

	Geochemistry Global	Doc Type Method Summary Method Code GE_IMS21B20 Service Testing Issued Date July 2024
Natural Resources	Multi-element Determination in Exploration Grade Samples by Aqua Regia Digestion and Inductively Coupled Plasma Mass Spectrometry (ICP-MS)	Approved by K. Williams

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

Silver (Ag); Arsenic (As); Barium (Ba); Beryllium (Be); Bismuth (Bi); Boron (B); 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); Titanium (Ti) in %

This is a partial digestion and some elements yield 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).

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 (ppm)	Element	Reporting Limit (ppm)	Upper Limit (ppm)	Element	Reporting Limit (ppm)	Upper Limit (ppm)
Ag	0.01	10	Ga	0.1	10000	Ni	0.2	10000
Al	0.01 %	10%	Ge	0.1	10000	P	0.01%	1%
As	1	10000	Hf	0.05	500	Pb	0.2	10000
Ba	5	10000	Hg	0.01	100	Re	0.02	50
Be	0.05	100	In	0.005	500	Rb	0.05	10000
Bi	0.01	10000	K	0.01%	10%	Sb	0.05	10000
Ca	0.01%	15%	La	0.1	10000	Sc	0.1	10000
Cd	0.01	10000	Li	0.5	10000	Se	1	1000
Ce	0.02	1000	Lu	0.01	1000	Sn	0.2	1000
Co	0.1	10000	Mg	0.01%	15%	Sr	0.5	10000
Cr	1	10000	Mn	2	10000	Ta	0.01	10000
Cs	0.05	1000	Mo	0.05	10000	Tb	0.02	10000
Cu	0.5	10000	Na	0.01%	10%	Te	0.05	1000
Fe	0.01%	15%	Nb	0.05	1000	Th	0.05	10000

Element	Reporting Limit (ppm)	Upper Limit
Ti	0.01%	10%
Tl	0.02	10000
U	0.05	10000
V	1	10000
W	0.05	10000
Y	0.05	10000
Yb	0.1	100
Zn	1	10000
Zr	0.5	10000

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 [Accredited Organizations | Standards Council of Canada \(scc-ccn.ca\)](https://www.sgs.ca/en/mining)