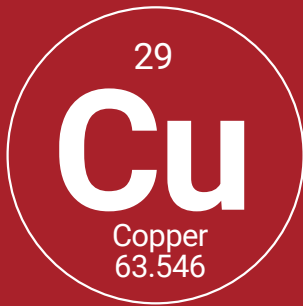


Quick Guide to Sequential Leach for Copper Ores



MSALABS offers sequential leach packages to determine the approximate constituents of copper ore.



Sequential Copper Leach packages are very useful tools for revealing the mix between Oxides, secondary Sulphides and relatively insoluble Sulphides.

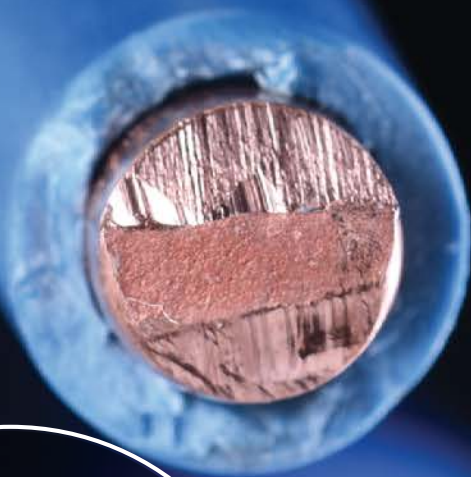
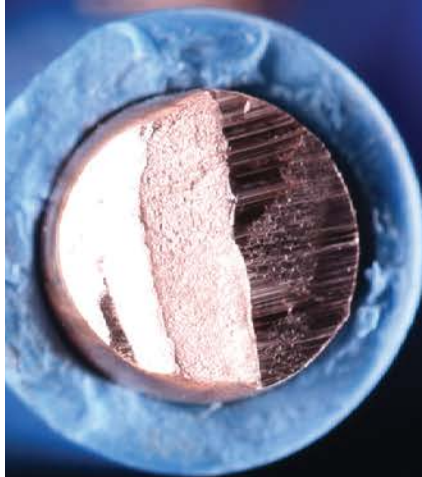
In combination with Mineralogical data, sequential leaches can reveal time saving information about the deposit. This can save money as one progresses in an exploration program.

Information garnered from the sequential leach process will enable a better understanding of the metallurgical processes required to successfully extract copper from the ore.



Typical minerals extracted by each stage of the sequential leach are shown in Table 1. In general, Sulphuric acid (H_2SO_4) is the first leach, followed by a Cyanide leach (eg NaCN). The residue is subsequently assayed by total digestion with Atomic Absorption finish.

In summary, the Sulphuric acid attacks copper oxide species, the Cyanide attacks secondary sulphides and Bornite minerals; while the total digestion attacks the relatively insoluble sulphide ores and chalcopyrite minerals. Information garnered from this process will enable a better understanding of the metallurgical processes required to successfully extract copper from the ore. A citric acid ($C_6H_8O_7$) digest will attack oxide and non sulphide copper minerals. It is a weaker acid than H_2SO_4 .



29
Cu
Copper
63.546

**TABLE 1:
APPROXIMATE PERCENTAGE DISSOLUTION OF COPPER MINERALS IN SULPHURIC ACID AND SODIUM CYANIDE SOLUTION**

Mineral	Approximate composition	% Dissolution in H ₂ SO ₄ *	% Dissolution in NaCN*
OXIDES			
Mineral	Approximate composition	% Dissolution in H ₂ SO ₄ *	% Dissolution in NaCN*
Atacamite	Cu ₂ Cl(OH) ₃	100	100
Azurite	2CuCO ₃ ·Cu(OH) ₂	100	100
Cuprite	Cu ₂ O	70	100
Chrysocolla	CuSiO ₃ ·2(H ₂ O)	100	45
Malachite	CuCO ₃ ·Cu(OH) ₂	100	100
Native Copper	Cu	5	100
Tenorite	CuO	100	100
SECONDARY SULPHIDES			
Chalcocite	Cu ₂ S	3	100
Covellite	CuS	5	100
PRIMARY SULPHIDES			
Bornite	Cu ₅ FeS ₄	2	100
Chalcopyrite	CuFeS ₂	2	7

Notes: ^ Citric acid leach is also available

*-Approximate dissolution after 1 hour of leaching pulverized material

With thanks to the SME for the use of this table

METHOD CODES AND DESCRIPTIONS

Cu by citric acid leach	SQL-CA1
Cu by sulfuric acid leach	SQL-AS1
Cu by sulfuric acid leach/sodium sulfite leach	SQL-AS2
Cu residue by 4-acid, ICP-ES finish	SQL-RE1
Cu residue by calculation	SQL-RE2
Total Cu by 4-acid, icp ES finish	ICF-6Cu
Sequential leach package	SQL-PK1





DELIVERING A FULL RANGE OF GEOCHEMICAL LABORATORY SERVICES GLOBALLY

EXTENSIVE RANGE OF SERVICES

- PhotonAssay™ Analysis (Gold, Silver and Copper*)
- Sample preparation, storage and disposal
- Precious metals by Fire Assay
- Multi-element packages - Basic, Trace, Ultra-trace
- Fusion, ICP-OES and ICP-MS
- XRF
- Specialty Assay
- Biogeochemistry and Hydrogeochemistry
- Metallurgical Samples Analysis and Services
- Mineralogical Services

* Copper assay only available in select locations and is not currently available in Canada

STRINGENT QUALITY STANDARDS

Our company maintains the highest quality standards and follows the guidelines of ISO17025 accreditation and ISO9001, ISO14001 and ISO45001 certification. Certificates are available for download from our website.

Additionally, we participate in CDN Labs, Geostats, PTP-MAL, and Rockslabs Proficiency Testing Schemes (PTS), among others.

EXPERTISE IN SITE-BASED LABORATORY MANAGEMENT

We have extensive laboratory design, construction and management experience in a range of countries.

We implement a complete set of systems, training, software and procedures enabling ISO certification and complete regular audits.

Our laboratories are managed by experienced, highly qualified staff, who undertake regular training.

BROAD RANGE OF COMMODITIES

We operate across a broad range of commodities.

- Gold
- Silver
- Platinum Group Metals
- Copper
- Rare Earth Elements
- Cobalt
- Lithium
- Lead
- Zinc

TIER 1 CLIENTS



EVERY SAMPLE SAFELY MEASURED
EVERY RESULT RELIABLY DELIVERED

contact@msalabs.com
msalabs.com

