Analytical Report

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Report ID: **AgReport- A14-00203**

Sample Name: **St. George Black**

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Analysis Methods

1) FUS-ICP (Fusion-Inductively Coupled Plasma)
An oxidized sample is dissolved in a borate flux and then diluted in aqueous nitric acid. ICP-OES is used to quantify various elements in the resulting solution.

2) TD-ICP (Total Digestion-Inductively Coupled Plasma)
A sample is digested via sequential addition of hydrofluoric, perchloric, and nitric acids. The acids are evaporated and the residue reconstituted in aqua regia. ICP-OES is used to quantify various elements in the resulting solution.

3) INAA (Instrumental Neutron Activation Analysis)
Samples are bombarded with neutrons to generate radioactive nuclides. Measurement of the energy and intensity of the alpha particles generated by their subsequent decay is used to quantify the various elements present in the original sample.

4) PGNAA (Prompt Gamma Neutron Activation Analysis)
Similar to INAA, except the energy and intensity of the alpha particles generated during neutron bombardment is used to quantify the various elements present in the original sample.

5) IR (Infrared)
To determine %C and %S, a sample is burned with an accelerator in an induction furnace to convert all carbon to carbon dioxide and all sulfur to sulfur dioxide. Carbon dioxide and sulfur dioxide are quantified using separate infrared detectors as they absorb infrared light at characteristic frequencies.

	Test Value	Unit Symbol	Detection Limit	Analysis Method
Silicon dioxide (SiO2)	44.76	%	0.01	FUS-ICP
Aluminium oxide (Al2O3)	11.28	%	0.01	FUS-ICP
Iron oxide (Fe2O3(T))	4.63	%	0.01	FUS-ICP
Manganese oxide (MnO)	0.07	%	0.01	FUS-ICP
Magnesium oxide (MgO)	2.47	%	0.01	FUS-ICP
Calcium oxide (CaO)	15.61	%	0.01	FUS-ICP
Sodium oxide (Na2O)	0.96	%	0.01	FUS-ICP
Potassium oxide (K2O)	2.65	%	0.01	FUS-ICP
Titanium dioxide (TiO2)	0.514	%	0.005	FUS-ICP
Phosphorus pentoxide (P2O5)	0.15	%	0.01	FUS-ICP
Loss on Ignition (LOI)	16.11	%		FUS-ICP
Total	99.21	%	0.01	FUS-ICP
Gold (Au)	< 5	ppb	5	INAA
Silver (Ag)	< 0.5	ppm	0.5	2 / 3
Arsenic (As)	14	ppm	2	INAA
Barium (Ba)	356	ppm	3	1 / 3
Beryllium (Be)	2	ppm	1	FUS-ICP
Bismuth (Bi)	< 2	ppm	2	TD-ICP
Bromine (Br)	< 1	ppm	1	INAA
Cadmium (Cd)	< 0.5	ppm	0.5	TD-ICP
Cobalt (Co)	19	ppm	1	INAA
Chromium (Cr)	52	ppm	1	INAA
Cesium (Cs)	4.7	ppm	0.5	INAA
Copper (Cu)	32	ppm	1	TD-ICP
Hafnium (Hf)	2.8	ppm	0.5	INAA
Mercury (Hg)	< 1	ppm	1	INAA
Iridium (Ir)	< 5	ppb	5	INAA
Molybdenum (Mo)	2	ppm	2	TD-ICP
Nickel (Ni)	42	ppm	1	TD-ICP
Lead (Pb)	11	ppm	5	TD-ICP
Rubidium (Rb)	130	ppm	20	INAA
Sulfur (S)	1.160	%	0.001	TD-ICP
Antimony (Sb)	0.7	ppm	0.2	INAA
Scandium (Sc)	10.4	ppm	0.1	INAA
Selenium (Se)	< 3	ppm	3	INAA
Strontium (Sr)	836	ppm	2	FUS-ICP
Tantalum (Ta)	< 1	ppm	1	INAA
Thorium (Th)	8.6	ppm	0.5	INAA
Uranium (U)	4.7	ppm	0.5	INAA
Vanadium (V)	112	ppm	5	FUS-ICP
Tungsten (W)	< 3	ppm	3	INAA
Yttrium (Y)	21	ppm	1	FUS-ICP
Zinc (Zn)	63	ppm	1	TD-ICP
Zirconium (Zr)	96	ppm	2	FUS-ICP
Lanthanum (La)	29.1	ppm	0.2	INAA
Cerium (Ce)	61	ppm	3	INAA
Neodymium (Nd)	54	ppm	5	INAA
Samarium (Sm)	5.0	ppm	0.1	INAA
Europium (Eu)	0.9	ppm	0.1	INAA
Terbium (Tb)	< 0.5	ppm	0.5	INAA
Ytterbium (Yb)	2.4	ppm	0.1	INAA
Lutetium (Lu)	0.47	ppm	0.05	INAA
Mass	0.940	g		INAA
Boron (B)	72	ppm	2	PGNAA
Mass	1.010	g		PGNAA
Total Carbon (C)*	4.91*	%	0.01	IR
Total Sulfur (S)*	1.13*	%	0.01	IR
Organic Carbon (calculated)	0.93	%	0.05	IR
Carbon Dioxide (CO2)	13.00	%	0.01	IR
Sulfate (SO4)	1.5	%	0.3	IR
Total Kjeldahl Nitrogen (TKN)	0.1	%	0.1	Analyzer

*Result reported from Report A12-02220

Results Approved By:

Steve Jenkins, PhD