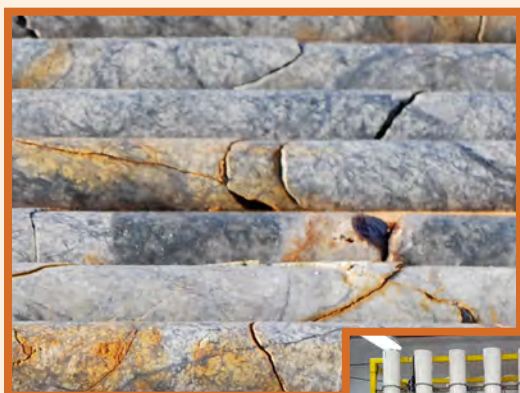


Arizona Assayers Inc. d.b.a.

# SKYLINE

ASSAYERS & LABORATORIES

For All Your Analytical Needs - From Exploration Through Development



## 2018 Schedule of Services and Fees Mexico



[www.skylinelabs.com](http://www.skylinelabs.com)

# About Us

## History of Skyline Assayers & Laboratories

Skyline Laboratories, Inc. purchased the assets of Hawley and Hawley Assayers & Chemists, Tucson, Arizona in 1973. Hawley and Hawley Assayers was recognized as one of the leading minerals laboratories in the Southwest with over 60 years experience in the Copper Industry. In 1997 Skyline Laboratories, Inc. was purchased by Actlabs, Inc. and began "doing business as" Actlabs-Skyline. As of January 1, 2006 the laboratory again became independent. Skyline Assayers & Laboratories is the d.b.a of Arizona Assayers Inc. Skyline is recognized as an industry leader for base metals, ferrous and non-ferrous analyses of ores, and umpire assays of metallurgical products. The Tucson laboratory continues to provide the same high quality analytical service to the Copper Mining Industry as it has for over a century.

## Staff

### **J. Robert Clark, Ph.D.                      President, Geologist/Geochemist**

Dr. Clark is the sole owner of Skyline Assayers & Laboratories. Dr. Clark is the inventor of the *Enzyme Leach<sup>SM</sup>* and he co-developed the MAGIC organic extraction system that has been widely used in a variety of analytical disciplines.

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### **Nancy G. Gungor                              Vice President of Business Operations, Quality Manager**

Nancy joined Skyline in 2008. Business graduate from the University of Arizona, in the mining industry since 2002. Nancy has experience in working with and establishing logistics for clients in US, Canada, Mexico, Central America, Democratic Republic of Congo, South Africa and Zambia.

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### **Mike Jacobson                                      Chief Assayer, Arizona Assayer Emeritus, No. 52700**

Mike has been with Skyline Labs since 2006. Graduate of the University of Arizona with a Bachelor of Science in Mathematics. Mike has over 10 years' experience in laboratory operations, including precious metals fire assay technique, instrumental analysis by AAS, ICP-OES, ICP-MS, and analysis of Base Metals, Fluorine, Acid Consumption and Gypsum. Mike obtained his Registered Assayer Certification in 2011, and currently retains the status "Assayer Emeritus".

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### **Bill Lehmbeck                                      Consultant, Geologist, Arizona Assayer Emeritus No. 9425**

Bill was a former co-owner of Skyline Labs. Bill was Manager of the Tucson operation from 1973 through 2000, and has served as consultant to the laboratory since 2001.

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### **Jim Williams                                      Consultant, Arizona Assayer Emeritus No. 7411**

Jim Williams has over fifty years of management experience in the mining industry and has been involved in changes that have developed into the present state of mining, including: SX/EW, hydrogen reduced copper powder start up, and sales of copper powder. Jim has also managed and implemented new technologies in metallurgical and assay laboratories.

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### **Kent McGrew, P.E., M.S. B.S                      Consultant, Arizona Metallurgist No. 26146**

Kent McGrew has over fifty years of experience in the design, construction and operation of mines worldwide. Kent innovated winter leaching of gold ores in northern climates, participated in numerous feasibility studies and discovered the iron reduction process for selenate reduction in AMD and spent cyanide leach solutions. Kent built and operated the Fluor Mining and Metals Metallurgical Testing Laboratory and is proficient in modeling test results to project metallurgical recoveries for a wide variety of metal commodities.

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# Introduction

## Services

- Custom trace analyses and assays of ores, rocks, soils, sediments, and natural waters.
- Multiple-element packages including **Enzyme Leach<sup>SM</sup> VI**.
- Electronic data transfer, **Enzyme Leach<sup>SM</sup>** data processing and interpretation.
- Analysis of concentrates and high grades
- Metallurgical analyses
- Whole Rock Analyses for major, minor, and trace elements

## Laboratory Facilities

The following types of analysis are available

- Fire Assay (gravimetric or AA finish)
- Atomic Absorption (AA)
- ICP-OES
- ICP-MS (including water, **Enzyme Leach<sup>SM</sup>**)
- Titration (including cobalt hydroxide)
- Column Leach

## New for 2018

Skyline can now provide shipping arrangements outside our regular pickup area at highly competitive rates for bulk and pulp samples within the Contiguous U.S. and Northern Mexico, and for pulp samples within the Democratic Republic of the Congo.

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# Sample Preparation

## DETERMINATIONS

PRICE PER  
SAMPLE

Sample Preparation (CODE SP)		
SP-1*	Crush (up to 5 kg) to plus 75 % -10 mesh, split and pulverize with standard steel to plus 95% -150 mesh	\$7.90
Option A:	Weight: 6 kg to 10 kg \$8.95	Option B: Weight: 11 kg to 15 kg \$10.00
SP-3	Oversize charge per kg in excess of 15 kg for SP-1 and SP-7	\$0.65
SP-5*	Pulverization only (standard steel) - coarse pulp or crushed rock (minus ½ inch) ≤ 400 g	\$5.80
SP-7	Crush only (up to 5 kg) to plus 75 % -10 mesh	\$5.55
Option A:	Weight: 6 kg to 10 kg \$6.60	Option B: Weight: 11 kg to 15 kg \$7.65
SP-8	Sample preparation only, no analysis	on request
SP-9	Compositing (by weight) per sample (requires homogenizing at \$4.00 per composite)	\$1.35
SP-10	Drying of wet or damp samples submitted in cloth bags at 105 °C	\$1.05
SP-11	Drying of wet or damp samples submitted in plastic bags at 105 °C	\$2.10
SP-12	Checking quality of pulps or rejects prepared by other labs and issuing report	\$8.95
SP-13	Cleaner sand between samples at an additional cost	\$3.15
SP-14	Screen Analysis (requires SS-3)	\$21.00
SP-15	Core Cutting/per hour	\$63.00
SP-16	Re-blending historical pulps	\$1.85
SP-17	Extra split: -10 mesh reject material, 1500 g in 32 oz plastic jar	\$3.70
SP-18	Additional split of crushed reject and/or pulp material	at cost
SP-19	Report weight of original sample as received	\$1.05

\*Preparation procedures include cleaner sand between batches.

## Soils, Stream, Sediments (CODE SS)

SS-1	Drying (60 °C) and sieving (-80 mesh) - save all portions	\$4.05
SS-2	Drying (60 °C) and sieving (-80 mesh) - discard oversize	\$3.80
SS-3	Sieve size fractions and bracket sieving, add per fraction	\$2.65
SS-4	Wet or damp samples submitted in plastic bags, add	\$2.35

## Sample Logging (CODE RS)

RS-1	Randomization of samples for analysis, per client request	\$1.75
RS-2	Sample list not provided with orders	\$0.40
RS-3	Sorting chaotic shipments	\$0.40

## Sample Storage and Handling (CODE SH)

SH-1	Return of all reject portions and/or pulps	at cost
Add-on: A	Return or forwarding of all reject portions and/or pulps via third party carrier	at cost
SH-2	Incineration of soil, sediment and vegetation samples from outside USA (for samples up to 0.5 kg; samples over 0.5 kg will be charged at a higher rate)	\$0.45
SH-3	Monthly storage of reject after 3 months (monthly storage charge)	\$0.40
SH-4	Monthly storage of pulps after 3 months (monthly storage charge)	\$0.25
SH-5	Disposal of reject portions and/or pulps	at cost
SH-6	Sample pick-up and delivery may be arranged to meet client's needs	at cost

Sample Submittal and Chain of Custody forms available online at <http://www.skylinelabs.com>



# Quantitative Instrumental Analyses & Routine Assays

DETERMINATIONS		PRICE PER SAMPLE	DETERMINATIONS		PRICE PER SAMPLE
<b>For Routine Single Assays (CODE SEA)</b>					
SEA-Al	Aluminum	\$20.80	SEA-Mo	Molybdenum (ICP-OES, up to 10 %)	\$11.55
SEA-Sb	Antimony	\$20.80	SEA-oxMo	Molybdenum - Oxide	\$17.35
SEA-As	Arsenic	\$20.80	SEA-Ni	Nickel	\$11.00
SEA-Ba	Barium (instrumental)	\$20.80	SEA-K	Potassium	\$20.80
SEA-Bi	Bismuth	\$20.80	SEA-Si	Silicon	\$23.10
SEA-Cd	Cadmium	\$20.80		Silver (AR/AA ppm) See Code FA-8 on Page 6	
SEA-Ca	Calcium	\$20.80	SEA-Na	Sodium	\$20.80
SEA-Cr	Chromium	\$23.10	SEA-Sr	Strontium	\$20.80
SEA-Co	Cobalt	\$11.00		Sulfur (infrared) See Code WR-S on Page 10	
SEA-Cu	Copper (total)	\$10.15	SEA-Ti	Titanium	\$20.80
SEA-CuCN	Copper (CN soluble)	\$10.40	SEA-U	Uranium (ICP-MS, low level) - U <sub>3</sub> O <sub>8</sub>	\$19.65
SEA-CuAS	Copper (acid soluble)	\$10.15	SEA-V	Vanadium	\$19.65
SEA-CuFS	Copper (ferric sulfate soluble)	\$10.40	SEA-Zn	Zinc	\$10.15
SEA-CuSAP	Copper (hot ferric sulfate soluble)	\$11.55			
SEA-CuSEQ	Copper (sequential analysis)	\$20.55	SEA-MI-1	Acid Consumption (Rapid Method)	\$28.90
	Gold See Code FA on Page 6		SEA-MI-2	Free Acid	\$26.25
	Gold-Silver See Code FA on Page 6		SEA-MI-3	Insolubles	\$26.25
SEA-Fe	Iron	\$17.35	SEA-MI-4	Loss on Ignition (Specify Temperature)	\$20.80
SEA-Pb	Lead	\$10.15	SEA-MI-4G	Gypsum by LOI (45 °C + 225 °C)	\$37.45
SEA-Mn	Manganese	\$20.80	SEA-MI-5	Moisture - H <sub>2</sub> O	\$20.80
SEA-Mg	Magnesium	\$20.80	SEA-MI-6	Specific Gravity	\$26.60

Note: For optional multi acid (with HF) near total digestion, add per sample: \$5.80

## Multi-Element Assays by ICP-OES (CODE MEA)

Copper (Cu), Cobalt (Co), Iron (Fe) Lead (Pb), Molybdenum (Mo), Nickel (Ni), Zinc (Zn)	First 2 elements	\$14.45
	Each additional element	\$3.50
	Optional:	
	Multi acid (with HF) near total digestion	\$5.80

**SEA and MEA analyses of Concentrates and High Grades available for \$140.00 per sample, \$500 Minimum Charge**

## Cyanide Soluble and Solutions (CODE CN)

CN-1	Au cyanide soluble 0.03-100 ppm 2 hour	\$14.70
CN-2	Au, Ag cyanide soluble 0.03-100 / 1.0-100 ppm 2 hour	\$17.35
CN-3	Additional elements for shake leach	\$4.75
CN-4	Single element solution analysis 0.03 ppm	\$11.55
CN-5	Additional element analysis on solutions 0.03 ppm	\$5.25

# Precious Metals & Trace Element Geochemistry

## DETERMINATIONS

## PRICE PER SAMPLE

### Precious Metal Geochemistry (CODE FA)

FA-1	Au Fire Assay - AA (geochem) 5-5,000 ppb, 30 g	\$15.60
FA-1-50g	Au Fire Assay - AA (geochem) 5-5,000 ppb, 50 g	\$17.20
FA-2	Au Fire Assay - Gravimetric (assay) 0.03-1,000 g/mt, 30 g	\$19.65
FA-2-50g	Au Fire Assay - Gravimetric (assay) 0.03-1,000 g/mt, 50 g	\$21.65
FA-3	Au, Ag Fire Assay - Gravimetric (assay) 0.03-1,000 g/mt, 30 g	\$23.10
FA-3-50g	Au, Ag Fire Assay - Gravimetric (assay) 0.03-1,000 g/mt, 50 g	\$25.20
FA-4	Ag Fire Assay - Gravimetric (assay) 3-1,000 g/mt (Au not deducted), 30g	\$17.35
FA-4-50g	Ag Fire Assay - Gravimetric (assay) 3-1,000 g/mt (Au not deducted), 50g	\$18.90
FA-5	Au Fire Assay - Metallic Screen (assay) 0.03-1,000 g/mt (300 g sub-sample)	\$86.65
FA-6	Au Fire Assay - Metallic Screen (assay) 0.03-1,000 g/mt (1000 g sub-sample)	\$115.50
FA-7	Fire Assay + ICP-MS (Au 5 ppb, Pt 5 ppb, Pd 5 ppb)	\$26.25
FA-8	Ag by Aqua Regia/AA (geochem) 0.1-100 ppm	\$6.40
FA-MC-Au	Au Umpire Assay	\$173.25
FA-MC-AuAg	Au, Ag Umpire Assay	\$210.00

### Trace Element Geochemistry (CODE TE) (See tables on following page)

TE-2	Trace Elements by Aqua Regia leach, ICP-OES (31 elements)	\$13.90
TE-3	Trace Elements by Aqua Regia leach, ICP-OES/ICP-MS (49 elements)	\$20.80
TE-4	Trace Elements by Multi Acid (with HF) near total digestion, ICP-OES (24 elements)	\$16.75
TE-5	Trace Elements by Multi Acid (with HF) near total digestion, ICP-OES/ICP-MS (47 elements)	\$22.55
	Hg cold-vapor FIMS (Aqua Regia digestion) 5 ppb	See Code WR-HG on Page 10

**FA and TE analyses of Concentrates and High Grades available for \$140.00 per sample, \$500 Minimum Charge**

### Metallurgical Analyses (CODE MET)

We have recently added column leach testing and bottle roll testing to the list of services we offer to the mining industry. This metallurgical testing capability has been integrated into the Laboratory Information Management System used to track samples passing through the analytical laboratory. Results from periodic tests will be automatically added to the metallurgical record of each column, eliminating human error from the long-term record keeping associated with column testing and making full data available to the client throughout the test cycle.

We also use the LIMS for tracking and reporting of results from bottle roll testing, and can help with the modeling of test results for forecasting recovery rates from full scale heap leach operations.

MET-COL	Column Leach Testing	Call for Customized Quote
MET-BRL	Bottle Roll Testing	Call for Customized Quote
MET-CoOH2	Cobalt Hydroxide Package - Includes Ca,Cu,Fe,Mg,Mn,Ni,Zn by ICP-OES	\$152.25

# Precious Metals & Trace Element Geochemistry

## TE-2: Trace Elements by Aqua Regia Leach, ICP-OES (31 elements)

Element	Reporting Limits	Element	Reporting Limits	Element	Reporting Limits	Element	Reporting Limits
Ag	0.2 - 150 ppm	Co	1 - 10000 ppm	Mo	2 - 1000 ppm	Sr *	1 - 1000 ppm
Al *	0.01 - 10 %	Cr *	1 - 10000 ppm	Na *	0.01 - 10 %	Ti *	0.01 - 1 %
As	5 - 1000 ppm	Cu	1 - 10000 ppm	Ni	1 - 10000 ppm	Tl *	10 - 1000 ppm
Ba *	10 - 1000 ppm	Fe *	0.01 - 10 %	P *	0.001 - 1 %	V *	1 - 1000 ppm
Be *	0.5 - 1000 ppm	K *	0.01 - 10 %	Pb	2 - 10000 ppm	W *	10 - 1000 ppm
Bi	5 - 1000 ppm	La *	10 - 10000 ppm	S **	0.01 - 10 %	Zn	1 - 10000 ppm
Ca *	0.01 - 10 %	Mg *	0.01 - 10 %	Sb	5 - 1000 ppm	Zr *	1 - 10000 ppm
Cd	1 - 1000 ppm	Mn	5 - 10000 ppm	Sc *	1 - 1000 ppm		

Note: \* Dissolution may not be complete by Aqua Regia

\*\* AR soluble sulfide sulfur

## TE-3: Trace Elements by Aqua Regia Leach, ICP-OES/ICP-MS (49 elements)

Element	Reporting Limits	Element	Reporting Limits	Element	Reporting Limits	Element	Reporting Limits
Ag	0.05 - 150 ppm	Fe *	0.01 - 10 %	Nb *	0.1 - 10000 ppm	Te	0.1 - 1000 ppm
Al *	0.01 - 10 %	Ga *	1 - 1000 ppm	Ni	0.1 - 10000 ppm	Th *	0.1 - 1000 ppm
As	0.05 - 1000 ppm	Ge	0.1 - 10000 ppm	P *	0.001 - 1 %	Ti *	0.005 - 1 %
Ba *	1 - 1000 ppm	Hf *	0.1 - 10000 ppm	Pb	0.1 - 10000 ppm	Tl *	0.05 - 1000 ppm
Be *	1 - 1000 ppm	Hg	0.005 - 1000 ppm	Rb *	0.1 - 10000 ppm	U *	0.1 - 1000 ppm
Bi	0.1 - 1000 ppm	In	0.01 - 10000 ppm	Re	5 - 1000 ppb	V *	2 - 1000 ppm
Ca *	0.01 - 25 %	K *	0.01 - 10 %	S **	0.05 - 10 %	W *	0.1 - 1000 ppm
Cd	0.1 - 1000 ppm	La *	1 - 10000 ppm	Sb	0.05 - 1000 ppm	Y *	0.1 - 1000 ppm
Ce *	1 - 1000 ppm	Li *	0.1 - 10000 ppm	Sc *	0.1 - 1000 ppm	Zn	1 - 10000 ppm
Co	0.1 - 10000 ppm	Mg *	0.01 - 10 %	Se	0.5 - 1000 ppm	Zr *	0.1 - 10000 ppm
Cr *	1 - 10000 ppm	Mn	1 - 10000 ppm	Sn *	0.1 - 1000 ppm		
Cs *	0.1 - 10000 ppm	Mo	0.1 - 1000 ppm	Sr *	1 - 1000 ppm		
Cu	0.1 - 10000 ppm	Na *	0.01 - 10 %	Ta	0.1 - 1000 ppm		

Note: \* Dissolution may not be complete by Aqua Regia

\*\* AR soluble sulfide sulfur

## TE-4: Trace Elements by Multi Acid Digestion (with HF), ICP-OES (24 elements)

Element	Reporting Limits	Element	Reporting Limits	Element	Reporting Limits	Element	Reporting Limits
Ag	0.1 - 150 ppm	Cd	1 - 1000 ppm	Mg *	0.01 - 25 %	Pb	2 - 10000 ppm
Al *	0.01 - 10 %	Co	1 - 10000 ppm	Mn	5 - 10000 ppm	Sr *	1 - 1000 ppm
Ba *	10 - 1000 ppm	Cr * †	1 - 10000 ppm	Mo	2 - 1000 ppm	Ti *	0.01 - 1 %
Be *	1 - 1000 ppm	Cu	1 - 10000 ppm	Na *	0.01 - 25 %	V *	1 - 1000 ppm
Bi	5 - 1000 ppm	Fe *	0.01 - 10 %	Ni	1 - 10000 ppm	W *	10 - 1000 ppm
Ca *	0.01 - 25 %	K	0.01 - 25 %	P *	0.001 - 1 %	Zn	2 - 10000 ppm

Note: \* Dissolution may not be complete by Aqua Regia or Multi Acid

† Partial loss (volatilization) by Multi Acid (with HF) dissolution

## TE-5: Trace Elements by Multi Acid Digestion (with HF), ICP-OES/ICP-MS (47 elements)

Element	Reporting Limits	Element	Reporting Limits	Element	Reporting Limits	Element	Reporting Limits
Ag	0.05 - 150 ppm	Cu	0.1 - 10000 ppm	Na *	0.01 - 10 %	Ta	0.1 - 1000 ppm
Al *	0.01 - 10 %	Fe *	0.01 - 10 %	Nb *	0.1 - 10000 ppm	Te †	0.1 - 1000 ppm
As †	0.05 - 1000 ppm	Ga *	1 - 1000 ppm	Ni	0.1 - 10000 ppm	Th *	0.1 - 1000 ppm
Ba *	1 - 1000 ppm	Ge	0.1 - 10000 ppm	P *	0.001 - 1 %	Ti *	0.005 - 1 %
Be *	1 - 1000 ppm	Hf *	0.1 - 10000 ppm	Pb	0.1 - 10000 ppm	Tl *	0.05 - 1000 ppm
Bi	0.1 - 1000 ppm	In	0.01 - 10000 ppm	Rb *	0.1 - 10000 ppm	U *	0.1 - 1000 ppm
Ca *	0.01 - 25 %	K *	0.01 - 10 %	Re	5 - 1000 ppb	V *	2 - 1000 ppm
Cd	0.1 - 1000 ppm	La *	1 - 10000 ppm	S †	0.05 - 10 %	W *	0.1 - 1000 ppm
Ce *	1 - 1000 ppm	Li *	0.1 - 10000 ppm	Sb †	0.05 - 1000 ppm	Y *	0.1 - 1000 ppm
Co	0.1 - 10000 ppm	Mg *	0.01 - 10 %	Sc *	0.1 - 1000 ppm	Zn	1 - 10000 ppm
Cr * †	1 - 1000 ppm	Mn	1 - 10000 ppm	Sn *	0.1 - 1000 ppm	Zr *	0.1 - 10000 ppm
Cs *	0.1 - 10000 ppm	Mo	0.1 - 1000 ppm	Sr *	1 - 1000 ppm		

Note: \* Dissolution may not be complete by Multi Acid (with HF)

† Partial loss (volatilization) by Multi Acid (with HF) dissolution

# Selective Extractions & Hydrogeochemistry

## DETERMINATIONS

PRICE PER  
SAMPLE

### Selective Leach Extractions (CODE SLE)

SLE-1	<b>Enzyme Leach<sup>SM</sup> VI</b> proprietary extraction + ICP-MS **	\$39.90
Add-ons to SLE-1:		
A	Final pH of leach solution	\$8.10
B	Conductivity of leach solution	\$8.10
C	pH and conductivity of leach solution	\$11.55
SLE-3	TerraSol Leach <sup>SM</sup> - Proprietary extraction for trace elements bound primarily to limonite	\$42.00
SLE-5	Water Leach (hot/cold) - Dissolves any water soluble components and metals released by hydrolysis of silicates	\$38.15
SLE-6	Water Pre Wash - Removes water soluble components prior to application of selective leaching	\$4.65

**\*\* Recent improvements in the *Enzyme Leach<sup>SM</sup> VI* method include a better method of preserving soil samples in the field. If the customer follows this procedure, there is no sample prep charge at the laboratory. Directions and a video for the improved sampling procedure can be downloaded at:**

<http://www.skylinelabs.com/enzymeleach>

### Hydrogeochemical (CODE HY) (See table on next page)

HY-1	Hydrogeochemistry ICP-MS for natural waters with low TDS (<0.05 %)	1-50 samples	\$52.00
		51+ samples	\$46.20
HY-2	Complex matrix+acid digested solutions	1st element	\$138.60
		additional element	\$231.00
HY-3	ICP-MS for marine waters, brines (TDS >0.05 %)		\$98.20
Add-on:	A Over-range: Elements which may be over-range are reanalyzed if required	Add	\$28.90
	B Filter: Sample filtered 0.45 µm	Add	\$23.10
	C Hg: Hg by FIMS	Add	\$28.90
	D Digest Water: Acidification with 2 % nitric acid, digested at 60 °C for 16 hours	Add	\$23.10

### Lithium Ore Analyses (CODE LI)

LI-1	Lithium by Peroxide Fusion, ICP-OES	\$18.90	
LI-2	Lithium by Multi Acid (with HF), ICP-OES	\$15.50	
LI-3	Lithium on brines by ICP-OES	\$18.90	
Add-on:	Add to any LI package: Si, Al, Fe, Cu, Mn, Zn, Co	per additional element	\$3.45

**SLE and HY processes incur an increased minimum charge of \$770**



# Selective Extractions & Hydrogeochemistry

## SLE-1: Enzyme Leach<sup>SM</sup> VI, ICP-MS (70 elements) (ppb)

Element	Lower Limit	Element	Lower Limit	Element	Lower Limit	Element	Lower Limit	Element	Lower Limit
Ag	0.01	Cr	0.1	In	0.001	Pb	0.1	Ta	0.001
Al	100	Cs	0.01	K	100	Pd	0.002	Tb	0.002
As	0.1	Cu	0.2	La	0.01	Pr	0.005	Te	0.2
Au	0.0001	Dy	0.005	Li	0.5	Pt	0.002	Th	0.01
B	100	Er	0.005	Lu	0.002	Rb	0.1	Ti	0.2
Ba	0.5	Eu	0.001	Mg	100	Re	0.002	Tl	0.002
Be	0.5	Fe	100	Mn	0.5	Ru	0.2	Tm	0.002
Bi	0.01	Ga	0.01	Mo	0.1	S	500	U	0.01
Br	0.5	Gd	0.002	Na	1000	Sb	0.01	V	0.1
Ca	100	Ge	0.01	Nb	0.001	Sc	0.05	W	0.1
Cd	0.01	Hf	0.001	Nd	0.01	Se	1	Y	0.01
Ce	0.01	Hg	0.1	Ni	0.1	Sm	0.001	Yb	0.002
Cl	200	Ho	0.005	Os	0.15	Sn	0.01	Zn	1
Co	0.1	I	0.1	P	100	Sr	0.1	Zr	0.01

## SLE-3: Terrasol Leach<sup>SM</sup>, ICP-MS (67 elements) (ppb)

Element	Lower Limit	Element	Lower Limit	Element	Lower Limit	Element	Lower Limit	Element	Lower Limit
Ag	20	Cu	5	La	1	Pt	0.1	Th	0.05
Al	0.5 ppm	Dy	0.1	Li	2	Rb	0.5	Ti	20
As	5	Er	0.06	Lu	0.1	Re	0.05	Tl	0.5
Au	0.1	Eu	0.05	Mg	2 ppm	Rh	5	Tm	0.05
Ba	10	Fe	1 ppm	Mn	5	Ru	0.2	U	0.05
Be	0.5	Ga	0.5	Mo	1	S	10 ppm	V	5
Bi	0.5	Gd	0.7	Na	5 ppm	Sb	1	W	10
Ca	0.5 ppm	Ge	1	Nb	0.4	Sc	50	Y	0.2
Cd	0.5	Hf	0.1	Nd	0.2	Se	20	Yb	0.1
Ce	0.5	Hg	0.1	Ni	10	Sm	0.1	Zn	20
Cl	20 ppm	Ho	0.02	Os	0.1	Sn	10	Zr	0.4
Co	0.5	In	0.2	Pb	5	Sr	1		
Cr	40	Ir	10	Pd	1	Ta	0.1		
Cs	0.1	K	5 ppm	Pr	0.2	Te	10		

## HY-1: Natural Waters, ICP-MS (70 elements) (ppb)

Element	Lower Limit	Element	Lower Limit	Element	Lower Limit	Element	Lower Limit	Element	Lower Limit
Ag	0.001	Cr	0.01	In	0.0001	Pb	0.01	Ta	0.0001
Al	10	Cs	0.001	K	10	Pd	0.0002	Tb	0.0002
As	0.01	Cu	0.02	La	0.001	Pr	0.0005	Te	0.02
Au	0.00001	Dy	0.0005	Li	0.1	Pt	0.0002	Th	0.002
B	10	Er	0.0005	Lu	0.0002	Rb	0.01	Ti	0.02
Ba	0.1	Eu	0.0001	Mg	10	Re	0.0002	Tl	0.0002
Be	0.05	Fe	10	Mn	0.1	Ru	0.02	Tm	0.0002
Bi	0.001	Ga	0.001	Mo	0.01	S	50	U	0.002
Br	0.5	Gd	0.0002	Na	100	Sb	0.001	V	0.01
Ca	10	Ge	0.001	Nb	0.0001	Sc	0.005	W	0.01
Cd	0.001	Hf	0.0001	Nd	0.001	Se	0.1	Y	0.001
Ce	0.001	Hg	0.05	Ni	0.01	Sm	0.0001	Yb	0.0002
Cl	200	Ho	0.0005	Os	0.015	Sn	0.001	Zn	0.1
Co	0.01	I	0.1	P	10	Sr	0.1	Zr	0.001

# Additional Analytical Procedures

## DETERMINATIONS

**PRICE PER  
SAMPLE**

### Lithogeochemical (CODE WR)

WR-1	Major elements by lithium metaborate/tetraborate fusion and ICP-OES (see table below)	\$57.75
WR-2	Same as WR-1, plus additional trace elements by ICP-MS (see tables below)	\$94.50

#### WR-1/WR-2 Elements by ICP-OES

Determination	Lower Limit
Al <sub>2</sub> O <sub>3</sub>	0.01 %
CaO	0.01 %
Fe <sub>2</sub> O <sub>3</sub> *	0.01 %
K <sub>2</sub> O	0.01 %
MgO	0.01 %
MnO	0.001 %
Na <sub>2</sub> O	0.01 %
P <sub>2</sub> O <sub>5</sub>	0.01 %
SiO <sub>2</sub>	0.01 %
TiO <sub>2</sub>	0.001 %
LOI	0.01 %

Note: \* Indicates total Fe reported as Fe<sub>2</sub>O<sub>3</sub>

#### WR-2 Added Elements by ICP-MS (ppm)

Element	Lower Limit	Element	Lower Limit	Element	Lower Limit	Element	Lower Limit
Ag	0.5	In	0.2	Tl	0.1	Eu	0.05
As	5	Mo	2	U	0.1	Gd	0.1
Ba	2	Nb	1	V **	5	Tb	0.1
Be	1	Ni	20	W	1	Dy	0.1
Bi	0.4	Pb	5	Y	1	Ho	0.1
Co	1	Rb	2	Zn	30	Er	0.1
Cr	20	Sb	0.5	Zr	2	Tm	0.05
Cs	0.5	Sc	1	La	0.1	Yb	0.1
Cu	10	Sn	1	Ce	0.1	Lu	0.01
Ga	1	Sr	1	Pr	0.05		
Ge	1	Ta	0.1	Nd	0.1		
Hf	0.2	Th	0.1	Sm	0.1		

Note: \*\* V may be reported as V<sub>2</sub>O<sub>5</sub> upon request

WR-FEO	FeO by Titration	\$16.20
WR-S	S by Infrared	\$17.35
WR-SO4	SO <sub>4</sub> by Infrared	\$31.50
WR-HG	Hg by Cold Vapor FIMS	\$12.60
WR-F	F by Fusion Ion-Selective Electrode (ISE)	\$16.80
WR-CO2	CO <sub>2</sub> by Infrared	\$31.50
WR-H2O +/-	H <sub>2</sub> O by Gravimetric	\$23.10
WR-CS	C,S by Infrared	\$23.10
WR-SS	Sulfide Sulfur by difference from carbonate leach, by infrared	\$26.25

### Miscellaneous Methods (CODE MI)

MI-1	Total C by Infrared	\$17.35
MI-2	Graphitic C by Infrared	\$28.90
MI-3	Organic C by Infrared	\$28.90
MI-4	F by Fusion Ion-Selective Electrode (ISE)	\$16.80
MI-6	pH	\$7.90
MI-7	Total Suspended Solids (TSS)	\$23.10
MI-8	Total Dissolved Solids (TDS)	\$23.10
MI-9	Alkalinity (carbonate & bicarbonate)	\$28.90
MI-10	Conductivity	\$8.70
MI-11	Salinity	\$23.10
MI-12	Acidity	\$23.10
MI-13	Turbidity	\$17.35

# General Terms & Conditions

1. The price list is applicable to samples received by Skyline Assayers & Laboratories through December 31, 2018. All prices are in U.S. dollars. A minimum charge of \$300 will apply to all orders unless a higher minimum is noted in the price list.
2. Payment should accompany the samples unless credit has been established with Skyline Assayers & Laboratories. Analysis will not begin without payment unless the client has made credit arrangements in advance of the receipt of samples from the client. Credit terms require payment in full 15 days from the date of the invoice. Interest will be charged on all past due invoices at a rate of 1.5% per month (18% per year). Payment by check, bank draft or direct bank deposits, (EFT), is acceptable.
3. The price list applies to most geological materials submitted for routine analysis upon a non-emergency basis. A surcharge will apply for abnormal matrices or non-routine analytical requirements. Client will be informed of the amount of such surcharge prior to Skyline Assayers & Laboratories performing the analytical work. The price list is subject to change without notice. In the event that problems are encountered with the analysis, Skyline Assayers & Laboratories retains the right to impose additional charges resulting from unforeseen expenses or circumstances.
4. Reports of analyses of client-submitted samples by Skyline Assayers & Laboratories are intended solely for the use of the client. Skyline Assayers & Laboratories disclaims all implied warranties regarding its reports. By submitting samples to Skyline Assayers & Laboratories, client agrees to indemnify and hold harmless Skyline Assayers & Laboratories, its officers, directors and employees from and against all actions, claims, proceedings or demands (including any costs and expenses in defending or servicing same) arising out of any use made by the client of any report provided to the client by Skyline Assayers & Laboratories.
5. All services provided by Skyline Assayers & Laboratories shall be done in accordance with industry recognized analytical procedures. Skyline Assayers & Laboratories reserves the right to hire appropriately qualified subcontractors for all or part of the testing and analysis requested by client. Skyline Assayers & Laboratories disclaims any warranties that the analysis requested by the client is appropriate for client's intended uses. Skyline Assayers & Laboratories makes no warranties that samples provided by client are in any way a representative sample from which client may extrapolate the results to the larger geological source of the sample. Client is solely responsible for choosing the appropriate tests it wants performed upon any sample. Skyline Assayers & Laboratories is not responsible for suggesting any tests or analyses for any sample provided by the client.
6. The liability of Skyline Assayers & Laboratories to the client is limited to the refund of any charges paid by the client to Skyline Assayers & Laboratories. Under no circumstances can Skyline Assayers & Laboratories be liable for consequential damages incurred by client or anyone provided the report of Skyline Assayers & Laboratories by the client. The client hereby releases Skyline Assayers & Laboratories, its officers, directors and employees from liability arising out of the providing of its testing and analytical services regardless of the cause of the loss, including the negligence of Skyline Assayers & Laboratories and its employees in the handling, testing or analysis of samples.
7. Skyline Assayers & Laboratories will not be liable for the storage or preservation of client's samples. Client must make arrangements for the preservation or storage of samples in advance of any work undertaken by Skyline Assayers & Laboratories, including payment and insurance. Client's results and reports will be retained for a period of 5 (five) years. In the event that client does not regain possession of the remaining portions of its samples not used up in the testing process, client will be responsible for arranging for the storage of any remaining materials. Skyline Assayers & Laboratories will not be responsible for the storage or delivery of any such remaining materials.
8. This agreement is governed by the laws of the State of Arizona. If any provision in this agreement is deemed unenforceable for any reason, that shall not cause the remaining terms to be ineffective, but the offending provision will be ignored and the remainder of the provisions of this agreement will be enforced as written. Any action to enforce the terms of this agreement must be brought in the Superior Court for the County of Pima, Arizona. Client agrees to pay the costs and legal fees of Skyline Assayers & Laboratories if it is required to hire counsel to enforce this agreement.
9. All service quotes cover Skyline Assayers & Laboratories analytical services only. The costs of wire transfer fees, government fees or taxes on the transaction or payment of invoices shall be borne by the client.
10. Either Party shall be excused from performance and shall not be in default in respect of any obligation hereunder to the extent that the failure to perform such obligation is due to a Force Majeure Event. For the purpose of this Agreement, an "Event of Force Majeure" means any natural or political circumstance not within the reasonable control of the Party affected, but only if and to the extent that such circumstance, despite the exercise of reasonable diligence and the observance of Good Utility Practice, cannot be, or be caused to be, prevented, avoided or removed by such Party, and such circumstance materially and adversely affects the ability of the Party to perform its obligations under this Agreement, and such Party has taken all reasonable precautions, due care and reasonable alternative measures in order to avoid the effect of such event on the Party's ability to perform its obligations under this Agreement and to mitigate the consequences thereof.

## SAMPLE SUBMITTAL & SHIPPING INSTRUCTIONS

Filling out the Sample Submittal form will provide the information required to process your samples. Instructions for report and invoice distribution should be included with each sample shipment. Make sure to include date of shipment, carrier of shipment and the waybill number so that we can track shipments. An accurate sample list can be sent as an e-mail attachment to [tucson@skylinelabs.com](mailto:tucson@skylinelabs.com) and will speed up order processing. Poorly labeled or packaged samples, or samples having incomplete or no submission sheets will not be processed until adequate written instructions are received from the client. Additional sorting charges will be incurred on shipments which are chaotic.

Sample Submittal form and Chain of Custody form available online at <http://www.skylinelabs.com>

Pulp samples should be packed with care to avoid punctures and chaotic mixing during shipment.

Heavy duty plastic bags, cloth sample bags, soil envelopes and sample books are available at cost plus shipping & handling.

Ship samples to: Skyline Assayers & Laboratories  
1775 West Sahuaro Drive  
Tucson, AZ 85745-1434  
USA

For most efficient delivery, we recommend the use of couriers.

# Periodic Table of the Elements

PERIOD	GROUP	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18																												
		IA	IIA	IIIB	IVB	VB	VIB	VII B	VIII B	VIIIB	VIIIB	VIIIB	IB	IIB	IIIA	IIIA	IVA	VA	VIA	VIIA	VIIIA																										
1	1	1.0079 <b>H</b> Hydrogen																			4.0026 <b>He</b> Helium																										
2	2	6.9410 <b>Li</b> Lithium	9.0122 <b>Be</b> Beryllium												10.811 <b>B</b> Boron	12.011 <b>C</b> Carbon	14.007 <b>N</b> Nitrogen	15.999 <b>O</b> Oxygen	18.998 <b>F</b> Fluorine	20.180 <b>Ne</b> Neon																											
3	3	22.990 <b>Na</b> Sodium	24.305 <b>Mg</b> Magnesium												13 26.982 <b>Al</b> Aluminium	14 28.086 <b>Si</b> Silicon	15 30.974 <b>P</b> Phosphorus	16 32.066 <b>S</b> Sulfur	17 35.453 <b>Cl</b> Chlorine	18 39.948 <b>Ar</b> Argon																											
4	4	39.098 <b>K</b> Potassium	40.078 <b>Ca</b> Calcium												19 39.098 <b>K</b> Potassium	20 40.078 <b>Ca</b> Calcium	21 44.956 <b>Sc</b> Scandium	22 47.867 <b>Ti</b> Titanium	23 47.867 <b>Ti</b> Titanium	24 50.941 <b>V</b> Vanadium	25 50.941 <b>V</b> Vanadium	26 54.938 <b>Cr</b> Chromium	27 55.846 <b>Mn</b> Manganese	28 58.933 <b>Fe</b> Iron	29 58.933 <b>Co</b> Cobalt	30 63.546 <b>Ni</b> Nickel	31 65.409 <b>Cu</b> Copper	32 69.723 <b>Zn</b> Zinc	33 72.640 <b>Ga</b> Gallium	34 74.922 <b>Ge</b> Germanium	35 78.960 <b>As</b> Arsenic	36 79.904 <b>Se</b> Selenium	37 85.468 <b>Br</b> Bromine	38 87.620 <b>Kr</b> Krypton													
5	5	85.468 <b>Rb</b> Rubidium	87.620 <b>Sr</b> Strontium												37 85.468 <b>Rb</b> Rubidium	38 87.620 <b>Sr</b> Strontium	39 88.906 <b>Y</b> Yttrium	40 91.224 <b>Zr</b> Zirconium	41 91.224 <b>Zr</b> Zirconium	42 92.906 <b>Nb</b> Niobium	43 92.906 <b>Nb</b> Niobium	44 95.940 <b>Mo</b> Molybdenum	45 95.940 <b>Mo</b> Molybdenum	46 101.07 <b>Ru</b> Ruthenium	47 101.07 <b>Ru</b> Ruthenium	48 102.91 <b>Rh</b> Rhodium	49 102.91 <b>Rh</b> Rhodium	50 106.42 <b>Pd</b> Palladium	51 106.42 <b>Pd</b> Palladium	52 107.87 <b>Ag</b> Silver	53 107.87 <b>Ag</b> Silver	54 112.41 <b>Cd</b> Cadmium	55 112.41 <b>Cd</b> Cadmium	56 114.82 <b>In</b> Indium	57 114.82 <b>In</b> Indium	58 118.71 <b>Sn</b> Tin	59 118.71 <b>Sn</b> Tin	60 121.76 <b>Sb</b> Antimony	61 121.76 <b>Sb</b> Antimony	62 127.60 <b>Te</b> Tellurium	63 127.60 <b>Te</b> Tellurium	64 131.29 <b>Xe</b> Xenon	65 131.29 <b>Xe</b> Xenon				
6	6	132.91 <b>Cs</b> Caesium	137.33 <b>Ba</b> Barium												61 132.91 <b>Cs</b> Caesium	62 137.33 <b>Ba</b> Barium	63 137.33 <b>La-Lu</b> Lanthanide	64 178.49 <b>Hf</b> Hafnium	65 178.49 <b>Hf</b> Hafnium	66 180.95 <b>Ta</b> Tantalum	67 180.95 <b>Ta</b> Tantalum	68 183.84 <b>W</b> Tungsten	69 183.84 <b>W</b> Tungsten	70 186.21 <b>Re</b> Rhenium	71 186.21 <b>Re</b> Rhenium	72 192.22 <b>Os</b> Osmium	73 192.22 <b>Os</b> Osmium	74 195.08 <b>Pt</b> Platinum	75 195.08 <b>Pt</b> Platinum	76 196.87 <b>Au</b> Gold	77 196.87 <b>Au</b> Gold	78 200.59 <b>Hg</b> Mercury	79 200.59 <b>Hg</b> Mercury	80 204.38 <b>Tl</b> Thallium	81 204.38 <b>Tl</b> Thallium	82 207.20 <b>Pb</b> Lead	83 207.20 <b>Pb</b> Lead	84 208.98 <b>Bi</b> Bismuth	85 208.98 <b>Bi</b> Bismuth	86 212.01 <b>Po</b> Polonium	87 212.01 <b>Po</b> Polonium	88 222.01 <b>Rn</b> Radon	89 222.01 <b>Rn</b> Radon				
7	7	223 <b>Fr</b> Francium	(226) <b>Ra</b> Radium												87 223 <b>Fr</b> Francium	88 (226) <b>Ra</b> Radium	89-103 <b>Ac-Lr</b> Actinide	89 227 <b>La</b> Lanthanum	90 227 <b>La</b> Lanthanum	91 232.04 <b>Ce</b> Cerium	92 232.04 <b>Ce</b> Cerium	93 231.04 <b>Pr</b> Praseodymium	94 231.04 <b>Pr</b> Praseodymium	95 238.03 <b>Nd</b> Neodymium	96 238.03 <b>Nd</b> Neodymium	97 237 <b>Pm</b> Promethium	98 237 <b>Pm</b> Promethium	99 244 <b>Sm</b> Samarium	100 244 <b>Sm</b> Samarium	101 244 <b>Eu</b> Europium	102 244 <b>Eu</b> Europium	103 247 <b>Gd</b> Gadolinium	104 247 <b>Gd</b> Gadolinium	105 261 <b>Tb</b> Terbium	106 261 <b>Tb</b> Terbium	107 269 <b>Dy</b> Dysprosium	108 269 <b>Dy</b> Dysprosium	109 271 <b>Ho</b> Holmium	110 271 <b>Ho</b> Holmium	111 285 <b>Er</b> Erbium	112 285 <b>Er</b> Erbium	113 289 <b>Tm</b> Thulium	114 289 <b>Tm</b> Thulium	115 290 <b>Yb</b> Ytterbium	116 290 <b>Yb</b> Ytterbium	117 293 <b>Lu</b> Lutetium	118 293 <b>Lu</b> Lutetium

C	Solid
Hg	Liquid
H	Gas

Alkali Metals	Actinides
Alkaline Earth Metals	Other Metals
Transition Metals	Nonmetals
Lanthanides	Noble Gases

57	138.91 <b>La</b> Lanthanum	140.12 <b>Ce</b> Cerium	140.91 <b>Pr</b> Praseodymium	140.91 <b>Pr</b> Praseodymium	144.24 <b>Nd</b> Neodymium	144.24 <b>Nd</b> Neodymium	145 <b>Pm</b> Promethium	150.36 <b>Sm</b> Samarium	150.36 <b>Sm</b> Samarium	151.96 <b>Eu</b> Europium	151.96 <b>Eu</b> Europium	157.25 <b>Gd</b> Gadolinium	157.25 <b>Gd</b> Gadolinium	158.93 <b>Tb</b> Terbium	158.93 <b>Tb</b> Terbium	162.50 <b>Dy</b> Dysprosium	162.50 <b>Dy</b> Dysprosium	164.93 <b>Ho</b> Holmium	164.93 <b>Ho</b> Holmium	167.26 <b>Er</b> Erbium	167.26 <b>Er</b> Erbium	168.93 <b>Tm</b> Thulium	168.93 <b>Tm</b> Thulium	173.04 <b>Yb</b> Ytterbium	173.04 <b>Yb</b> Ytterbium	174.97 <b>Lu</b> Lutetium	174.97 <b>Lu</b> Lutetium
89	(227) <b>Ac</b> Actinium	232.04 <b>Th</b> Thorium	231.04 <b>Pa</b> Protactinium	231.04 <b>Pa</b> Protactinium	238.03 <b>U</b> Uranium	238.03 <b>U</b> Uranium	(237) <b>Np</b> Neptunium	(244) <b>Pu</b> Plutonium	(244) <b>Pu</b> Plutonium	(243) <b>Am</b> Americium	(243) <b>Am</b> Americium	(247) <b>Cm</b> Curium	(247) <b>Cm</b> Curium	(247) <b>Bk</b> Berkelium	(247) <b>Bk</b> Berkelium	(251) <b>Cf</b> Californium	(251) <b>Cf</b> Californium	(252) <b>Es</b> Einsteinium	(252) <b>Es</b> Einsteinium	(257) <b>Fm</b> Fermium	(257) <b>Fm</b> Fermium	(258) <b>Md</b> Mendelevium	(258) <b>Md</b> Mendelevium	(259) <b>No</b> Nobelium	(259) <b>No</b> Nobelium	(262) <b>Lr</b> Lawrencium	(262) <b>Lr</b> Lawrencium