

	<p style="text-align: center;">Geochemistry</p> <p style="text-align: center;">North America</p>	<p>Doc Type Method Summary Method No: GE_ICM21B20 Code (GE_ICP21B20 and GE_IMS21B20)</p> <p>Service Testing Issued Date April 2022</p> <p>Approved by K. Williams</p>
<p>Natural Resources</p>	<p>Multi-element determination on exploration grade samples by Aqua Regia Digestion and a Combination of Inductively Coupled Plasma Emission Spectrometry (ICP-OES) and Inductively Coupled Plasma Mass Spectrometry (ICP-MS)</p> <p>[HCl; HNO₃; Ag; Al; As; Ba; Be; Bi; Ca; Cd; Ce; Co; Cr; Cs; Cu; Fe; Ga; Ge; Hf; Hg; In; K; La; Li; Lu; Mg; Mn; Mo; Na; Nb; Ni; P; Pb; Rb; Re; S; Sb; Sc; Se; Sn; Sr; Ta; Te; Tb; Th; Tl; Ti; U; V; W; Y; Yb, Zn; Zr]</p>	

1. Parameter(s) measured, unit(s):

Silver (Ag); Arsenic (As); Barium (Ba); Beryllium (Be); Bismuth (Bi); Cadmium (Cd); Cerium (Ce); Chromium (Cr); Cobalt (Co); Cesium (Cs); Copper (Cu); Gallium (Ga); Germanium (Ge); Hafnium (Hf); Indium (In); Lanthanum (La); Lithium (Li); Lutetium (Lu); Manganese (Mn); Mercury (Hg); Molybdenum (Mo); Niobium (Nb); Nickel (Ni); Lead (Pb); Rubidium (Rb); Rhenium (Re); Antimony (Sb); Scandium (Sc); Selenium (Se); Tin (Sn); Strontium (Sr); Tantalum (Ta); Tellurium (Te); Terbium (Tb); Thallium (Tl); Thorium (Th); Uranium (U); Vanadium (V); Tungsten (W); Yttrium (Y); Ytterbium (Yb); Zinc (Zn); Zirconium (Zr), in ppm
Aluminum (Al); Calcium (Ca); Iron (Fe); Potassium (K); Magnesium (Mg); Sodium (Na); Phosphorus (P); Sulphur (S); Titanium (Ti) in %

This is a partial digestion and some elements yield low recoveries low recoveries, due to volatilization during the digestion stage or incomplete dissolution of minerals such as chromite, zircon, rutile, etc

2. Typical sample size:

0.25 g

3. Type of sample applicable (media):

Crushed and Pulverized exploration grade samples (rocks, soils and sediments)

4. Sample preparation technique used:

Weighed representative samples are digested with HCl and HNO₃, with the acids in a 3:1 ratio. This digestion is recommended for samples which contain no organic material and are low in sulphide mineral content.

5. Method of analysis used:

The digested sample solution is analyzed by Inductively Coupled Plasma Mass Spectrometer (ICP-MS) and Inductively Coupled Plasma Optical Emission Spectrometer (ICP-OES).

6. Data reduction by:

Computer, on line, data fed to SGS Laboratory Information Management System with secure audit trail.

7. Figures of Merit:

This method has been fully validated for the range of samples typically analyzed. Method validation includes the use of certified reference materials, replicates, duplicates and blanks to calculate accuracy, precision, linearity, range, limit of detection, reporting limit, specificity and measurement uncertainty.

The Reporting Limit has been determined as follows:

Element	Reporting Limit (ppm)	Upper Limit	Element	Reporting Limit (ppm)	Upper Limit	Element	Reporting Limit (ppm)	Upper Limit
Ag	0.01	100 ppm	Fe	0.01(%)	15%	Na	0.005(%)	15%
Al	0.005 (%)	15%	Ga	0.1	1%	Nb	0.05	0.1%
As	1	1%	Ge	0.1	1%	Ni	0.2	1%
Ba	2	1%	Hf	0.05	0.05%	P	0.003(%)	15%
Be	0.05	0.01%	Hg	0.01	0.01%	Pb	0.2	1%
Bi	0.01	1%	In	0.005	0.05%	Rb	0.05	1%
Ca	0.002(%)	15%	K	0.005(%)	15%	Re	0.02	50 ppm
Cd	0.01	1%	La	0.1	1%	S	0.01(%)	5%
Ce	0.02	0.1%	Li	0.5	1%	Sb	0.05	1%
Co	0.1	1%	Lu	0.01	0.1%	Sc	0.1	1%
Cr	1	1%	Mg	0.001(%)	15%	Se	1	0.1%
Cs	0.05	0.1%	Mn	2	1%	Sn	0.2	0.1%
Cu	0.5	1%	Mo	0.05	1%	Sr	0.5	1%

Element	Reporting Limit (ppm)	Upper Limit
Ta	0.01	1%
Tb	0.02	1%
Te	0.05	0.1%
Th	0.05	1%
Ti	0.001(%)	15%
Tl	0.02	1%
U	0.05	1%
V	1	1%
W	0.05	1%
Y	0.05	1%
Yb	0.1	0.01%
Zn	1	1%
Zr	0.5	1%

Bolded elements are generally reported by ICP-OES

8. Quality control:

Quality control materials include method blanks, replicates and reference materials and are randomly inserted with the frequency set according to method protocols at ~11%. Quality control materials will also include BRM (Barren reference materials, or preparations blanks) and preparation duplicates if samples have been taken through the sample reduction process. Instrument calibration is performed for each batch or work order and calibration checks are analyzed within each analytical run.

9. Accreditation:

SGS Natural Resources conforms to the requirements of ISO/IEC 17025. Scopes of Accredited tests are site specific, please visit <https://www.scc.ca/en/search/laboratories>