Imaging (SEM)

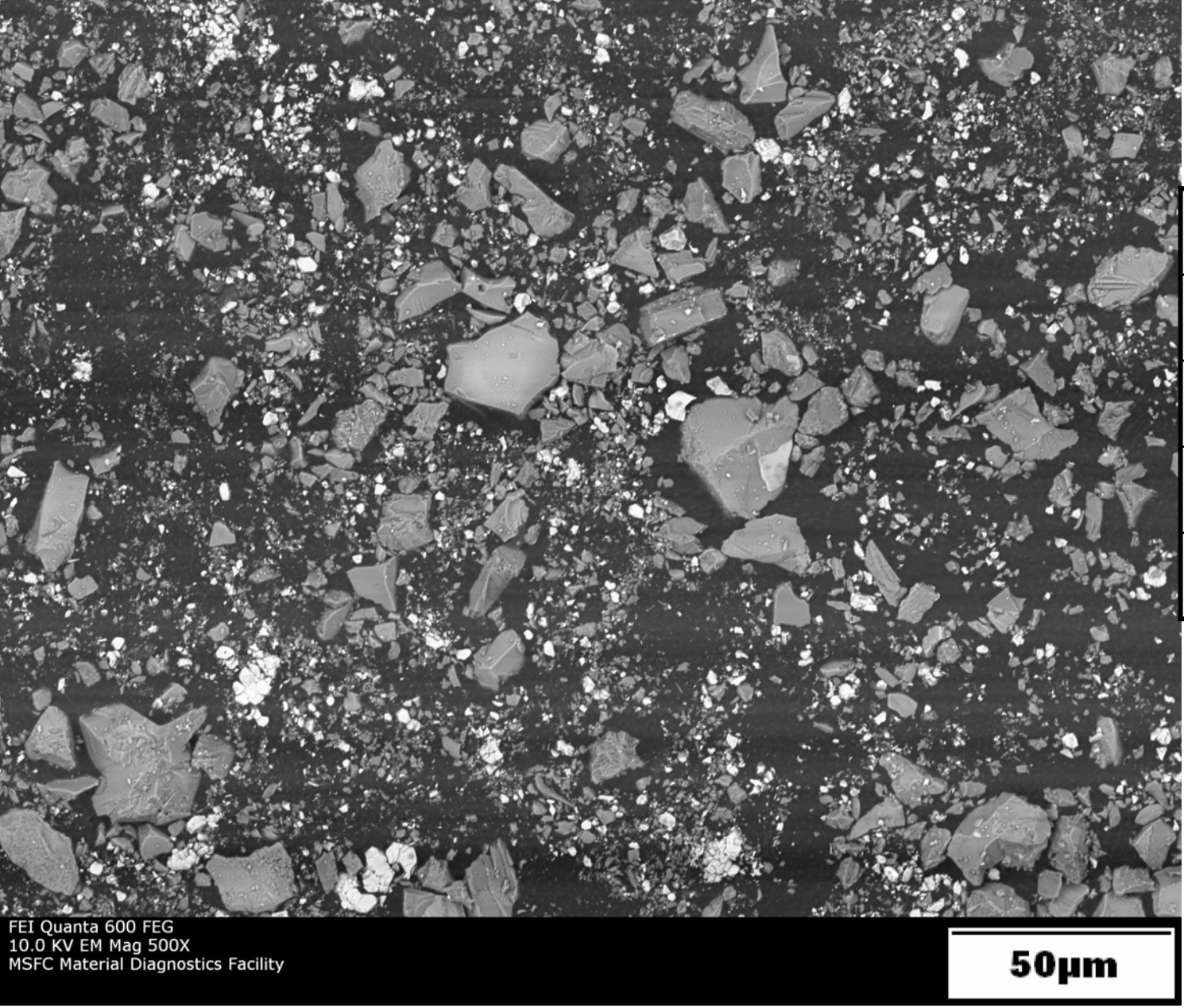
as a Tool for Testing Dust

Robert Richmond

NESC Mechanical Systems Team

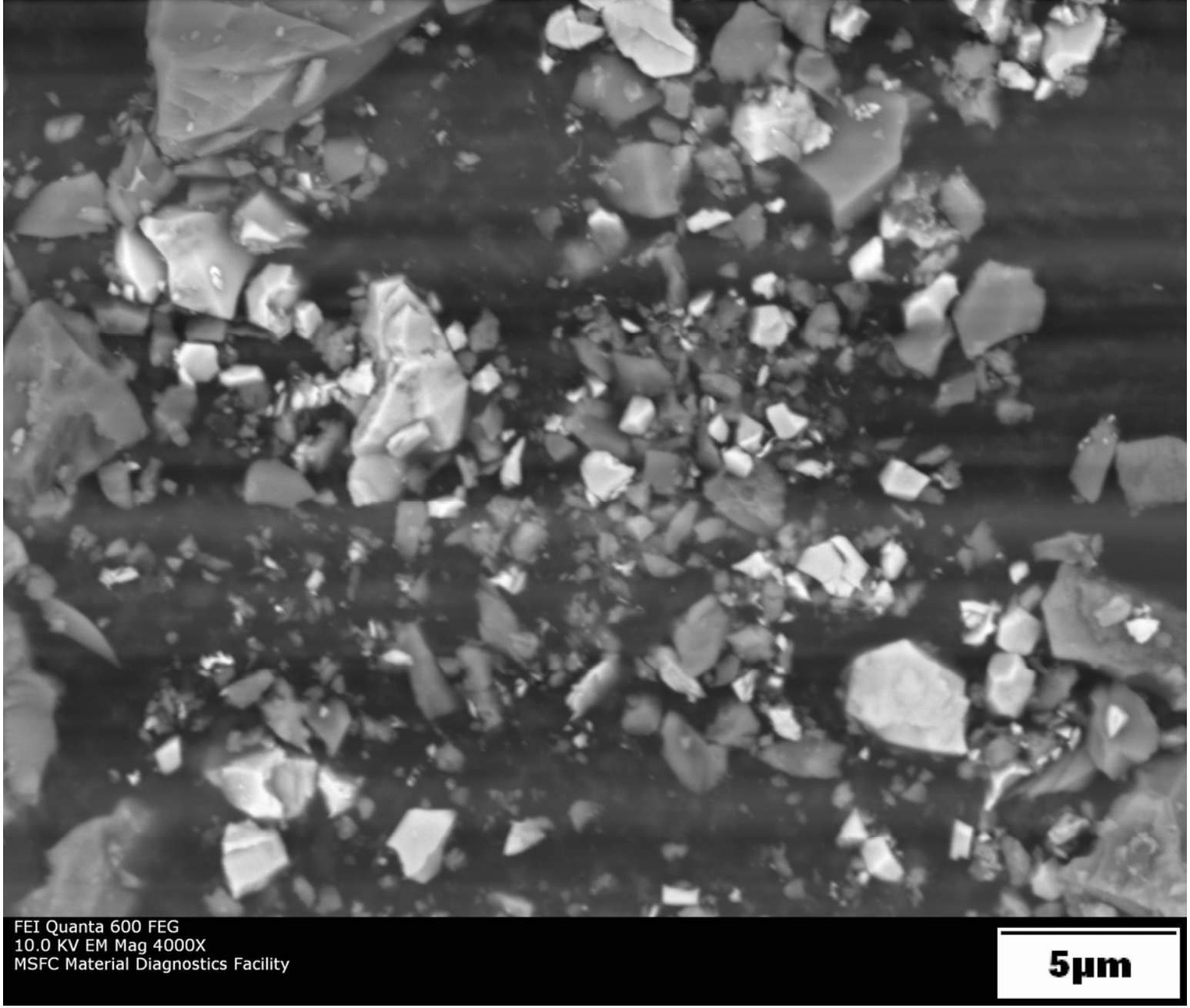
October 11, 2007

JSC-1AF

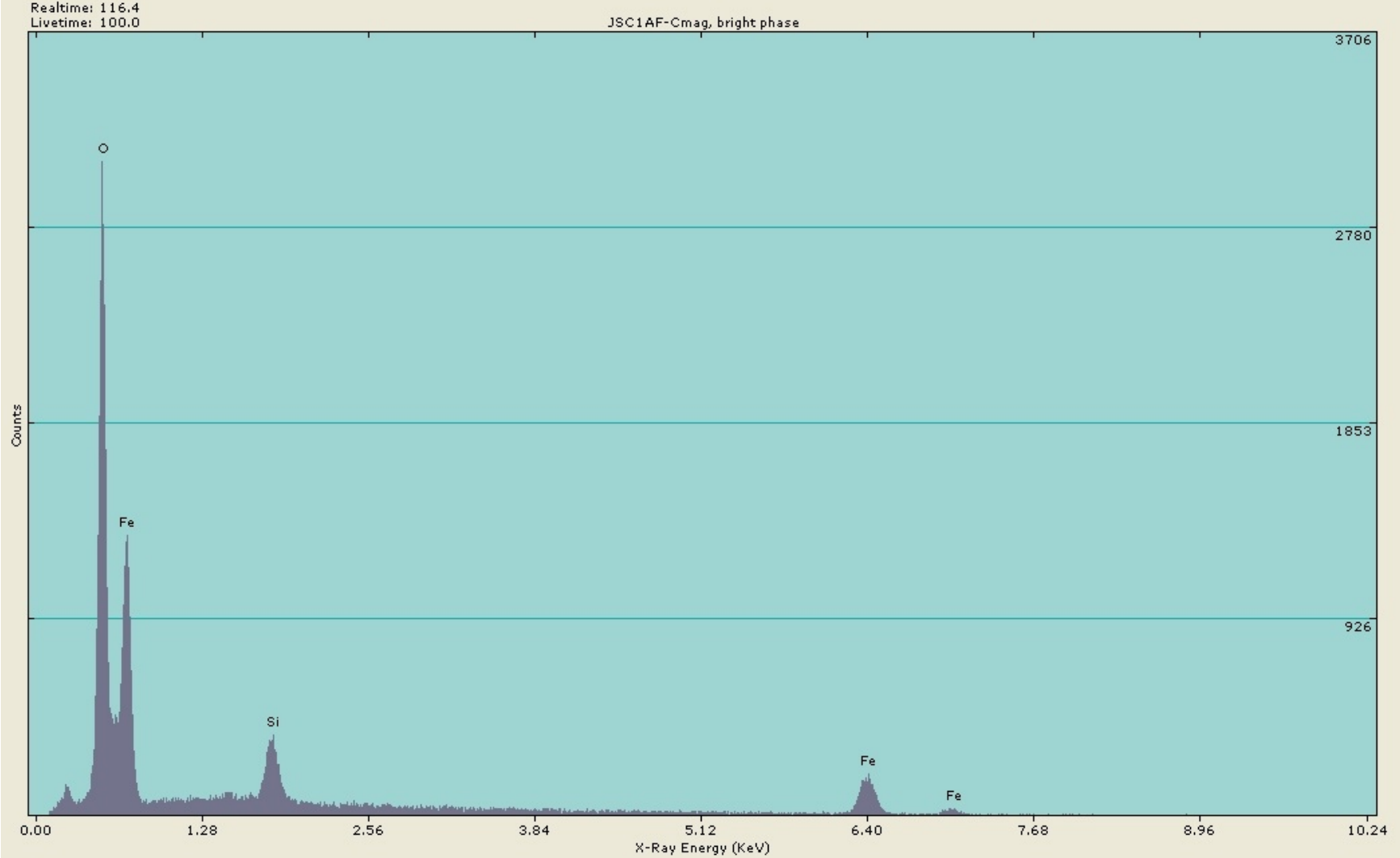


Particle count	**2535**
Dmin, um	**0.72**
Dmax, um	**32.52**
Davr, um	**1.67**
D std. dev., um	**1.75**

JSC-1AF on Carbon Tape 500X



JSC-1AF bright & grey phases on Carbon Tape 4000X



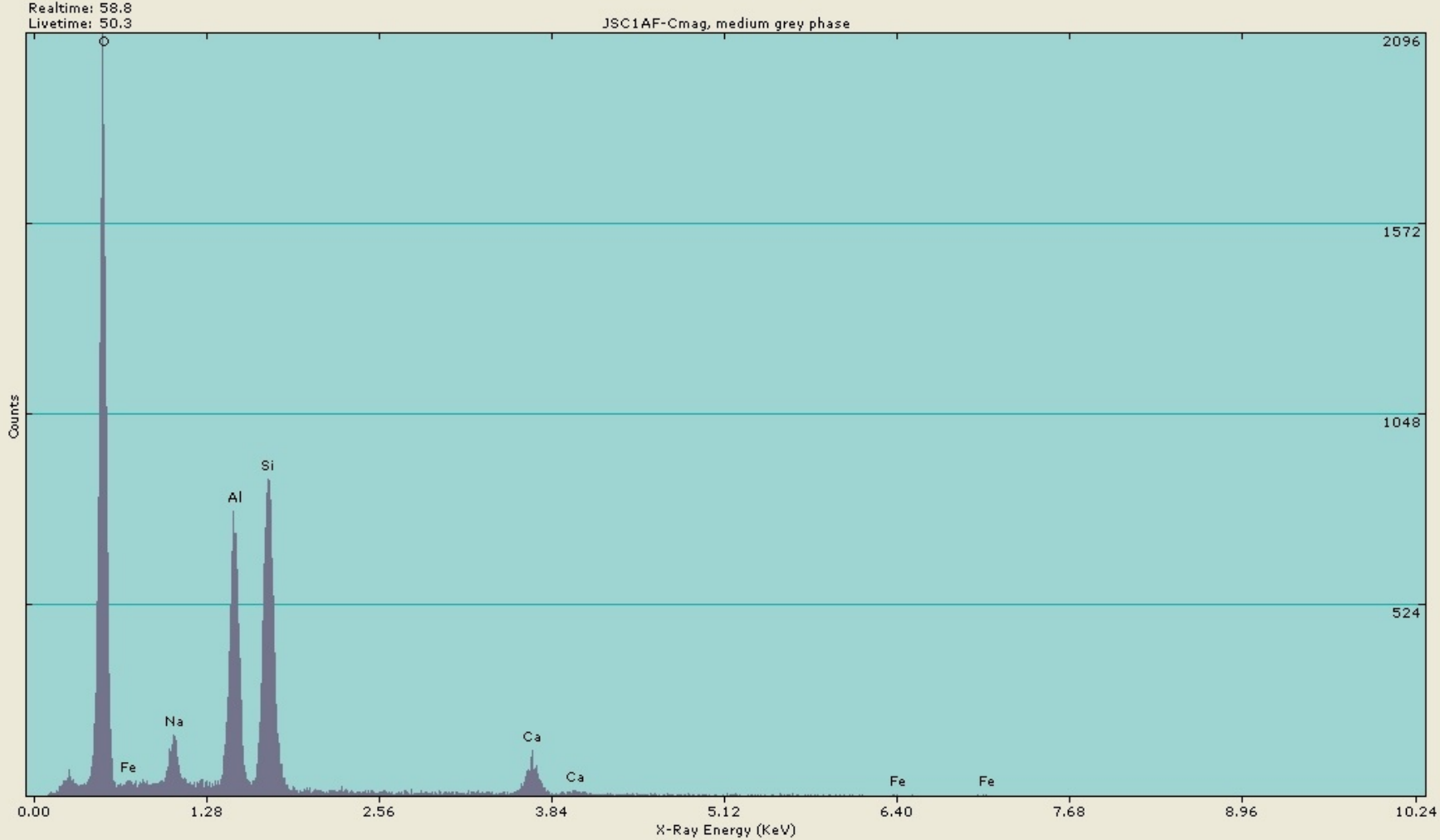
Quantitative Results for JSC1AF-Cmag, bright phase
Analysis: Bulk Method: Standardless
Acquired 25-Jul-2007, 10.0 KeV @10 eV/channel

Element	Weight %	Std. Dev.	MDL	Atomic %	k-Ratio	Intensities	Probability
O	30.97	1.13	0.14	60.80	0.4598	17393.4	0.94
Si ?	0.69	0.27	2.99	0.77	0.0056	246.7	0.00
Fe	68.34	2.89	1.79	38.43	0.6263	2000.7	0.97
Total	100.00						

? This element is statistically insignificant.

Bright phase 4000X -

note ca. magnetite Mohs ca. 5.5



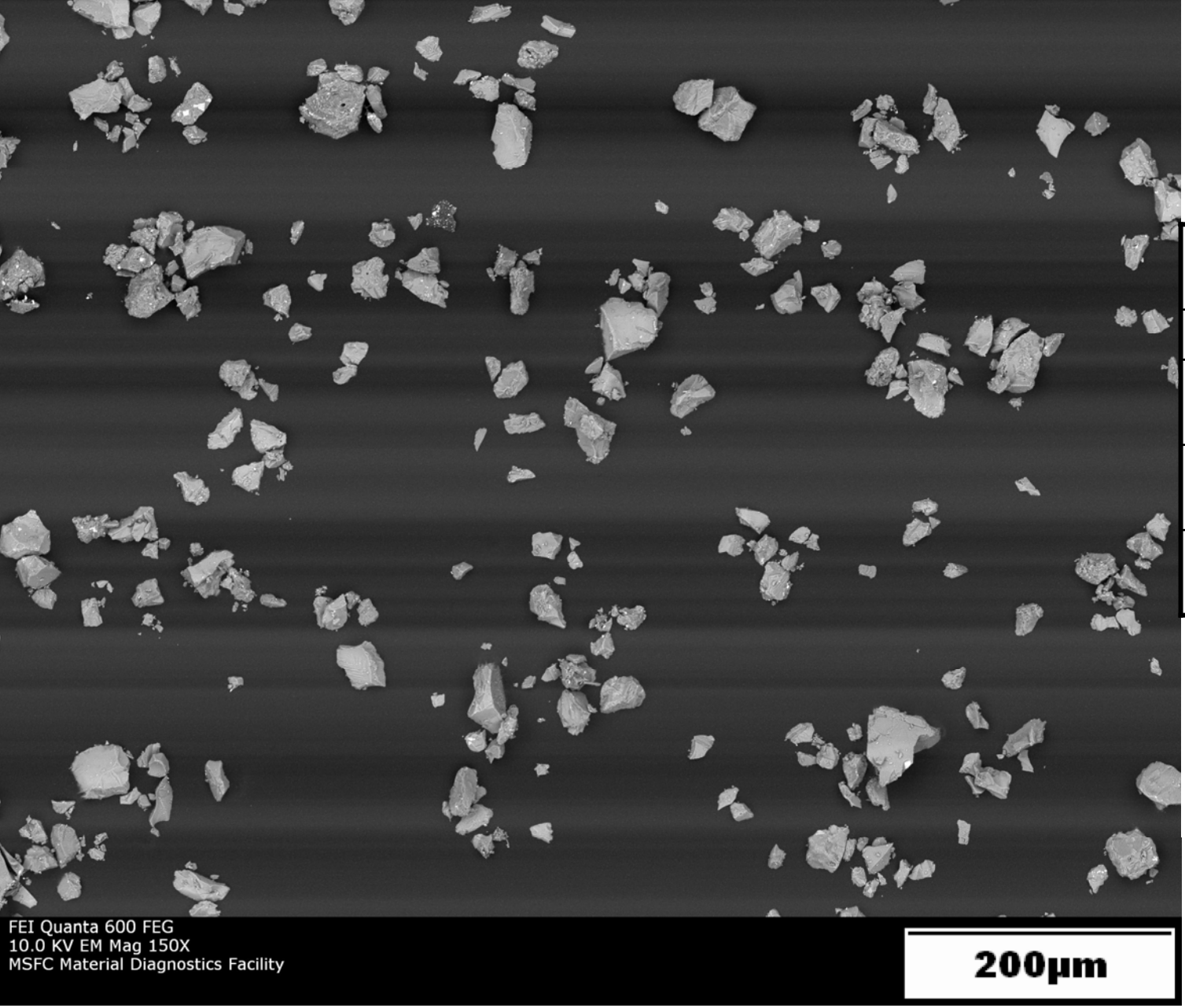
Quantitative Results for JSC1AF-Cmag, medium grey phase
Analysis: Bulk Method: Standardless
Acquired 25-Jul-2007, 10.0 KeV @10 eV/channel

Element	Weight %	Std. Dev.	MDL	Atomic %	k-Ratio	Intensities	Probability
O	54.68	1.61	0.28	68.09	0.3630	11140.5	0.95
Na	3.10	0.91	1.27	2.68	0.0203	794.8	1.00
Al	16.00	0.93	0.45	11.81	0.1322	4883.4	0.99
Si	20.77	1.08	0.37	14.73	0.1709	6066.0	0.99
Ca	5.27	1.20	0.99	2.62	0.0480	754.9	0.94
Fe ?	0.18	0.16	20.70	0.06	0.0015	3.8	0.00
Total	100.00						

? This element is statistically insignificant.

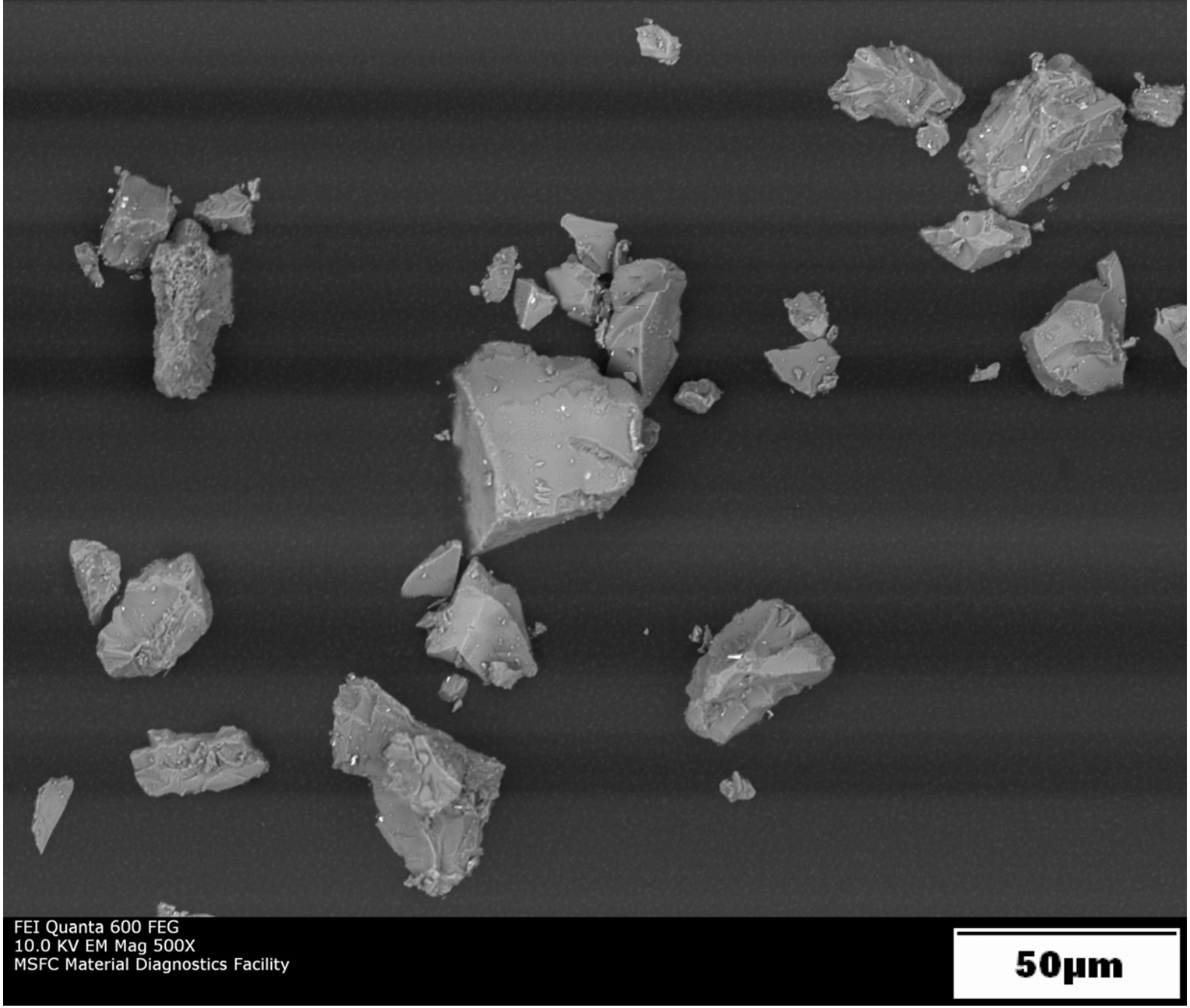
Grey phase 4000X -

note ca. plagioclase Mohs ca. 6.5

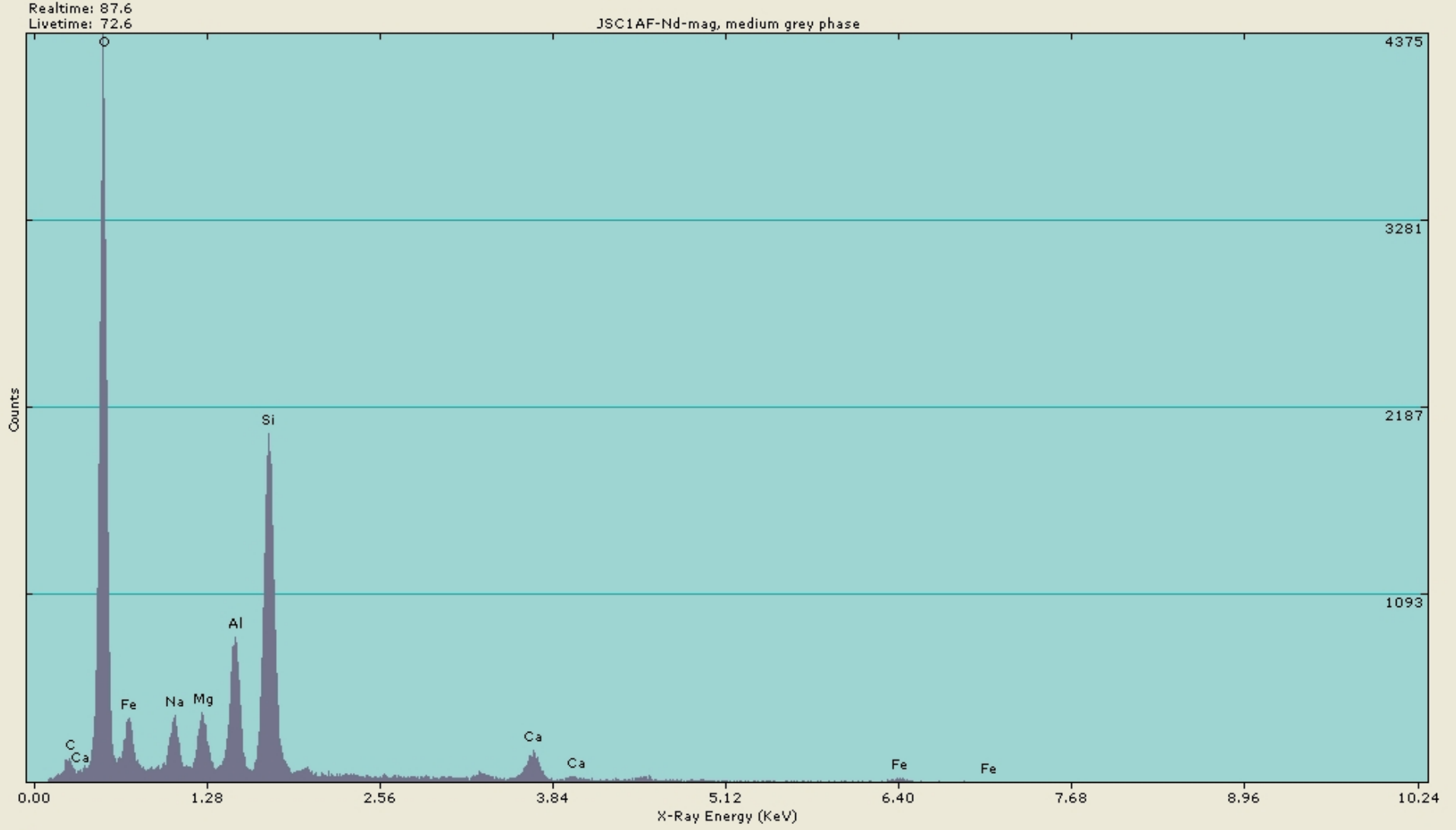


Particle count	246
Dmin, um	2.53
Dmax, um	118.53
Davr, um	15.95
D std. dev., um	14.59

JSC1AF - Nd Magnet Differentiation 150X



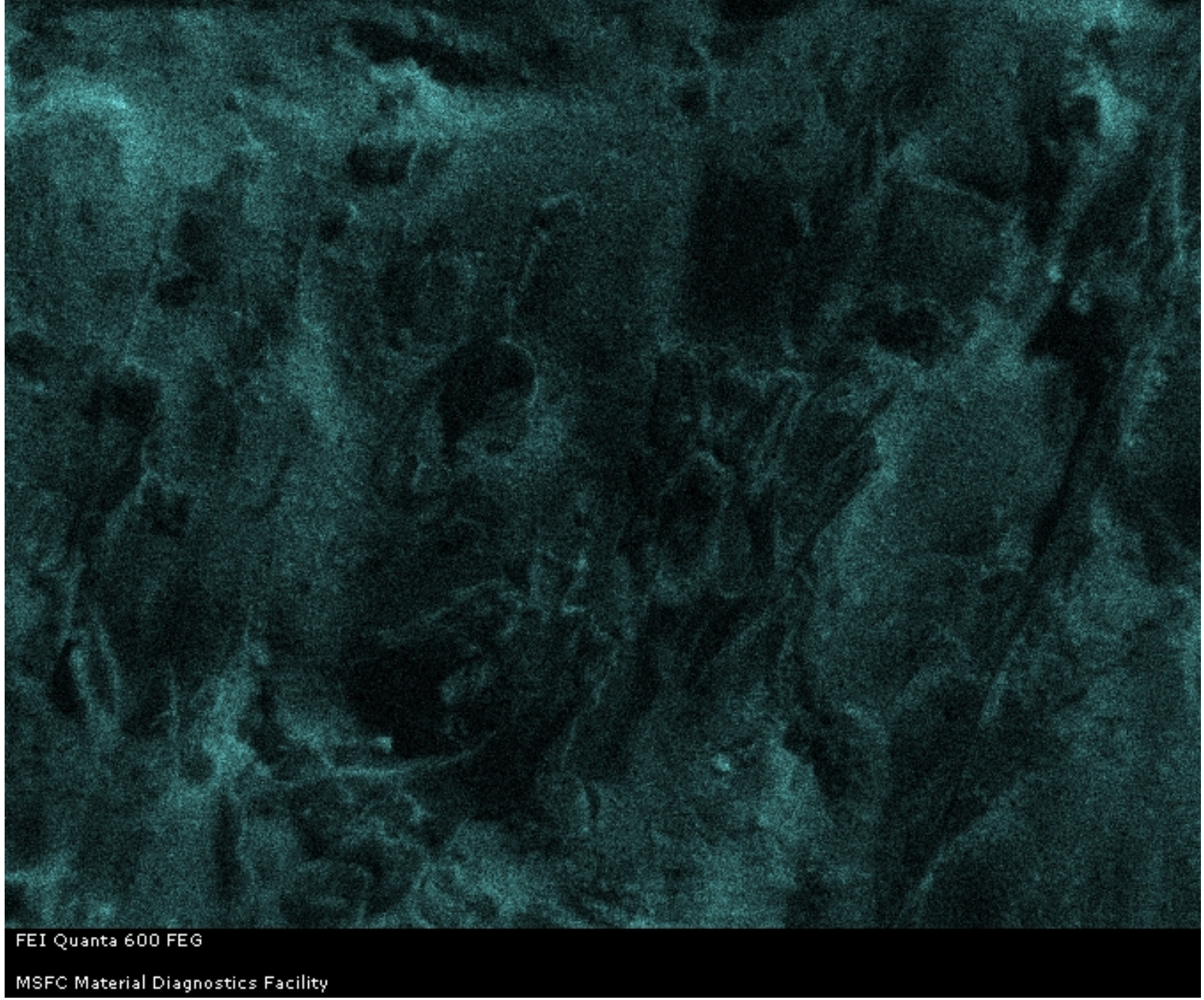
JSC1AF - Nd Magnet Differentiation 500X - note grey phase & spotty bright phase inclusions



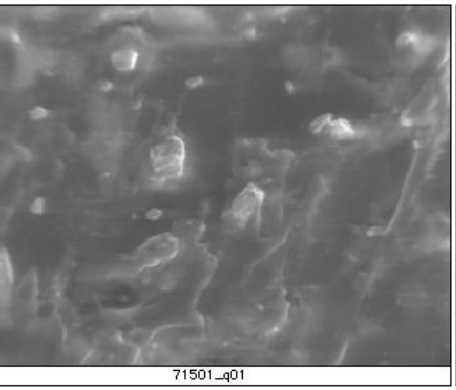
Quantitative Results for JSC1AF-Nd-mag, medium grey phase
Analysis: Bulk Method: Standardless
Acquired 25-Jul-2007, 10.0 KeV @10 eV/channel

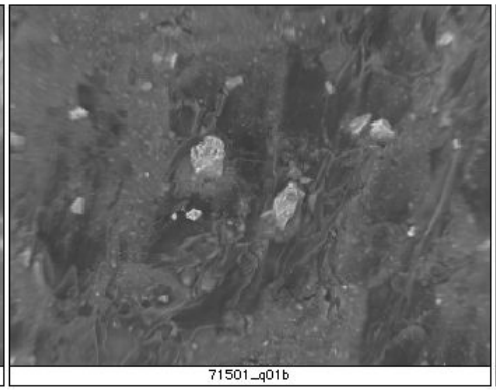
Element	Weight %	Std. Dev.	MDL	Atomic %	k-Ratio	Intensities	Probability
C	1.89	0.67	1.67	3.12	0.0080	278.5	0.84
O	53.58	1.42	0.20	66.51	0.3687	24313.8	0.94
Na	3.69	0.97	0.92	3.18	0.0233	1961.3	0.98
Mg	3.22	0.89	0.80	2.63	0.0240	2051.8	0.00
Al	8.20	0.97	0.49	6.04	0.0651	5168.4	0.99
Si	21.01	1.00	0.27	14.86	0.1756	13397.0	0.99
Ca	4.74	1.11	0.79	2.35	0.0433	1463.8	0.00
Fe	3.68	1.17	3.54	1.31	0.0300	166.9	0.00
Total	100.00						

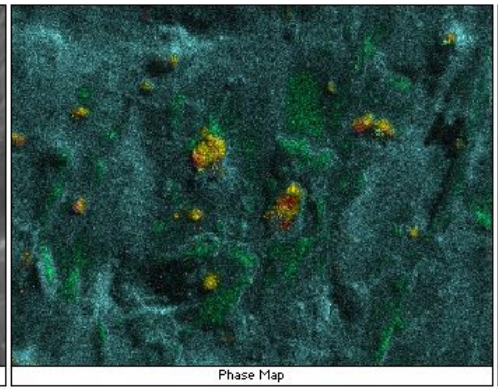
JSC1AF - Nd Magnet Differentiation 500X

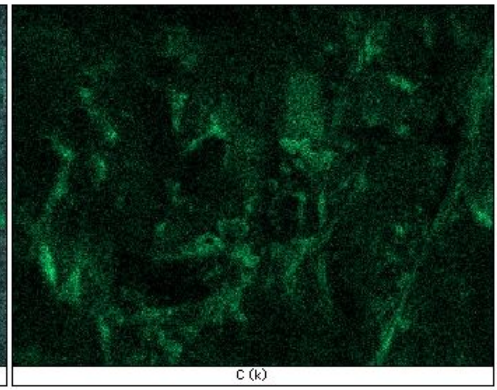


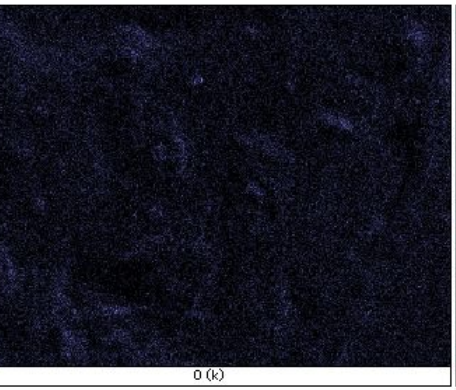
Braycote grease & 5% JSC-1AF -- Fluorine map 250x

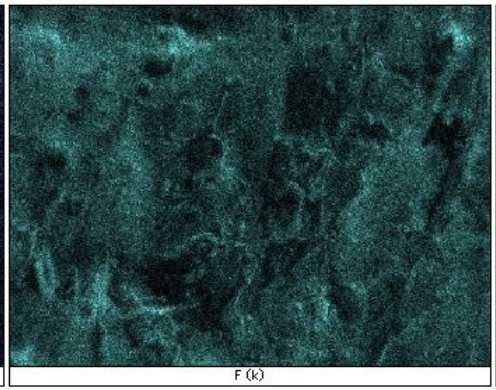

71501_q01

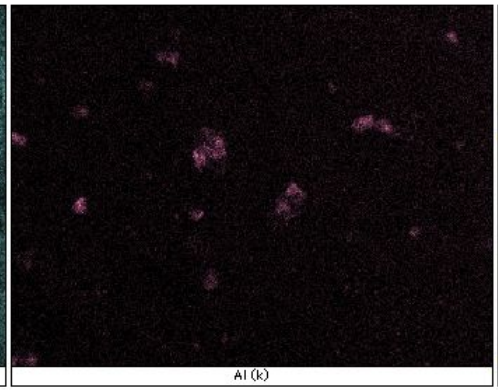

71501_q01b

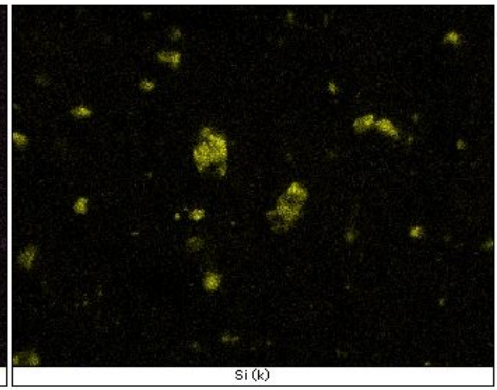

Phase Map

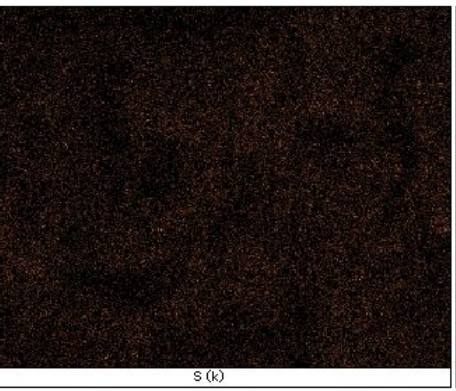

C (k)

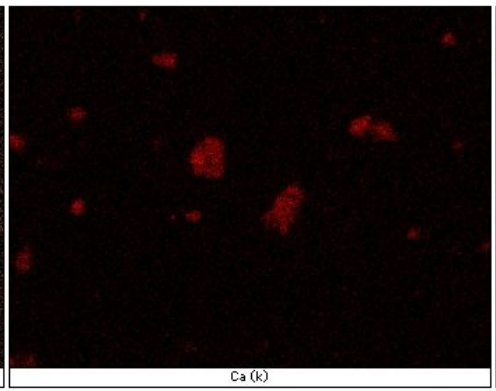

O (k)

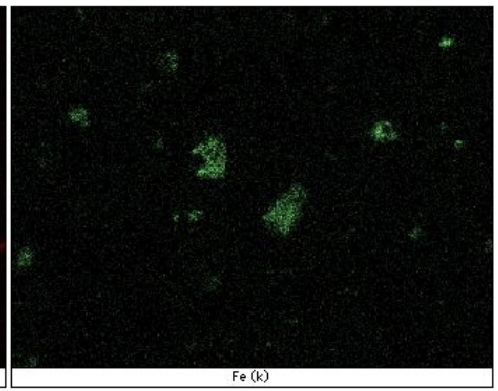

F (k)


Al (k)

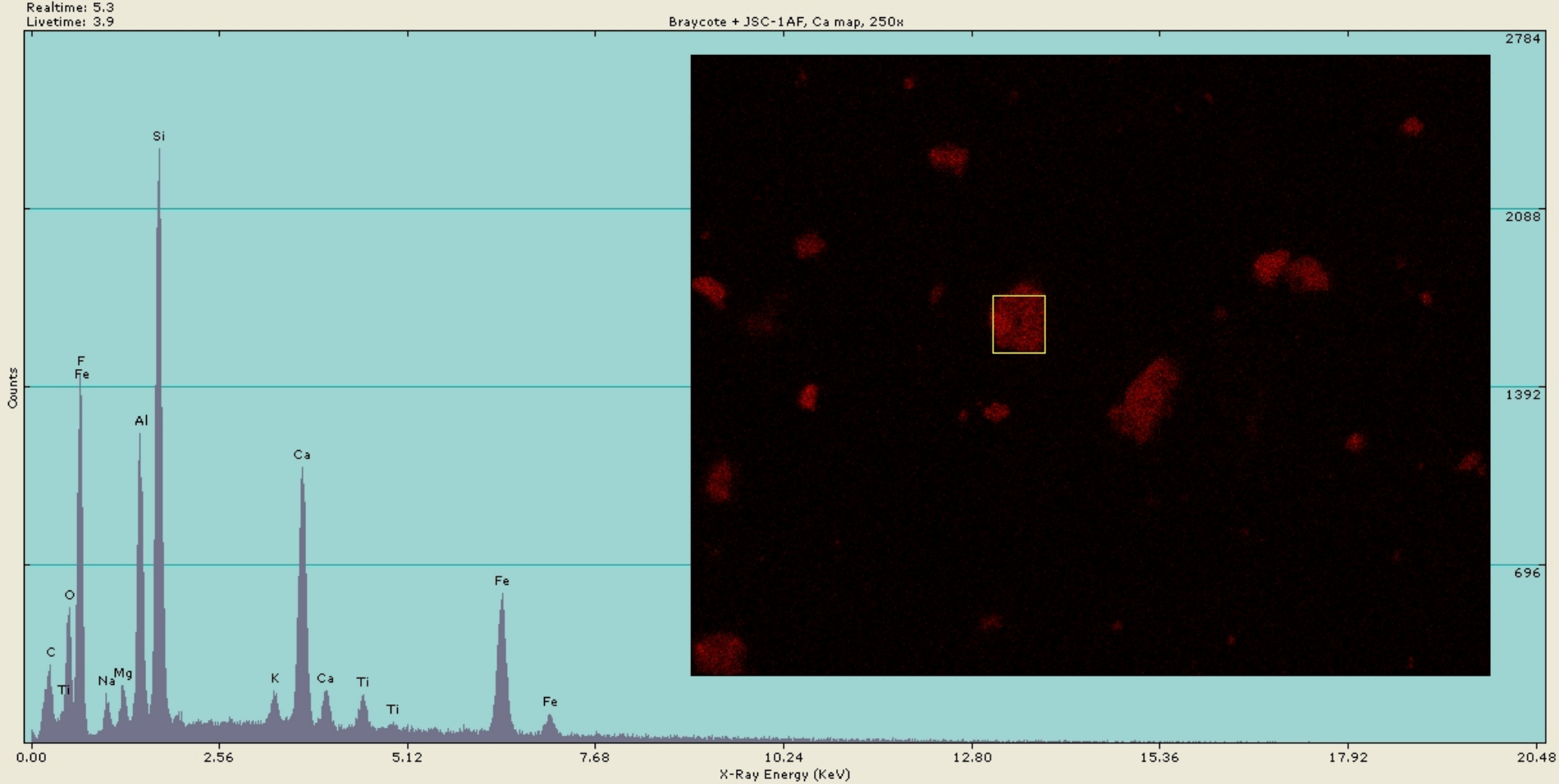

Si (k)


S (k)


Ca (k)


Fe (k)

Braycote grease & 5% JSC-1AF -- Multi-element map 250x



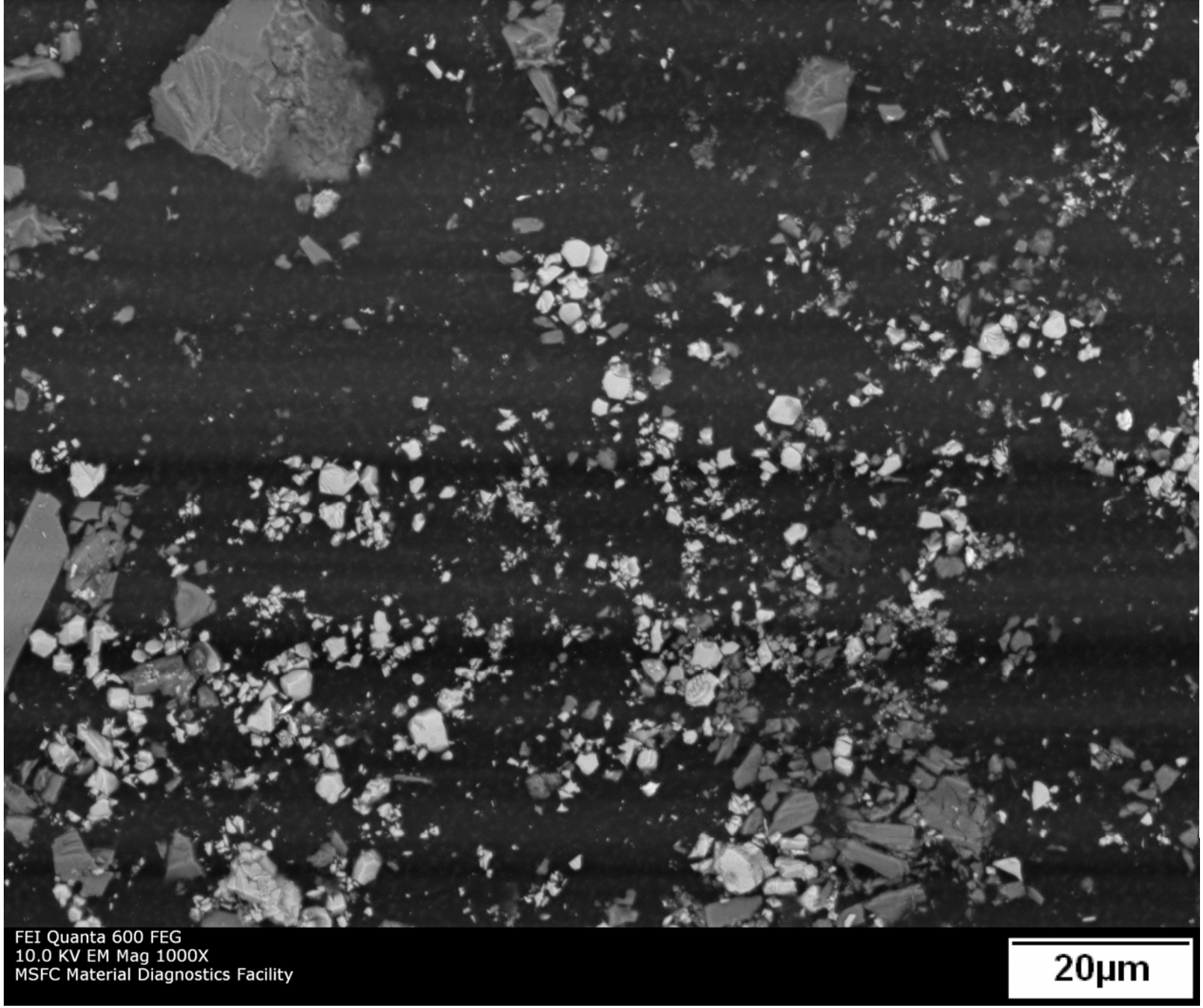
Quantitative Results for Braycote + JSC-1AF, Ca map, 250x
Analysis: Bulk Method: Standardless
Acquired 24-Aug-2007, 15.0 KeV @10 eV/channel

Element	Weight %	Atomic %	k-Ratio	Intensities
C	7.11	14.94	0.0463	1563.6
O	9.01	14.23	0.0389	3296.8
F	19.27	25.61	0.0837	9736.2
Na	1.00	1.10	0.0040	566.0
Mg	1.16	1.20	0.0064	964.2
Al	9.15	8.56	0.0606	8842.3
Si	17.39	15.64	0.1264	18474.1
K	1.18	0.76	0.0110	1060.2
Ca	11.71	7.38	0.1119	9945.7
Ti	2.22	1.17	0.0196	1246.5
Fe	20.81	9.41	0.1852	6042.3
Total	100.00			

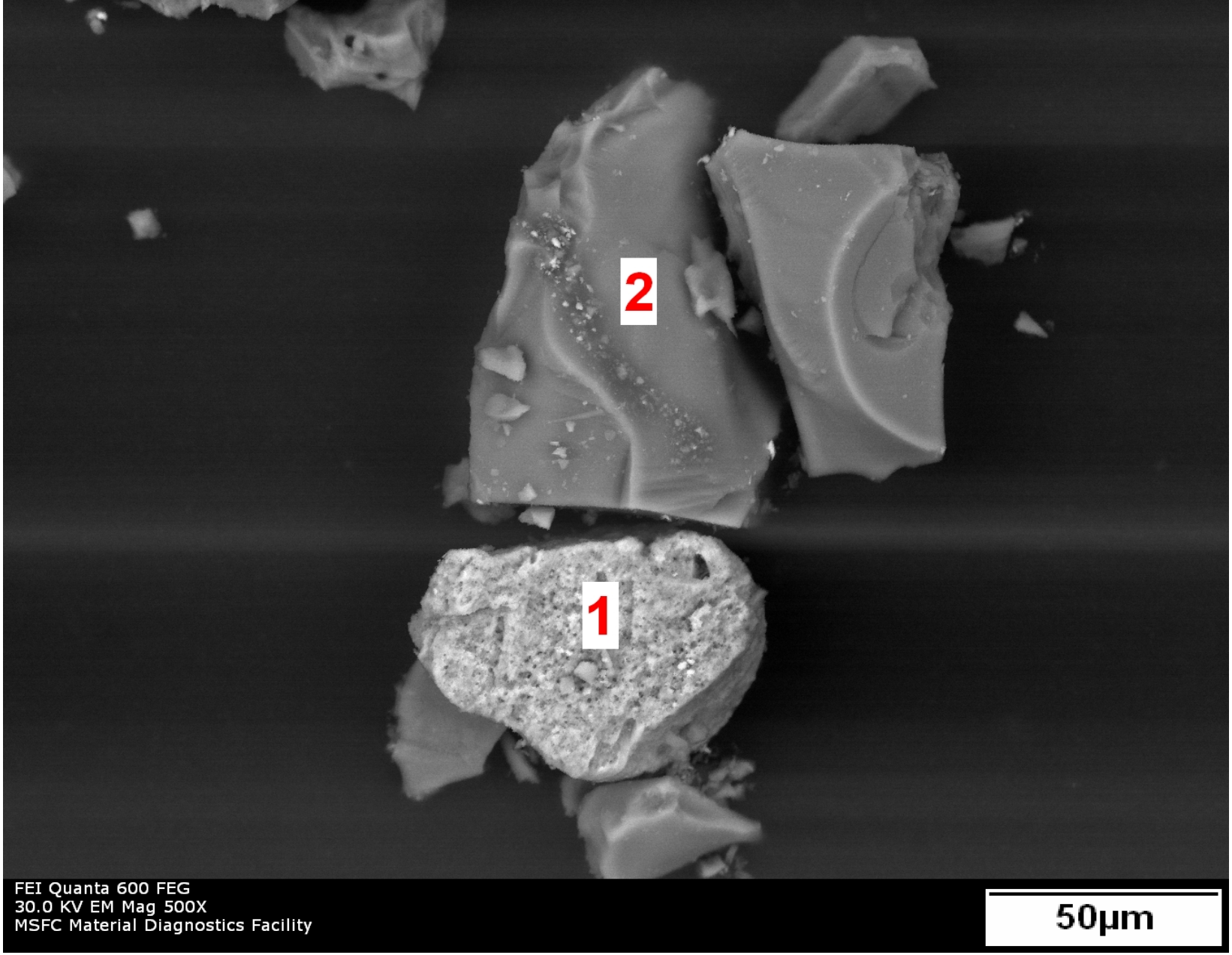
Braycote grease & 5% JSC-1AF --

Calcium map at 250x plus EDS of ROI

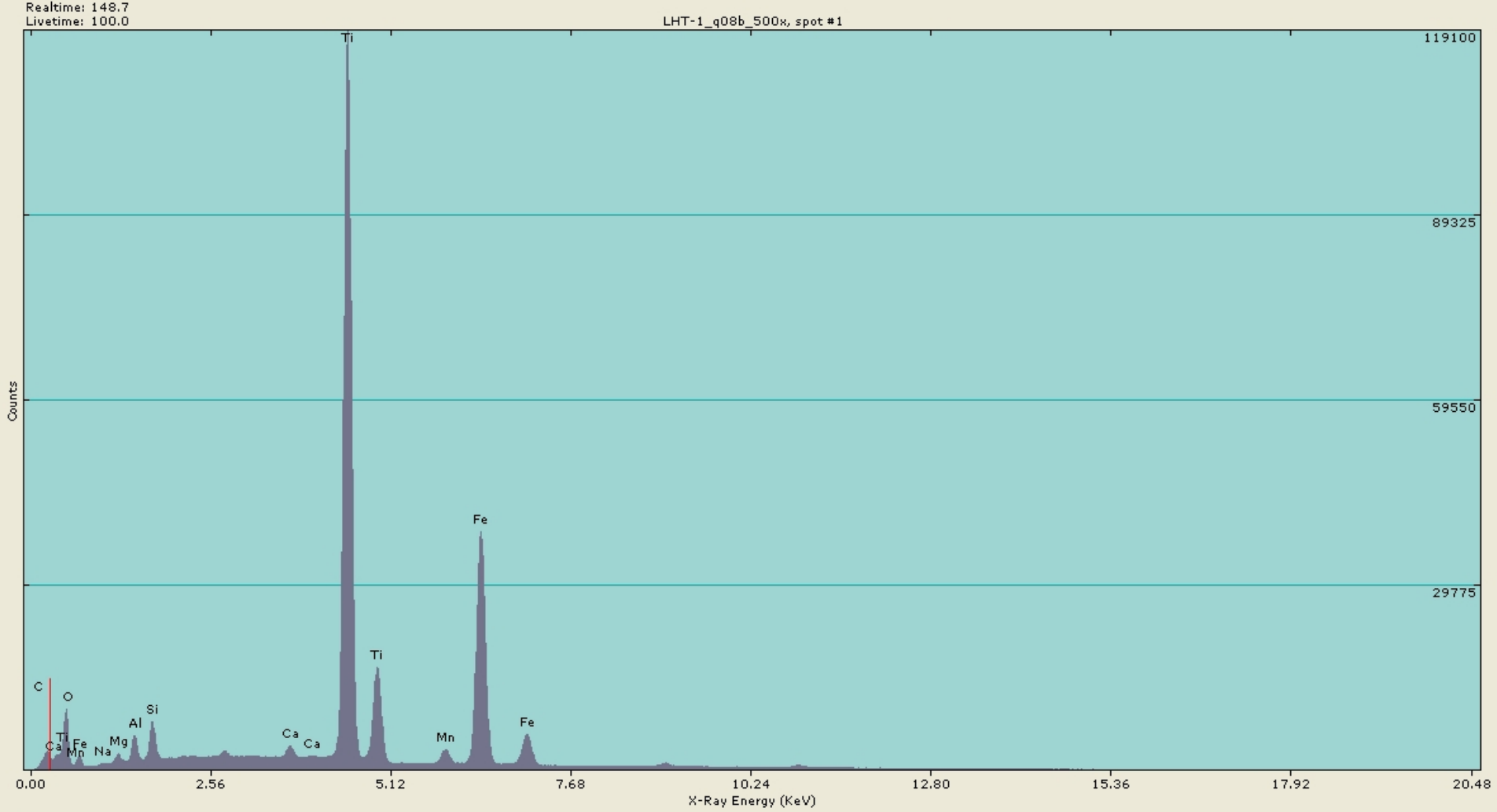
LHT-1



LHT-1 bright and grey phases 1000X



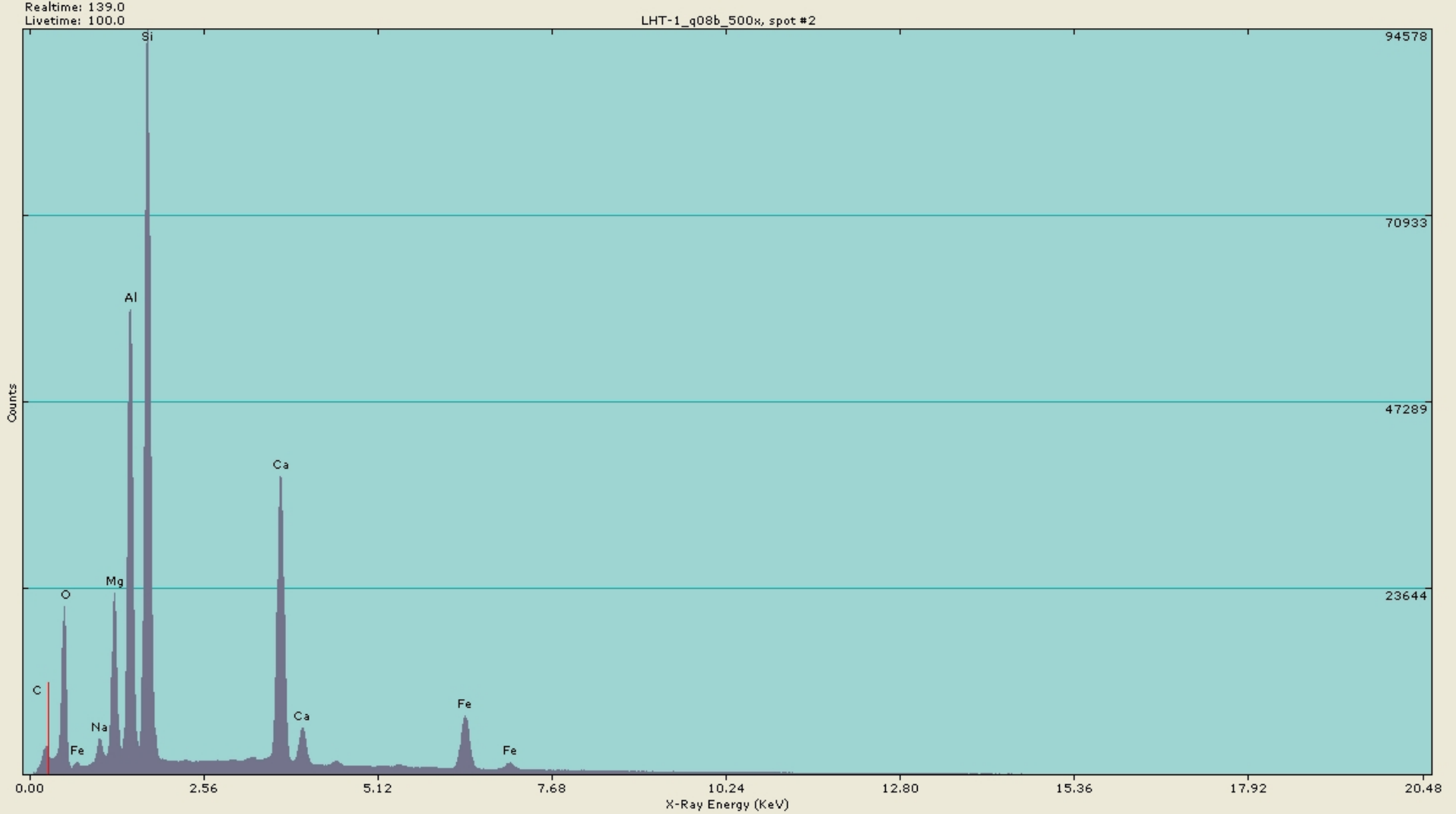
LHT-1 bright phase & grey phase 500X



Quantitative Results for LHT-1_q08b_500x, spot #1
Analysis: Bulk Method: Standardless
Acquired 24-Aug-2007, 30.0 KeV @10 eV/channel

Element	Weight %	Atomic %	Oxide %		k-Ratio	Intensities
O	34.97	61.88	0.00		0.0000	0.0
Na	0.06	0.07	0.08	(Na2O)	0.0001	460.9
Mg	0.63	0.73	1.04	(MgO)	0.0018	7691.7
Al	1.73	1.82	3.27	(Al2O3)	0.0057	28397.3
Si	1.64	1.65	3.51	(SiO2)	0.0075	45227.6
Ca	0.45	0.32	0.63	(CaO)	0.0047	17416.4
Ti	33.89	20.03	56.53	(TiO2)	0.3249	1174398.9
Mn	0.93	0.48	1.87	(Mn2O7)	0.0077	25010.8
Fe	25.69	13.02	33.06	(FeO)	0.2224	436906.6
Total	100.00		100.00			

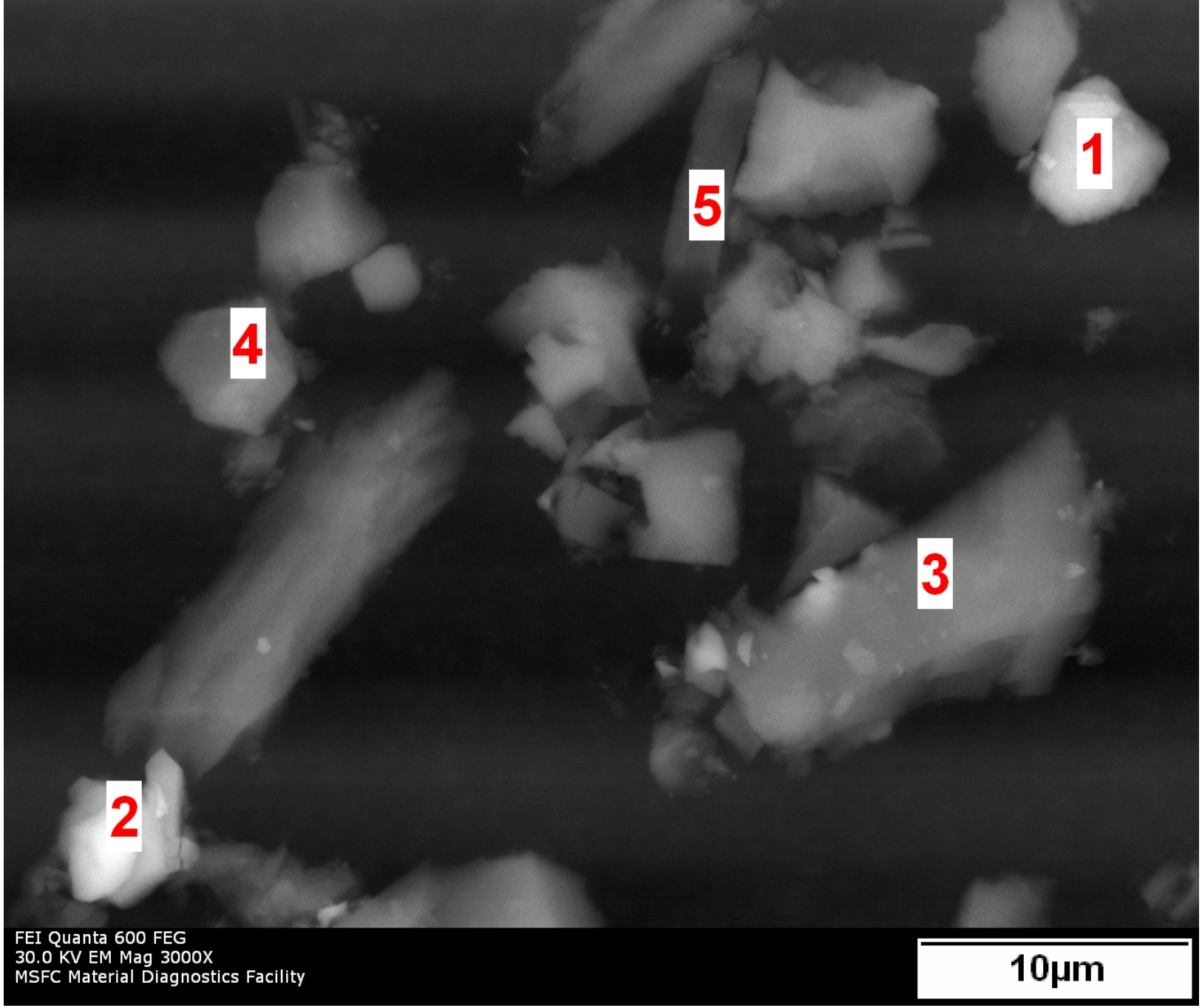
LHT-1 bright phase #1 500X - note Ilmenite



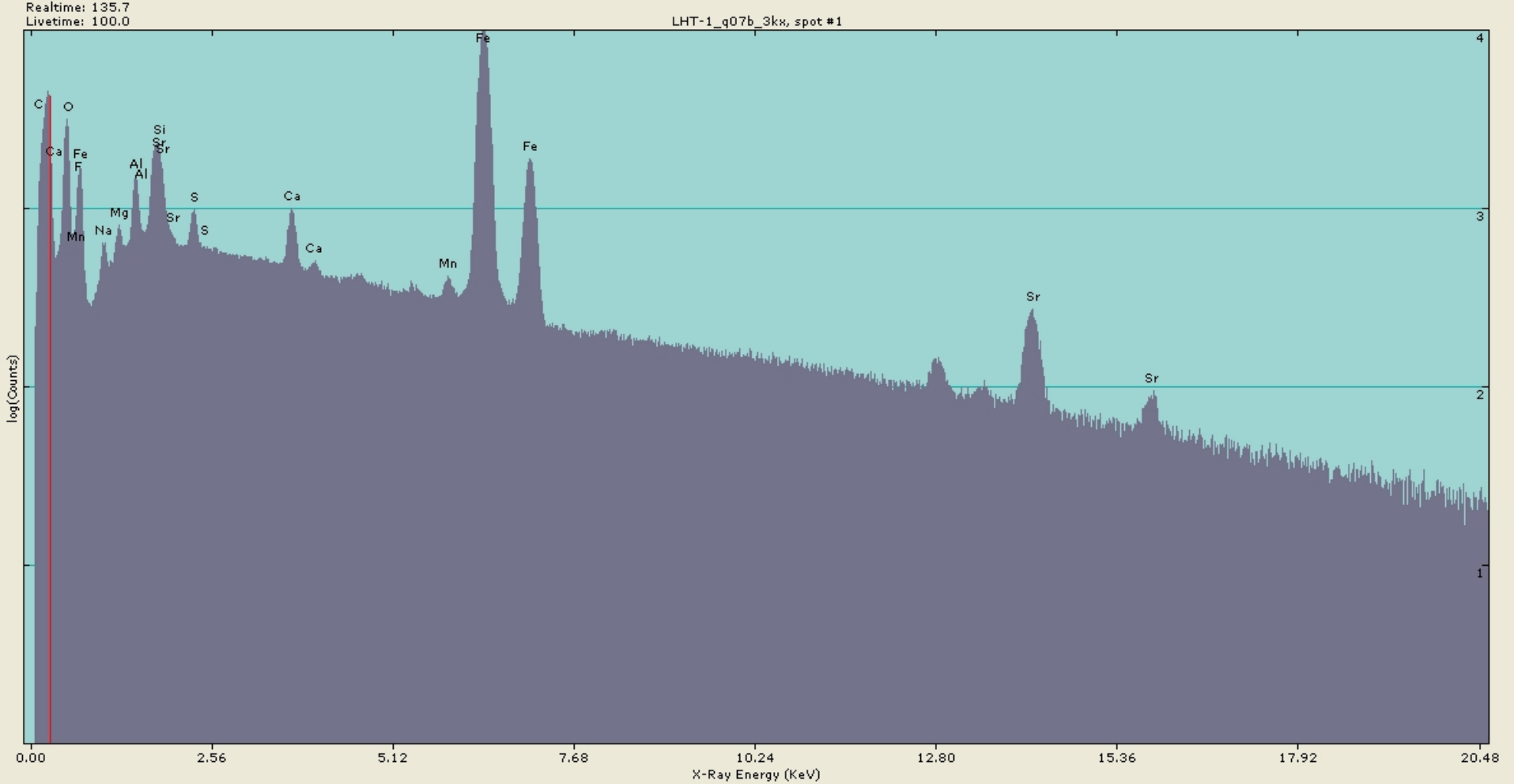
Quantitative Results for LHT-1_q08b_500x, spot #2
Analysis: Bulk Method: Standardless
Acquired 24-Aug-2007, 30.0 KeV @10 eV/channel

Element	Weight %	Atomic %	Oxide %		k-Ratio	Intensities
O	46.69	61.58	0.00		0.0000	0.0
Na	0.86	0.78	1.15	(Na2O)	0.0026	15733.2
Mg	4.56	3.96	7.56	(MgO)	0.0186	137606.4
Al	13.03	10.19	24.62	(Al2O3)	0.0635	433102.8
Si	24.55	18.45	52.53	(SiO2)	0.1190	740598.0
Ca	7.75	4.08	10.84	(CaO)	0.0651	356488.7
Fe	2.57	0.97	3.31	(FeO)	0.0227	77019.2
Total	100.00		100.00			

LHT-1 grey phase #2 500X



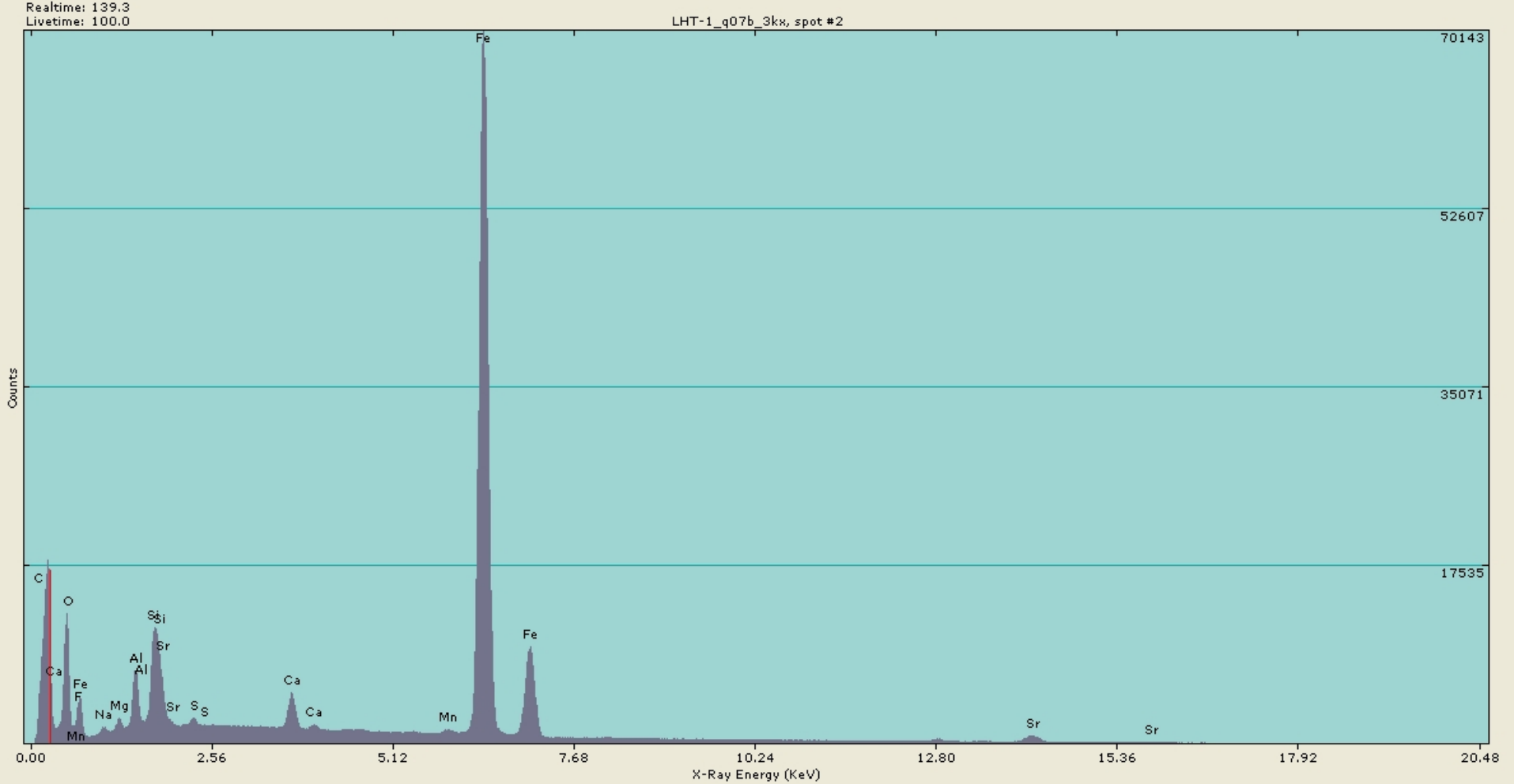
LHT-1 phase bright gradations 3000X



Quantitative Results for LHT-1_q07b_3kx, spot #1
Analysis: Bulk Method: Standardless
Acquired 24-Aug-2007, 30.0 KeV @10 eV/channel

Element	Weight %	Atomic %	Oxide %		k-Ratio	Intensities
O	36.06	60.75	0.00		0.0000	0.0
F	4.11	5.83	16.21	(F2O7)	0.0153	27916.9
Na	0.43	0.51	0.58	(Na2O)	0.0010	2124.2
Mg	0.84	0.93	1.39	(MgO)	0.0022	5290.0
Al	3.70	3.70	6.99	(Al2O3)	0.0112	27106.2
Si	3.73	3.58	7.99	(SiO2)	0.0153	38177.3
S	0.87	0.73	2.18	(SO3)	0.0051	12854.5
Ca	0.90	0.61	1.27	(CaO)	0.0083	19309.1
Mn	0.23	0.11	0.47	(Mn2O7)	0.0022	3274.2
Fe	46.56	22.47	59.90	(FeO)	0.4399	620756.6
Sr	2.56	0.79	3.02	(SrO)	0.0212	4314.9
Total	100.00		100.00			

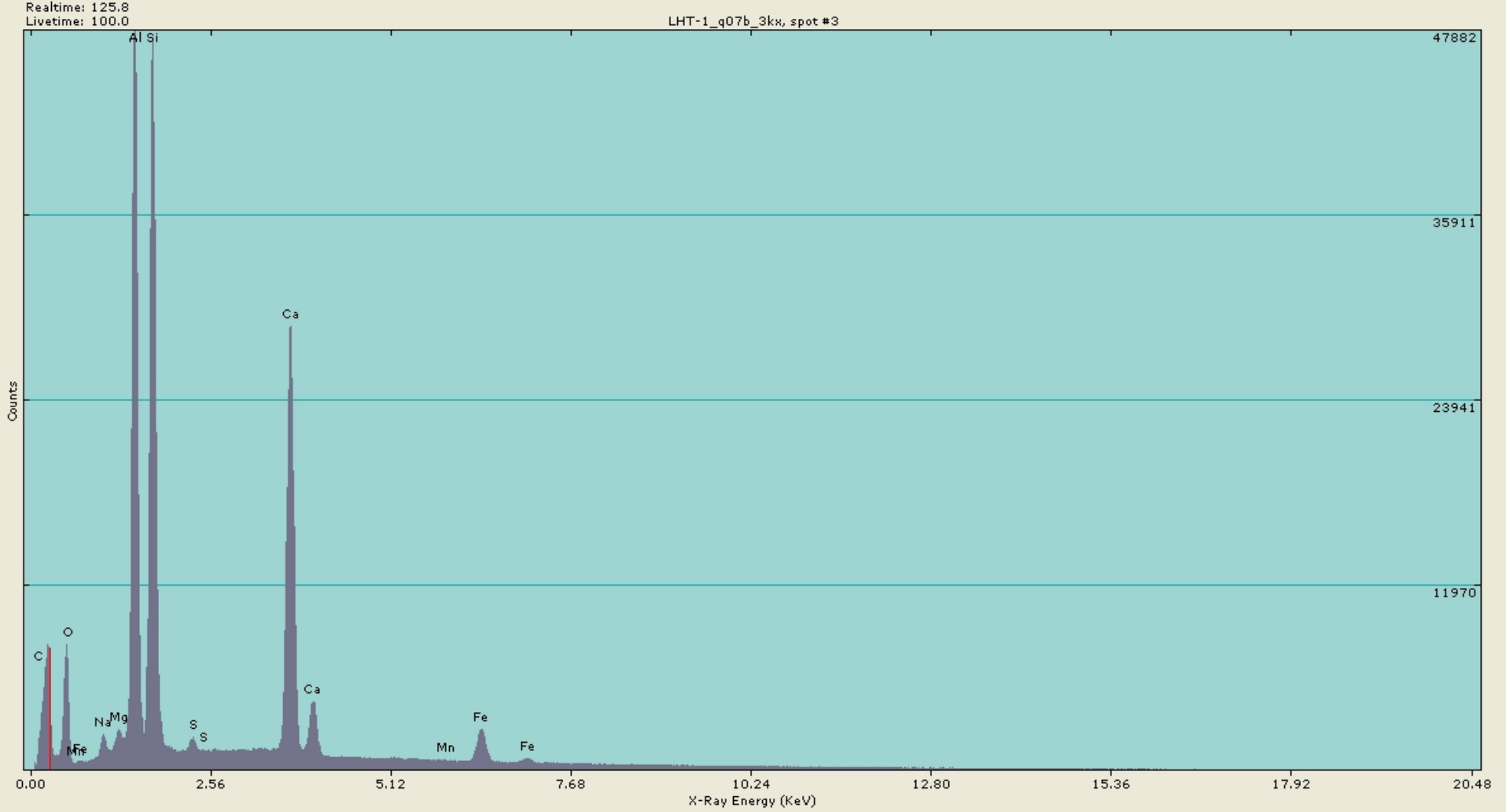
LHT-1 bright phase #1 3000X - note Strontium



Quantitative Results for LHT-1_q07b_3kx, spot #2
Analysis: Bulk Method: Standardless
Acquired 24-Aug-2007, 30.0 KeV @10 eV/channel

Element	Weight %	Atomic %	Oxide %		k-Ratio	Intensities
O	33.01	58.43	0.00		0.0000	0.0
F	2.33	3.47	9.19	(F2O7)	0.0089	20045.5
Na	0.28	0.34	0.38	(Na2O)	0.0007	1690.5
Mg	0.61	0.71	1.00	(MgO)	0.0016	4720.6
Al	4.54	4.77	8.59	(Al2O3)	0.0138	41084.2
Si	4.85	4.90	10.39	(SiO2)	0.0197	60194.9
S	0.40	0.35	0.99	(SO3)	0.0022	6917.0
Ca	1.29	0.91	1.81	(CaO)	0.0118	33517.2
Mn	0.29	0.15	0.59	(Mn2O7)	0.0028	5079.5
Fe	49.15	24.92	63.23	(FeO)	0.4647	803829.1
Sr	3.25	1.05	3.84	(SrO)	0.0271	6749.2
Total	100.00		100.00			

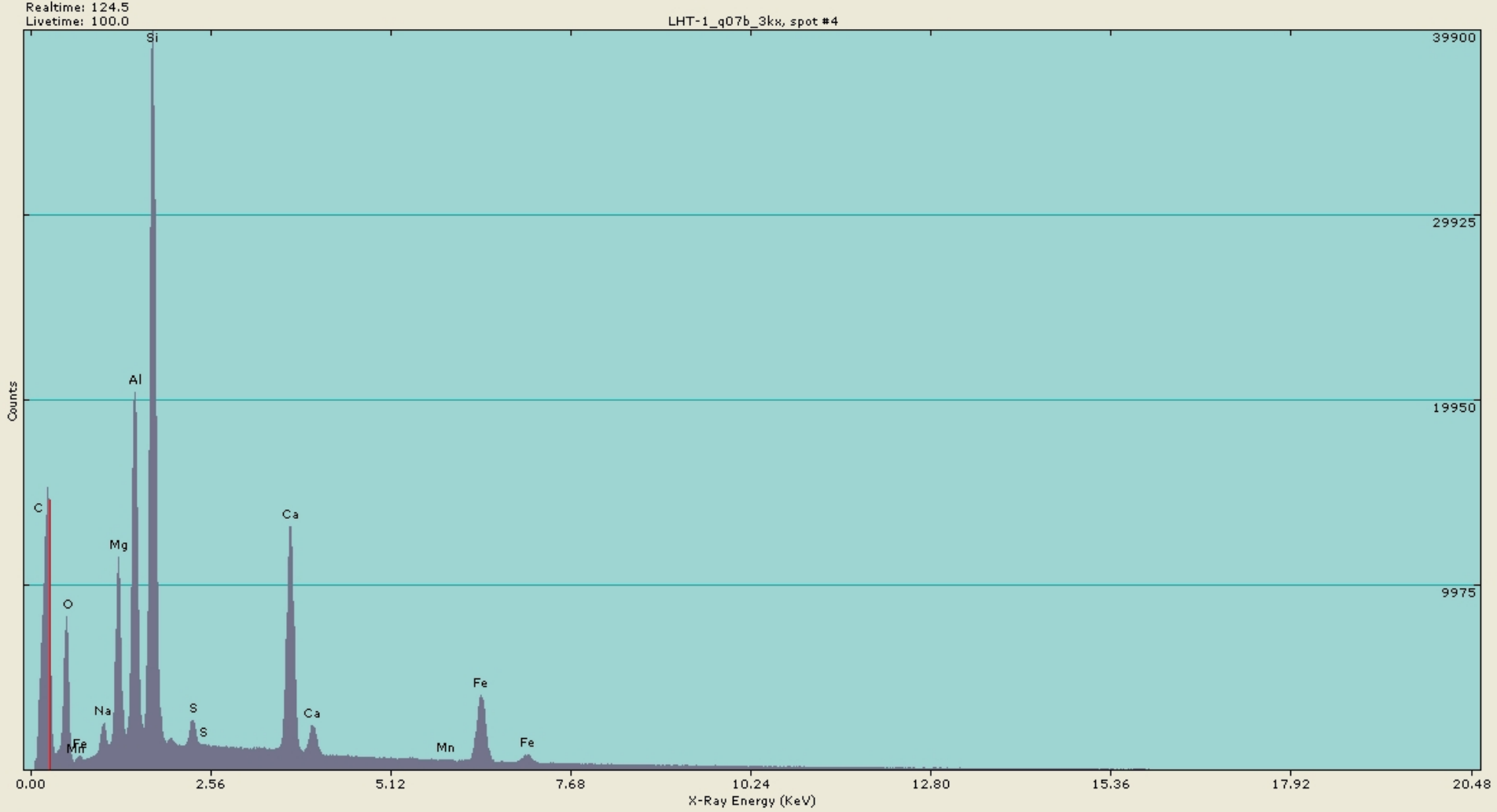
LHT-1 bright phase #2 3000X - note Strontium



Quantitative Results for LHT-1_q07b_3kx, spot #3
Analysis: Bulk Method: Standardless
Acquired 24-Aug-2007, 30.0 KeV @10 eV/channel

Element	Weight %	Atomic %	Oxide %		k-Ratio	Intensities
O	46.82	62.14	0.00		0.0000	0.0
Na	0.56	0.52	0.75	(Na2O)	0.0017	5717.8
Mg	0.41	0.36	0.68	(MgO)	0.0017	6920.7
Al	16.51	12.99	31.19	(Al2O3)	0.0895	359776.8
Si	23.11	17.48	49.45	(SiO2)	0.1122	376265.0
S	0.43	0.28	1.07	(SO3)	0.0023	6917.2
Ca	10.73	5.68	15.01	(CaO)	0.0905	267361.3
Mn	0.00	0.00	0.00	(Mn2O7)	0.0000	23.5
Fe	1.44	0.55	1.85	(FeO)	0.0126	23069.7
Total	100.00		100.00			

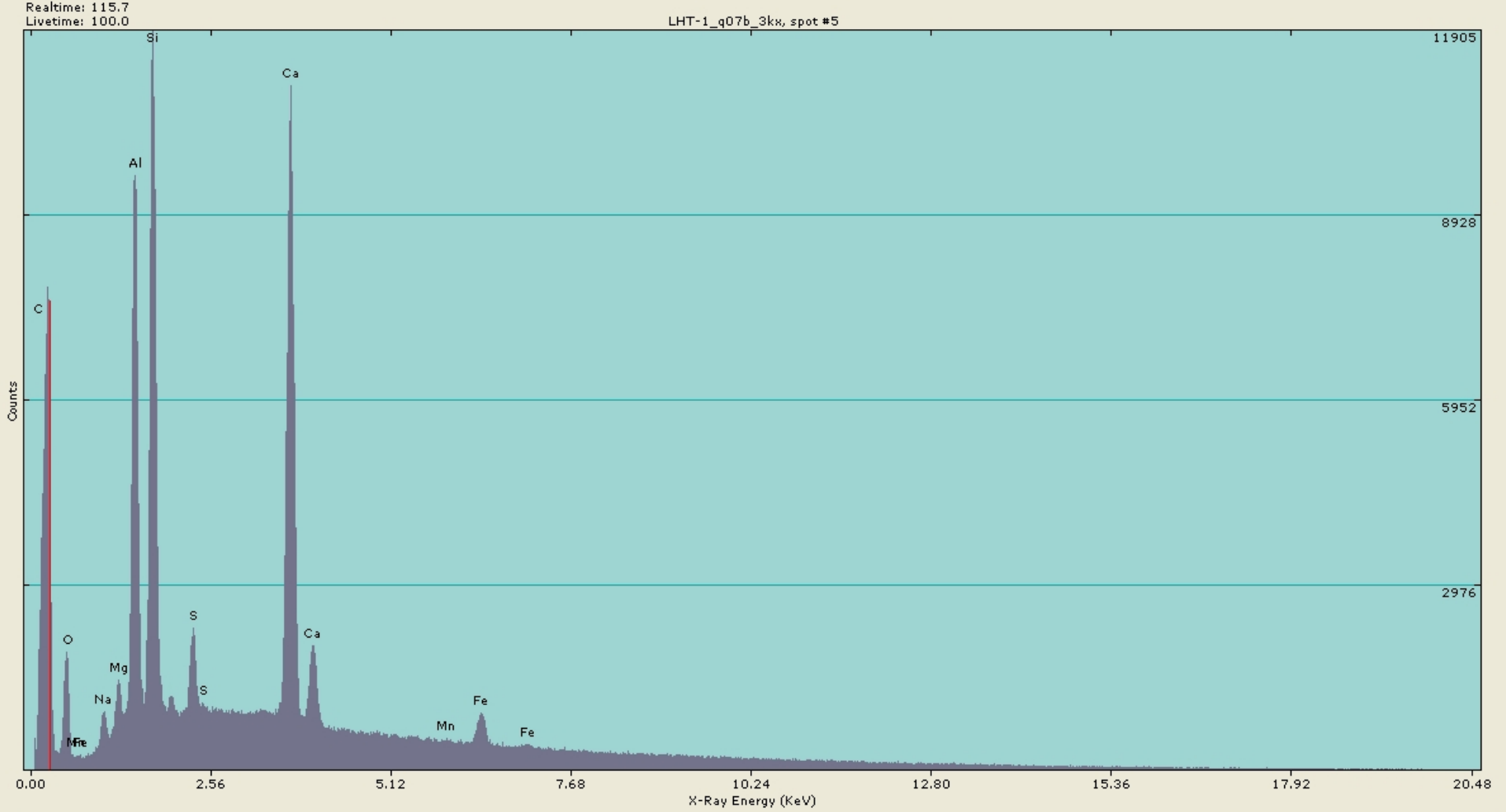
LHT-1 medium bright phase #3 3000X



Quantitative Results for LHT-1_q07b_3kx, spot #4
Analysis: Bulk Method: Standardless
Acquired 24-Aug-2007, 30.0 KeV @10 eV/channel

Element	Weight %	Atomic %	Oxide %		k-Ratio	Intensities
O	47.10	61.97	0.00		0.0000	0.0
Na	0.89	0.82	1.20	(Na2O)	0.0027	6728.4
Mg	5.33	4.62	8.84	(MgO)	0.0215	65897.9
Al	11.28	8.80	21.31	(Al2O3)	0.0534	149538.7
Si	24.78	18.57	53.02	(SiO2)	0.1220	316611.4
S	1.01	0.66	2.51	(SO3)	0.0053	12335.5
Ca	6.30	3.31	8.81	(CaO)	0.0527	119233.1
Mn	0.06	0.02	0.11	(Mn2O7)	0.0005	704.5
Fe	3.26	1.23	4.19	(FeO)	0.0289	40699.9
Total	100.00		100.00			

LHT-1 medium bright phase #4 3000X



Quantitative Results for LHT-1_q07b_3kx, spot #5
Analysis: Bulk Method: Standardless
Acquired 24-Aug-2007, 30.0 KeV @10 eV/channel

Element	Weight %	Atomic %	Oxide %		k-Ratio	Intensities
O	46.04	61.85	0.00		0.0000	0.0
Na	1.10	1.02	1.48	(Na2O)	0.0033	2886.0
Mg	1.33	1.17	2.20	(MgO)	0.0053	5685.2
Al	13.40	10.67	25.31	(Al2O3)	0.0691	72294.0
Si	20.57	15.74	44.00	(SiO2)	0.1031	95318.0
S	2.32	1.56	5.80	(SO3)	0.0129	10958.6
Ca	13.94	7.47	19.50	(CaO)	0.1182	95216.2
Mn	0.03	0.01	0.06	(Mn2O7)	0.0002	125.1
Fe	1.29	0.50	1.66	(FeO)	0.0112	5544.0
Total	100.00		100.00			

LHT-1 grey phase #5 3000X - note Sulfur