

Zn-Pb-Ag

DIGESTION OF ZINC-LEAD-SILVER SULPHIDE ORES USING COLDBLOCK™ DIGESTION CBL12

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Introduction

This application note will focus on the digestion of Zinc-Lead-Silver Sulphide Ores using ColdBlock™ Digestion CB12L Technology.

Method

Triplicate samples of CRM (Certified Reference Material) OREAS-624, OREAS 133b & OREAS 622 (ORE Research & Exploration) were weighed to 0.25g, placed in ColdBlock™ Digestion vessels and digested using the following methods:

- Phosphoric Sulfuric Method: 8mL Sulfuric acid + 5.5mL Phosphoric acid digested at 85% power for 20 minutes. Chiller temperature was set to -5° Celsius.
- Phosphoric Aqua Regia (AR) Method: 10mL Phosphoric digested at 85% power for 10 minutes + 8mL Aqua Regia digested at 85% power for 10 minutes. Chiller temperature was set to -5° Celsius.
- Aqua Regia (AR) Method: 10mL Aqua Regia digested at 65% power for 15 minutes. Chiller temperature was set to -5° Celsius.

After digestion and subsequent cooling, samples were normalized to 50mL using 1% HNO₃, centrifuged and analyzed on the Agilent 5100 ICP-OES or Perkin Elmer Elan DRC II ICP-MS.

Method (cont'd)
Table 1: OREAS-624 Certified Values of Major Elements (Peroxide Fusion ICP method)

Na %	**0.475
Mg %	1.31
Al %	4.32
K %	0.991
Ca %	1.49
Ti %	0.146
Mn %	0.066
Fe %	16.31
Co %	0.0273
Cu %	3.08
Zn %	2.41
Zr %	**0.0107
Cd %	0.0133
Ba %	0.107
Pb %	0.612

***Sodium & Zirconium based on 4-acid digestion*

Table 3: OREAS-622 Certified Values of Major Elements (4-acid digestion method)

Na %	0.729
Mg %	0.562
Al %	5.77
K %	1.72
Ca %	2.14
Ti %	0.147
Mn %	0.06
Fe %	4.31
Cu %	0.486
Zn %	10.24
Zr %	0.0124
Cd %	0.046
Pb%	2.21
Ag%	0.0124
Sb %	0.0195

Table 2: OREAS-133b Certified Values of Major Elements (4-acid digestion method)

Mg%	2.2496
Al %	3.6571
Ca %	3.8594
Fe %	8.16
Cu %	0.032
Zn %	11.35
Ag %	0.0104
Cd %	0.0311
Sb %	0.0181
Pb %	5.06

Results

**Table 4: ColdBlock™ Digestion CB12L Recoveries (%)
OREAS-624**

ColdBlock CB12L	Average %	Standard Deviation	% Recovery	Method
Na (*589.592)	0.486	0.011	102	Phosphoric-Sulfuric
Mg (*280.270)	1.291	0.007	99	Phosphoric-Sulfuric
Al (*396.152)	3.793	0.125	98	Phosphoric-Sulfuric
K(*766.491)	0.996	0.061	101	Phosphoric-Sulfuric
Ca (*396.847)	1.43	0.004	96	Phosphoric-Sulfuric
Ti (*368.520)	0.15	0.059	103	Phosphoric-Sulfuric
Mn (257.610)	0.068	0.002	103	Phosphoric-Sulfuric
Fe (*238.204)	15.84	0.002	97	Phosphoric-Sulfuric
Co	0.028	0.489	103	Phosphoric-Sulfuric
Cu (*327.395)	3.061	0.0002	99	Phosphoric-Sulfuric
Zn (*206.200)	2.329	0.062	97	Phosphoric-Sulfuric
Zr	0.012	0.0001	108	Phosphoric-Sulfuric
Cd	0.014	0.0003	103	Phosphoric-Sulfuric
Ba (*455.403)	0.100	0.004	93	Phosphoric-AR
Pb (*220.553)	0.606	0.006	99	Phosphoric-AR

*OES Wavelengths - Co, Zr & Cd analyzed by ICP-MS

**Table 5: ColdBlock™ Digestion CB12L Recoveries (%)
OREAS-133b**

ColdBlock CB12L	Average %	Standard Deviation	% Recovery	Method
Mg (*280.270)	2.198	0.011	98	Phosphoric-Sulfuric
Al (*396.152)	3.297	0.017	90	Phosphoric-Sulfuric
Ca (*396.847)	3.663	0.075	95	Phosphoric-Sulfuric
Fe (*238.204)	7.958	0.096	98	Phosphoric-Sulfuric
Cu	0.032	0.0003	100	AR
Zn (*206.200)	11.188	0.14	99	Phosphoric-Sulfuric
Ag	0.010	0.0001	98	AR
Cd	0.031	0.0005	99	AR
Sb	0.017	0.0001	98	AR
Pb (*220.253)	5.052	0.106	100	AR

* OES Wavelengths- Cu, Ag, Cd & Sb analyzed by ICP-MS

Results (cont'd)
**Table 5: ColdBlock™ Digestion CB12L Recoveries (%)
 OREAS-622**

ColdBlock CB12L	Average %	Standard Deviation	% Recovery	Method
Na (*589.592)	0.653	0.022	90	Phosphoric-Sulfuric
Mg (*280.270)	0.576	0.002	102	Phosphoric-Sulfuric
Al (*396.152)	5.563	0.062	96	Phosphoric-Sulfuric
K(*766.491)	1.707	0.013	99	Phosphoric-Sulfuric
Ca (*396.847)	2.109	0.094	99	Phosphoric-Sulfuric
Ti (*368.520)	0.187	0.002	128	Phosphoric-Sulfuric
Mn (257.610)	0.06	0	100	Phosphoric-Sulfuric
Fe (*238.204)	4.284	0.034	99	Phosphoric-Sulfuric
Cu (*327.395)	0.49	0.003	101	Phosphoric-Sulfuric
Zn (*206.200)	10.242	0.0240	100	Phosphoric-Sulfuric
Zr	0.0131	0.0006	105	Phosphoric-Sulfuric
Cd	0.047	0.0016	102	Phosphoric-Sulfuric
Pb (*220.553)	0.057	0.0030	98	AR
Ag	0.01	0.0002	102	Phosphoric-Sulfuric
Sb	0.022	0.001	114	Phosphoric-Sulfuric

* OES Wavelengths- Zr, Cd, Ag & Sb analyzed by ICP-MS