.7%	
Ca	242581	24.3%	
Mn	96024	9.6%	
Si	15294	1.5%	
Fe	6805	0.7%	
Al	3785	0.4%	
S	1413	0.1%	
Cl	945		
K	938		
Co	335		
Ti	245		
Ni	198		
Ba	184		
V	121		
Sr	77		
Zn	33		
Au	6		
U	4		
Th	2		

XRF analysis of the surface was made before the dark rind was chipped away to expose the limestone.

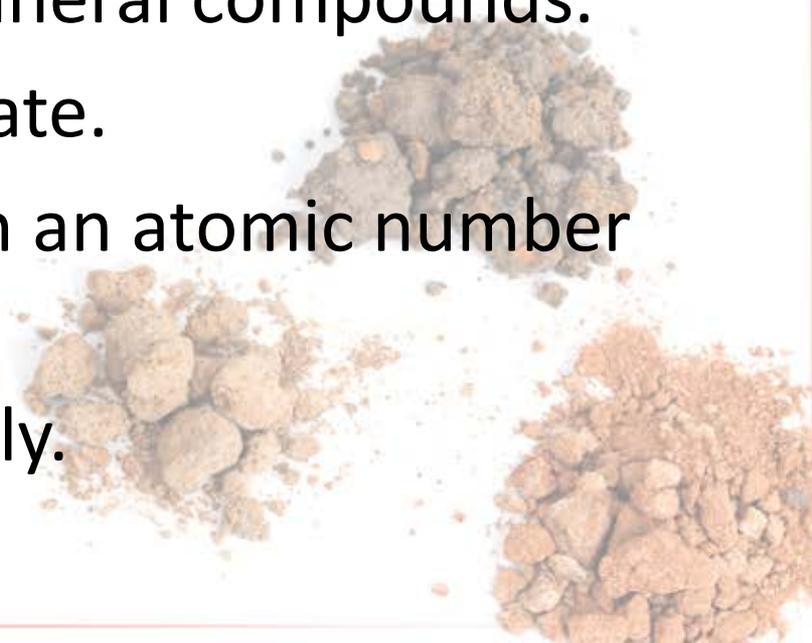
As in laboratory analysis, sample preparation is very important.



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Constraints

- Expensive and easily damaged
 - Requires safety training to use x-ray equipment as well as learning to set-up and use the instrument.
 - Transport and use regulated as X-Ray equipment.
 - Measures elements – Not mineral compounds.
 - Does not report oxidation state.
 - Cannot detect elements with an atomic number less than 12.
 - Measures sample surface only.
- 

Contacts

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Find out more about the XRF:

[http://www.tips.osmre.gov/Hardware/
Current List.shtml](http://www.tips.osmre.gov/Hardware/Current_List.shtml)

Thermo

SCIENTIFIC

MAXX300





To find out more about XRF
technology:

<http://www.niton.com>

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Questions?



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