When and how to use XRF for Analysis of Obsidian

Based on fundamental physics, which we have not yet found a way to violate:

1. One should never determine the ppm concentration of a non-uniform material using XRF. You must convert it to a uniform material first.
2. Nor can one ever use XRF to report content it cannot measure like C, O and H unless the compound it is bound to is known and part of the compound is measurable. So the content listed in this calibration is only the ppm of the elements that are measured. It does not add up to 100 percent.
3. The Tracer spot size is approximately 3 by 4 mm, if your substance has a mixture of particles smaller than 0.2 mm and they are well mixed then you will get a reasonable result.
4. Obsidian is Mother Nature's glass and is essentially a very stiff liquid and thus found to be elementally very uniform, even over very large volcanic flows.
5. Dr. Jeff Ferguson and Mike Glasscock of the University of Missouri selected a very unique set of obsidians that cover a large range of elements found in natural obsidian materials.
6. Bruker provided a calibration that is very accurate based on a calibration done on each instrument by specifically analyzing a set of 40 of these MURR obsidians.
7. Note obsidian with any covering like dirt on them are VERY non-uniform and the analysis will not be correct!
8. Your sample also has to be infinitely thick relative to the range of the emitted photon from each element of interest. See table 1 **below**.
9. Your sample must be thicker than the values listed for each element noted. Since Zr is of particular interest you can see to be very accurate you sample should be thicker than 4 mm.
10. Oxygen is listed for reference; we do not measure it directly with a Tracer.

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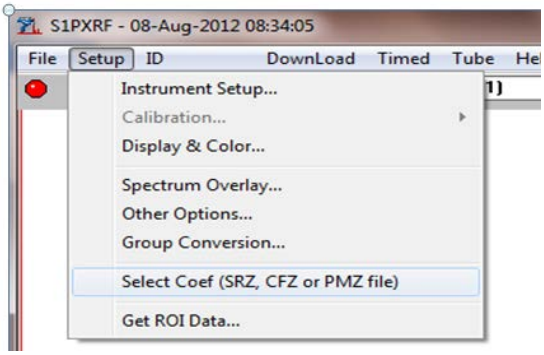
Element	Photon Emitted energy (keV)	Analysis depth in obsidian(cm)
O	0.53	0.000001
Na	1.04	0.0007
Mg	1.2	0.00096
Al	1.47	0.0017
Si	1.74	0.0027
P	2.01	0.0013
Ca	3.69	0.0064
Cr	5.41	0.0192
Fe	6.4	0.03
Cu	8.01	0.058
Zn	8.64	0.077
Pb	10.55	0.113
Zr	15.78	0.384

Note

- This calibration is located in the instrument folder.
- GL1.cfz* is a 40kV calibration used for trace elements. Run your unknown analysis using the green filter, no vacuum, at 40 kV and current evident in the Calibration *.PDZ files.

1) To calculate the concentration of a spectrum, **OPEN** the S1PXRF program
2) **OPEN** the spectrum file.



3) **SELECT** Setup > Select Coef (SRZ, CFZ or PMZ file).
4) **SELECT** the appropriate file from the calibration folder: GL1.CFZ for the trace element analysis
5) **CLICK** the CONC button. See example below
6) If you wish to save the data in a spread sheet then CLICK On the name block under the word copy, this will highlight the entire table. Then CLICK on copy and you can then paste the entire table in and excel table. **NOTE**: Use the numbers in the popup that are on the right of the box; the units are in weight percent.
7) For large data sets see "How to Perform a Chemistry Analysis of Large Data Sets.pdf".

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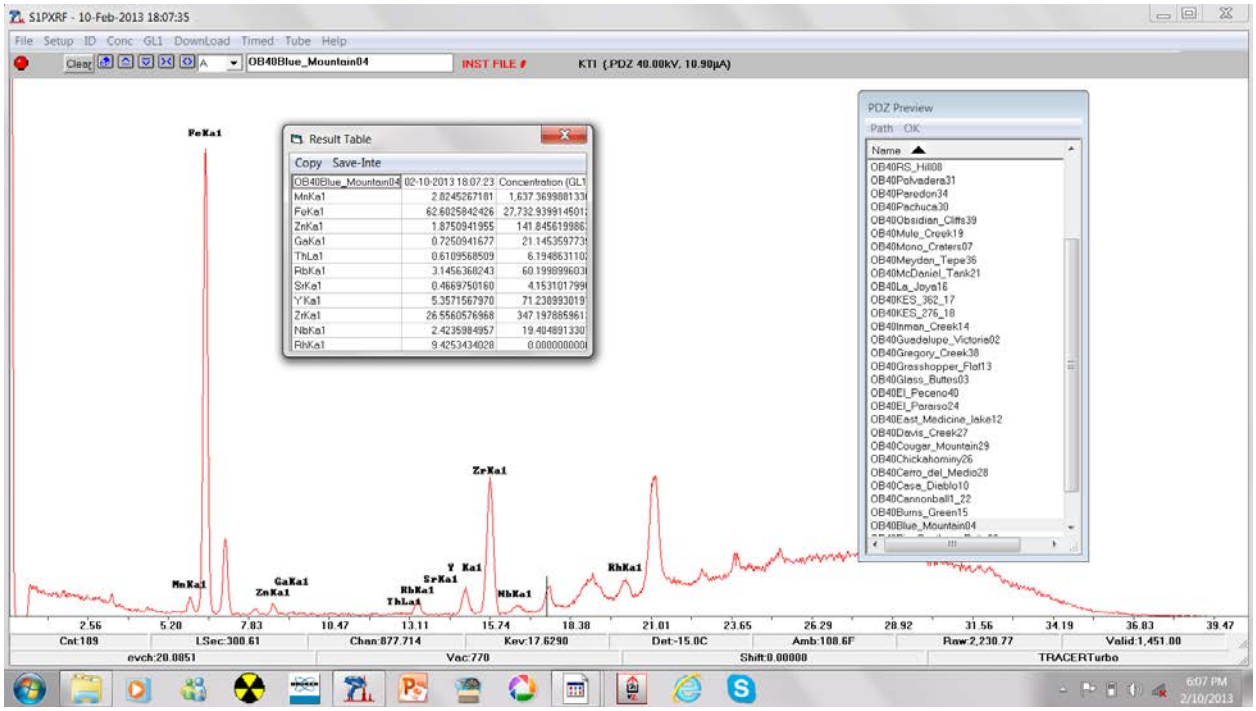
Table of sample concentration Provided by MURR

PPM	Mn	Fe	Zn	Ga	Th	Rb	Sr	Y	Zr	Nb
OB40Obsidian01	755	3690	59	25	12.0	172	13.4	42	60	35
OB40Obsidian02	519	4255	27	15	7.6	91	59.5	15	74	10
OB40Obsidian03	328	6179	28	12	8.5	94	54.7	27	106	7
OB40Obsidian04	1634	27448	160	30	6.2	59	0.8	76	380	20
OB40Obsidian05	592	8587	50	19	1.5	32	168.0	30	135	2
OB40Obsidian06	297	11669	253	32	19.0	273	0.2	207	292	286
OB40Obsidian07	357	7773	43	19	18.8	179	5.9	27	118	18
OB40Obsidian08	441	7203	134	26	42.7	361	0.6	85	159	239
OB40Obsidian09	250	7578	32	15	9.2	113	82.7	23	123	7
OB40Obsidian10	279	9278	33	21	15.3	145	108.1	15	181	14
OB40Obsidian11	521	4674	31	18	7.6	98	43.0	25	76	11
OB40Obsidian12	264	10410	34	18	15.1	141	70.0	25	192	8
OB40Obsidian13	269	9234	32	24	13.0	135	68.1	26	177	12
OB40Obsidian14	537	10825	52	19	6.7	81	139.1	19	95	7
OB40Obsidian15	458	17193	126	21	7.7	98	1.7	77	585	41
OB40Obsidian16	582	18851	129	26	15.8	157	0.8	70	739	63
OB40Obsidian17	1775	53658	592	19	82.9	436	6.1	415	3066	640
OB40Obsidian18	1077	23364	139	18	35.8	203	51.5	88	1049	290
OB40Obsidian19	403	6619	39	19	28.6	229	10.5	39	110	27
OB40Obsidian20	1082	68537	123	27	0.8	11	291.3	21	90	3
OB40Obsidian21	632	9990	64	18	17.9	155	167.2	39	249	37
OB40Obsidian22	461	23295	212	26	40.7	338	0.9	118	1060	124
OB40Obsidian23	649	25160	175	19	26.1	205	1.5	101	1038	87
OB40Obsidian24	234	19350	242	32	29.8	219	0.4	171	1113	61
OB40Obsidian25	1215	43835	278	20	21.5	186	8.8	136	1116	129
OB40Obsidian26	434	11808	64	17	7.7	104	21.6	53	289	21
OB40Obsidian27	410	5283	28	13	9.6	108	57.7	18	95	11
OB40Obsidian28	414	7121	57	16	16.2	150	3.4	42	163	48
OB40Obsidian29	308	8148	70	19	6.9	92	32.4	50	127	12
OB40Obsidian30	1113	16267	212	18	18.7	198	2.1	108	878	86
OB40Obsidian31	448	3810	33	17	16.4	144	3.8	21	76	43
OB40Obsidian32	255	12382	103	23	14.4	148	0.3	52	432	34
OB40Obsidian33	172	10633	39	20	35.8	278	33.9	53	225	21
OB40Obsidian34	365	8527	57	24	17.4	164	4.6	46	203	43
OB40Obsidian35	546	8666	48	17	14.9	114	282.8	20	120	19
OB40Obsidian36	538	9349	73	19	23.7	196	15.5	50	266	32
OB40Obsidian37	351	5465	30	16	16.4	131	20.9	23	98	17
OB40Obsidian38	670	6491	42	20	3.8	74	137.3	22	74	14

OB40Obsidian39	309	7300	30	15	6.9	76	100.8	16	99	7
OB40Obsidian40	886	6098	53	17	11.5	215	273.9	16	126	26



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