COMPLETE GEOCHEMICAL ASSAY SERVICES
GLOBAL LABORATORY NETWORK
LARGEST GLOBAL PHOTONASSAY™ CAPABILITY

MSALABS

Technical Document - Cobalt

27
Co
Cobalt
58.933

Cobalt (Co) is a transition metal with a long history of industrial use that dates back thousands of years.

With lithium ion batteries poised to revolutionise the transportation and energy industries it is important to remember that there is eight times more Co in a Lithium ion battery than there is Lithium.

This fact underpins the nearly five-fold increase in global demand for cobalt seen in the last decade.

With current production dominated by regions with poor political stability and human rights records, surging demand is driving a new wave of exploration focused on stable and ethical sources of this critical commodity.

PROPERTIES AND USES

Throughout the 20th century, Co became increasingly important as a key ingredient in metallic alloys critical to much of our modern infrastructure and today, Co continues to sit at the forefront of technological innovation.

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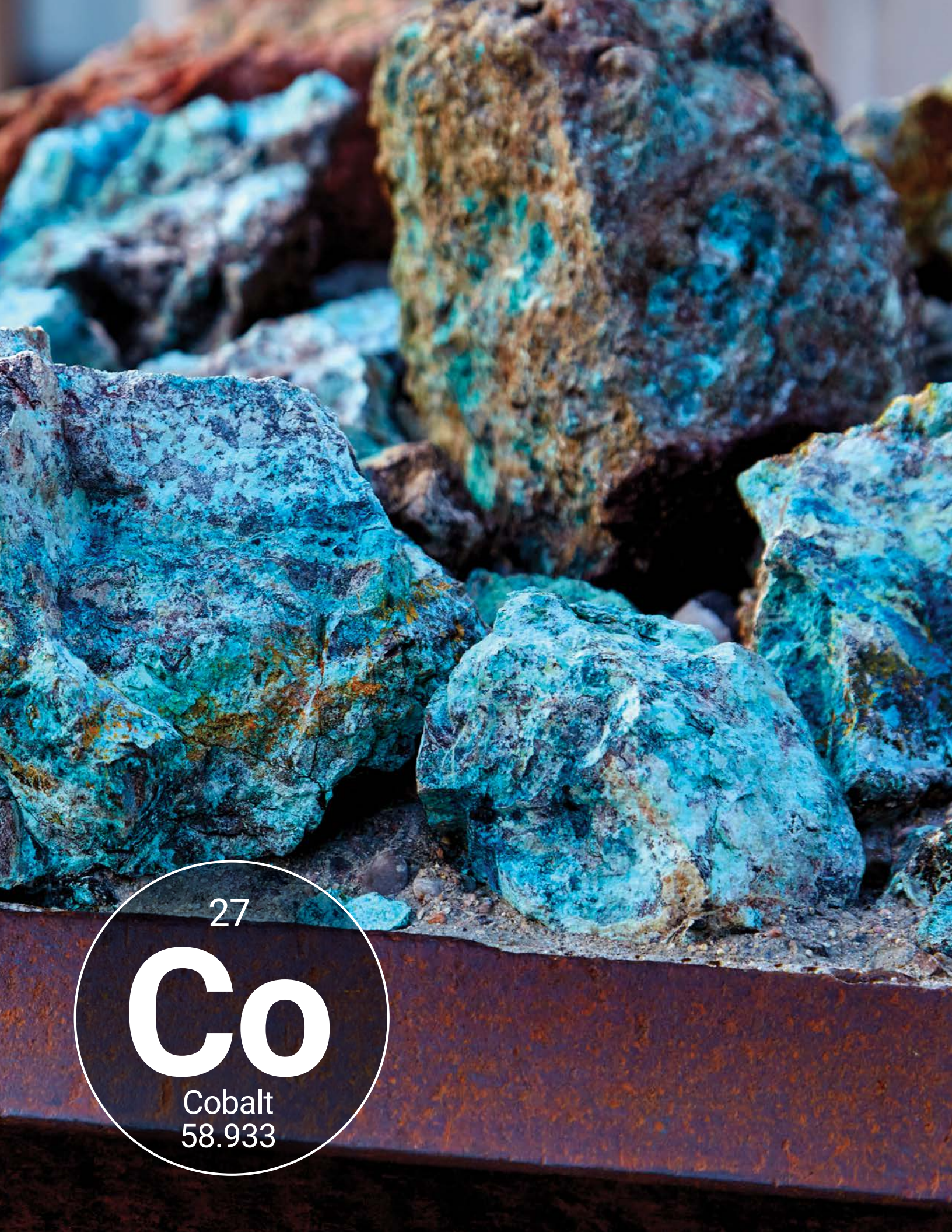
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DEPOSIT TYPES AND RECOMMENDED ANALYSES

Most Co is produced as a by-product of Copper and Nickel smelting and as such is typically associated with sulphide deposits. Its close association with other commodities, as well as its primary occurrence as arsenides means that multi-element analyses are typically required to fully understand both the credit and penalty element profile of both exploration and ore samples containing Co.

Where sulphide content is moderate to low, and hydrothermal alternation has not produced significant silicification, an aqua regia digestion can be used as a cost effective analytical method. Packages are available that cover a range of expected Co concentrations and suites of associated elements. For deposits containing gold, aqua regia digestions can also provide preliminary data to determine if the need for fire assay is present. MSALABS's experienced client service representatives are available to discuss the various options in detail, as well as larger mass aqua regia digestion designed to improve Au reproducibility.

Package Code	Description	Co Reporting Limits
IMS-130	51 element ultra trace Aqua Regia	0.1 - 10,000 ppm
ICP-130	35 element trace Aqua Regia	1 - 10,000 ppm
ICP-140	33 element ore grade trace Aqua Regia	0.001 -5%
ICA-6XX	Single element ore grade trace Aqua Regia	0.001 -5%

For deposits where siliceous alteration minerals may impede aqua regia recovery, MSALABS recommends a 4-acid digestion. Our 4-acid packages cover a range of expected concentrations and element suites and are specifically designed to reliably report critical volatile species such as arsenic. Where lower levels are expected, multi-element packages can be combined with automatic over limits so that high grade samples are automatically analysed with the appropriate ore grade method.

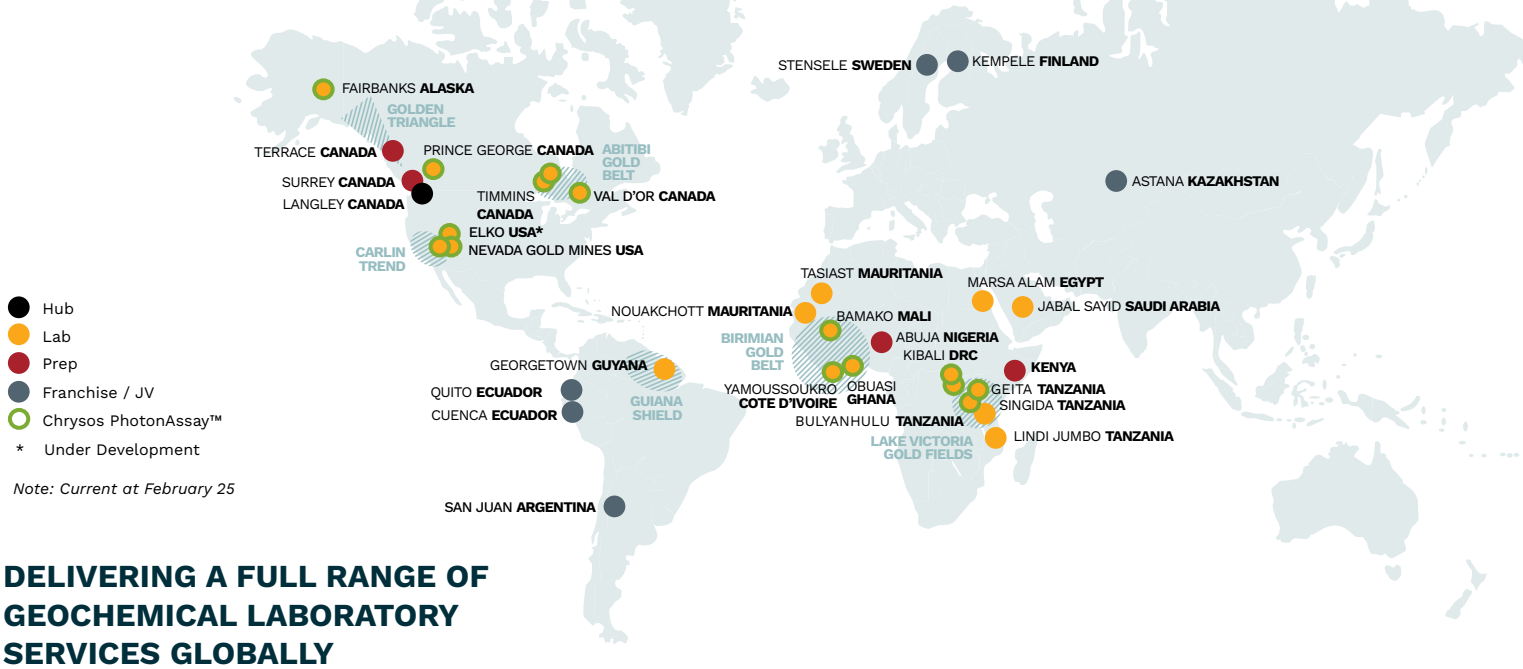
This ensures a robust set of data is delivered as quickly as possible by eliminating the need to re-submit high grade samples for further testing.

Please contact our client services team to discuss project specific protocols.

Package Code	Description	Co Reporting Limits
IMS-230	48 element ultra trace, 4 acid digest	0.1 - 10,000 ppm
ICP-230	34 element trace, level 4 acid digest	1 - 10,000 ppm
ICP-240	30 element ore grade, 4 acid digest	0.001 -5%
ICF-6XX	Single element ore grade 4 acid digest	0.001 -5%

Where extremely high sulphide concentrations are present, MSALABS recommends the use of a Sodium Peroxide fusion which has substantially more oxidising potential than acid digestions. This method also provides reliable quantification up to 30% Co making it ideal for high grade occurrences. Please contact one of our client service representatives to discuss how a small orientation survey can ensure you are using the most cost effective and robust analytical protocols on your project, or if you expect Co concentration greater than 30%.

Package Code	Description	Co Reporting Limits
PER-700	18 element sodium peroxide fusion	0.002 - 30%



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*

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

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.

TIER 1 CLIENTS

AGNICO EAGLE · ALAMOS GOLD INC · ARTEMIS · BARRICK · ENDEAVOUR MINING · G2GOLDFIELDS INC. · IAMGOLD · KINROSS · NEVADA GOLD MINES · PERSEUS MINING LIMITED · NORTHERN STAR

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.

MSALABS

EVERY SAMPLE **SAFELY** MEASURED
EVERY RESULT **RELIABLY** DELIVERED

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