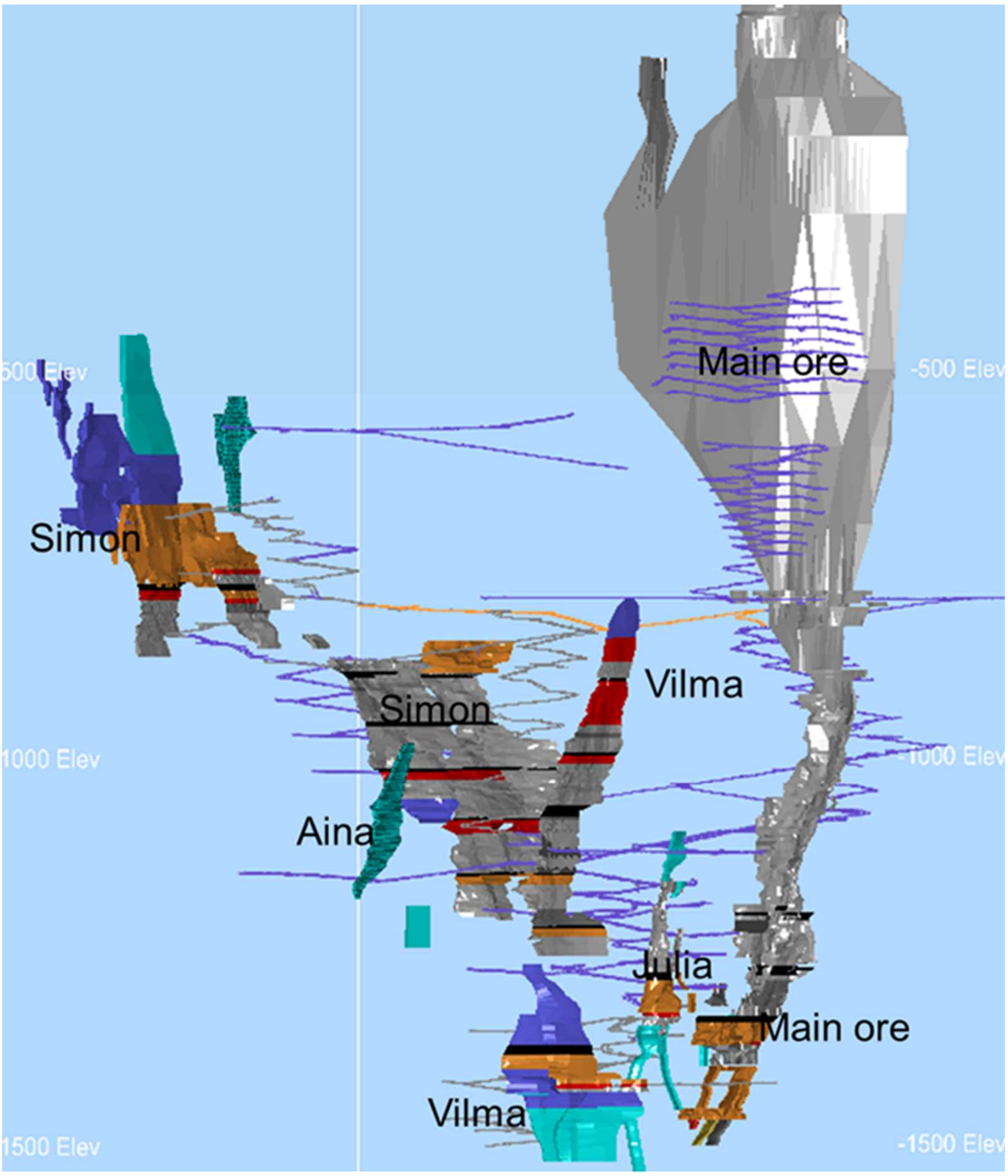
Boliden Summary Report

Mineral Resources and Mineral Reserves | 2021

Renström



Prepared by
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1 SUMMARY

This annual summary report concerns Boliden's wholly owned Renström mine (Sweden) and is a summary of underlying technical reports which have been prepared in accordance with the guidelines set out in the Pan-European Reserves and Resources Reporting Committee (PERC) "PERC Reporting Standard 2017". The report is updated and issued annually to provide the public (stakeholders, shareholders, potential investors and their advisers) with:

- An overview of the Renström mine and Boliden Area Operations; and
- Mineral Resource and Mineral Reserve statements for the mine and an overview of methods used to estimate these.

A summary of Mineral Reserves and additional Mineral Resources is presented in Table 1.

The effective date of this report is 31 December 2021.

Table 1: Mineral Reserves and additional Mineral Resources from the Renström Mine 31-12-2021 and comparison against previously reported tonnes and grades

	2021						2020					
Classification	**kt**	**Au (g/t)**	**Ag (g/t)**	**Cu (%)**	**Zn (%)**	**Pb (%)**	kt	Au (g/t)	Ag (g/t)	Cu (%)	Zn (%)	Pb (%)
Mineral Reserves												
Proved	**436**	**2.1**	**126**	**0.5**	**5.6**	**1.0**	**352**	**2.4**	**141**	**0.5**	**5.6**	**1.0**
Probable	**3,967**	**2.5**	**114**	**0.3**	**6.3**	**1.2**	**4,202**	**2.4**	**122**	**0.3**	**6.3**	**1.2**
Total	*4,403*	*2.5*	*116*	*0.36*	*6.22*	*1.14*	*4,554*	*2.4*	*124*	*0.3*	*6.2*	*1.2*
Mineral Resources												
Measured	**0**						**3**	**0.6**	**39**	**0.0**	**1.7**	**0.3**
Indicated	**1,477**	**1.3**	**76**	**0.5**	**3.9**	**0.7**	**1,277**	**1.4**	**81**	**0.6**	**4.1**	**0.8**
Total M&I	*1,477*	*1.3*	*76*	*0.5*	*3.9*	*0.7*	*1,280*	*1.4*	*81*	*0.6*	*4.1*	*0.8*
Inferred	**925**	**1.5**	**73**	**0.5**	**4.8**	**0.9**	**982**	**1.4**	**74**	**0.5**	**4.8**	**0.9**

Notes on Mineral Resource and Mineral Reserve statement.

- *Mineral Resources are reported exclusive of Mineral Reserves.*
- *Mineral Resource and Mineral Reserves is a summary of Resource estimations and studies made over time and adjusted to December 31 2021 terms.*
- *Mineral Resource are reported with 15% dilution*
- *Applied cut-off depends on selected mining method*

1.1 Competence

The contributors and Competent Persons responsible for the preparation of this report are presented in Table 2 below.

Table 2. Contributors and responsible competent persons for this report

Report Section	Contributors	Responsible CP
Overall compilation of this report	Luc Collin	Johan Bradley
Geology	Luc Collin; Johan Magnusson	
Resource estimation	Luc Collin, Robin Bernau	
Mineral processing	Lisa Malm, Nils-Johan Bolin	
Mining & Reserve estimation	Lena Andersson, Markus Isaksson	
Environmental and legal permits	Rodrigo Jr Embilde, Viktoria Lindberg	

2 GENERAL INTRODUCTION

2.1 Introduction

Boliden AB (“Boliden”) is a Swedish mining and smelting company focusing on production of copper, zinc, lead, gold and silver. Boliden operates six mining areas and five smelters in Sweden, Norway, Finland, and Ireland. The company primarily processes zinc, copper, nickel, gold, lead, and silver and is engaged in exploration, mining, smelting, and metals recycling.

This annual report is issued to provide the public (stakeholders, shareholders, potential investors and their advisers) with an overview of Boliden’s Renström mine, including the data and assumptions used to support the latest Mineral Resource and Mineral Reserve statements.

The annual report is a summary of internal technical reports, which provide a full evaluation of supporting information for the Mineral Reserves and additional Mineral Resources, having been prepared in accordance with the guidelines set out in the Pan-European Reserves and Resources Reporting Committee (PERC) “PERC Reporting Standard 2017”.

2.2 The PERC Reporting Standard

The PERC Reporting Standard 2017 (see www.percstandard.eu) is one of the world-wide CRIRSCO (see www.crirsco.com) group of standards for reporting of Mineral Resources and Mineral Reserves, along with JORC, CIM, SAMREC etc.

The PERC Reporting Standard was adopted by Boliden in 2019.

3 RENSTRÖM

3.1 Project Outline

The Renström mine is located 47 km northwest of Skellefteå in Västerbotten county, northern Sweden. Production from polymetallic mineralisation of volcanogenic hosted massive sulphide type commenced in 1948 and has continued uninterrupted to the present day. A combination of underground methods are currently used, between depths of 600 and 1500 m. In 2021 the mine produced 508 kton[1] at an average grade of 1,9 ppm gold, 112 ppm silver, 0,4% copper, 4,3% zinc and 0,9% lead. The dominating mining method is cut and fill, however since 2016, an increasing proportion of production is from large scale methods, namely long hole open stoping. Access to the mine is via a central shaft and ramp-drive system from the historic Petiknäs mine to the northwest. The mine employs roughly 185 staff and an additional 50 contractors. Crushed ore from Renström is trucked 17 km to the Boliden Area Operations Process Plant (BAOPP) for beneficiation by flotation and leaching, before further processing of concentrate to final product at the Rönnskär smelter (65 km). Subaqueous tailings deposition is at the Hötjärn facility west of the BAOPP.

3.2 Major changes

3.2.1 Technical studies

No position has been upgraded in mineral reserves in 2021.

3.2.2 Beneficiation test

The mill conducted a full-scale test on 11 kton of Fingal ore. Fingal has a higher copper to zinc ratio compared to other lenses at Renström and is usually stockpiled and processed together with zinc-sulphide dominated material. Selective batch processing of Fingal demonstrated an increased copper recovery from 75% to 95%. Future batch processing of Fingal is currently being considered.

In addition, lower mill through-put related to increased hardness was observed since November 2020. This is issue is currently being investigated and may result in a recommendation for further grindability testwork.

3.3 Location

The Renström mine is located 47 km northwest of the town of Skellefteå, on the border between Skellefteå and Norsjö municipalities, Västerbottens County, Sweden (Figure 1). The mine is centered on the following co-ordinates:

- WGS 84: N 64°55’26.6”, E 20°5’38.8”
- SWEREF: N 7209696, E 740632

[1] Mill throughput

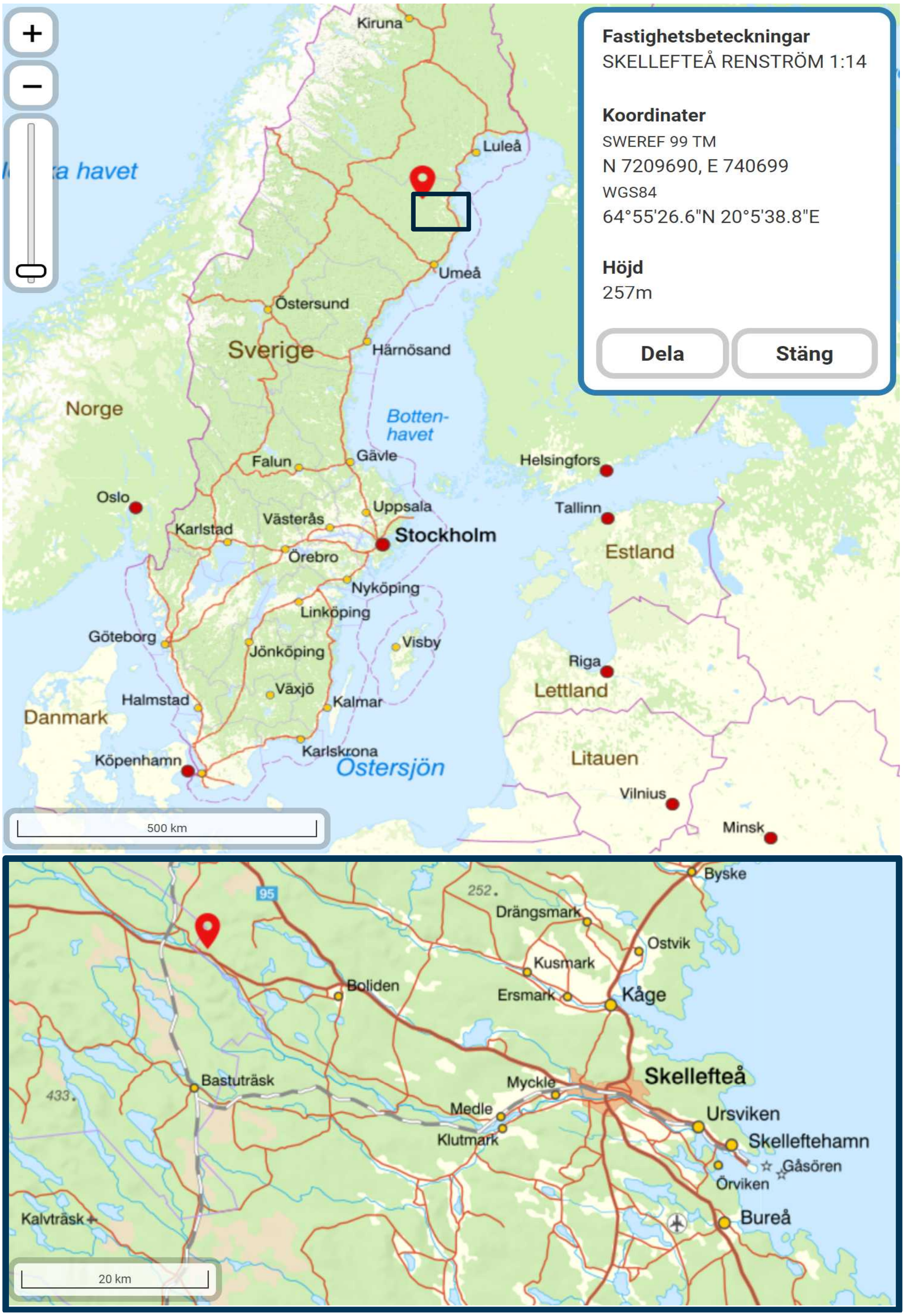


Figure 1: Renström mine location overview (above) and with respect to local population centers & infrastructure (below). Modified from https://minkarta.lantmateriet.se/)

3.4 History

In 1926, Renström East was found in drill holes along with two subsequent principal ores. Test mining and shaft sinking to down the 469 m level were achieved during the period 1944-48. In 1953, Renström was in full production. The shaft was deepened in 1959 down to the 910 m level. The Simon ore was discovered in 1998 and brought into production in 2000. Two additional sulphide lenses in the deep ore zone (Vilma and Julia) were encountered in 2005. Production from Vilma commenced in 2006. A transition to large scale mining method (open stoping) in Simon commenced in 2016.

3.5 Ownership and Royalties

Boliden owns the land immediately adjacent to the mine and covering the surface footprint of the majority of Mineral Reserves. There are several private landowners within the outlying land designation areas related to surface infrastructure, however royalties are applicable only to those permits where active production takes place. Table 3 provides an overview of these by permit.

Table 3: Landowner & Royalties

Permit name	Description of royalty payments
Renström K nr 1	Permit granted prior to 2005. Boliden owned land. No royalties are payable to the State.
Renström K nr 2	Permit granted after 2005. The total royalty comprises 0.2% of the value of the minerals recovered, of which 0.15% is payable to the landowner and 0.05% to the State. Only a very small part of the forecast LOMP production lies within this concession.

3.6 Permits

3.6.1 Introduction

Boliden Mineral AB is in possession of all required permits to mine at the Renström mine and the necessary land use designation from the Mining Inspectorate. Mining concessions and exploration permits are issued by the Mining Inspectorate of Sweden (Bergsstaten) which is part of the Geological Survey of Sweden (SGU). Summary details of these permits and concessions are presented the sub-section below and can be found at https://www.sgu.se/en/mining-inspectorate/.

The capacity of the tailings management facility at BOAPP is sufficient to include material from the Renström life of mine plan (LoMP) up to and including 2028. The final two to three years of production are expected to exceed the existing tailings dam capacity. It is not certain at this stage how the balance of this tailings material will be accommodated. Studies are however on-going, a suitable capital provision has been made and it is reasonable to assume that an appropriate solution will be selected in good time for necessary permitting, design and construction to take place.

3.6.2 Exploration Permits & Exploitation Concessions

The Renström mine is covered by one exploration permit and two exploitation concessions, as presented in Table 4 below. In addition, the Petiknäs concessions cover surface infrastructure at the historic Petiknäs mine, from which Renström is accessed via a ramp system. Current and forecast mine production is exclusively from the Renström K nr 1 and K nr 2 permits.

Table 4: Exploration Permit and Exploitation Concession Summary

Type	Exploration Permit	Exploitation Concession				
Name	Renström nr 1005	Renström K nr 1	Renström K nr 2	Petiknäs K nr 1	Petiknäs K nr 2	Petiknäs K nr 3
Owner	Boliden Mineral AB (100.00%)					
Licence id	2016:45	N/A				
Area (ha)	3 387,5	143,0	1,3	3,7	17,7	7,6
Valid from	2016-05-09	2000-01-01	2014-08-12	2001-10-22	2001-10-22	2005-03-04
Valid to	2022-05-09	2025-01-01	2039-08-12	2026-10-22	2026-10-22	2030-03-04
Diary nr	2016000184	1998000695:R:R:R	2014000396	2000000506:R	2000000505	2004000937:R:R:R:R
Municipality	Norsjö	Skellefteå		Norsjö		

It is notable that Renström K nr 1 is due to expire in 2025, some 5 years prior to the end of forecast production, according to the current life of mine plan (LOMP). Boliden intend to apply for a ten year extension to this license in good time and in accordance with standard operating procedure. Whilst the detailed terms of any extension are uncertain at this stage, Boliden is not aware of any current or impending material impediments that would negatively influence a decision from the relevant permitting authorities and would reasonably expect an application for extension to be granted.

3.6.3 Environmental Permits

Boliden has full surface rights surrounding and immediately adjacent to the mine.

In accordance with Environmental Law, a main permit as a partial decision: 2014-05-27, case nr. M354-13 was issued in May 2014 and updated in 2019 with final conditions for discharges as: 2019-03-27, case nr. M 354-13. A decision on 2019-11-20 (nr. M1832-19) permitted increased annual maximum production to a rate of 520 ktpa. These permits cover matters including:

- Maximum production rate 520 ktpa;
- Maximum total concentrations of elements in discharged water (there is no limitation on quantity);
- Maximum noise levels;
- Dust;
- Vibrations;
- Requirement to run operations as stated in the technical description;
- Acquisition and importation of additional waste rock and/or tailings sand, also temporary storage, for use as fill underground;
- Environmental monitoring;
- Explosives – spillage etc.;

- Remediation plans, to be submitted before closure; and
- As of 2019-02-19 a new financial bank guarantee of 20 MSEK was approved by the Environmental Court in case nr M354-13. The guarantee shall cover all environmental liabilities in case of bankruptcy.

3.7 Geology

3.7.1 Regional

The rocks in the Skellefte district were formed approximately 1.9 Ga during a period of active volcanism. The felsic magmas intruded as shallow (subvolcanic) intrusions (dykes and sills) at and close to the surface, where they mixed and mingled with wet sediments and mass-flows derived from volcanic slopes resulting in hyaloclastic brecciation and peperites. The active volcanic region also initiated a convection of solutions within the deposited package which enabled the dissolution and transportation of metals and minerals. These solutions also altered the rocks both physically, through (hydro-) brecciation and fragmentation, and chemically resulting in the heavily altered rocks present today.
After the main volcanic period, regional deformation took place within the Skellefte district. The brittle deformation accommodated for fractures and fissures, which would be filled by mafic magmas forming andesitic and basaltic dykes.

3.7.2 Local

The Renström area is located 15km west of Boliden, in the eastern part of the Skellefteå district. The Renström area has a volcanically complex and multiply deformed rock sequence. Rock types include a large range of basaltic andesite to rhyolite volcanic facies. Juvenile basaltic andesite, dacite and rhyolite volcanoclastic facies are particularly abundant and these have been intruded by numerous basaltic, andesitic dacitic and rhylitic sills and doms. The area has two main generations of folding with a complex interference pattern, and several generations of faults and intrusions.
The Renström area is one of the most intensely mineralized parts of the Skellefte district and the Renström deposit is one of the most important deposits due to its size (>10 million tonnes), grade (high Zn, Au, Ag values) and metallurgical characteristics (medium grained; low arsenic and antimony contents). The ores in the Renström deposit are associated with strong chlorite, dolomite, sericite and silica alteration.

3.7.3 Mineralization

The Renström mineralization consists of several smaller lenses, which are all characterized by massive to semimassive pyrite-sphalerite dominated ores with subordinate massive to semi-massive pyrite-chalocopyrite ore and local stringer-type pyrite-chalocopyrite±pyrrhotite mineralization. The main ore minerals are pyrite, sphalerite, galena, chalcopyrite, pyrrotite and arsenopyrite with minor tetrahedrite-tennantite, other sulphosalts, electrum and amalgam (Helfrich, 1971; Kläre, 2001). Ores in the Renström area have higher zinc, gold, silver and lead contents and lower sulphur and arsenic content than most volcanic-hosted massive sulfide ores in the Skellefte district.

3.8 Drilling procedures and data

3.8.1 Introduction

The present orebodies have no surface expression and have been explored entirely by drilling, at first from the surface but predominantly by underground drilling as described below. There is no other sampling of in-situ rock.

3.8.2 Drilling techniques

Exploration & delineation drilling: Planned and executed by the Near Mine and Field exploration groups, the purpose of these programmes is target identification, definition and delineation. Drill core sizes are typically BQ (36.5mm core diameter), WL56 (39mm) or NQ (47.6mm). Mineral Resource estimates using this data are prepared by Boliden's UDV mine services group, with models handed over to the mine once these have attained Indicated category. These block models are used by the mine as a basis for Mineral Reserve estimation. 10200 m of exploration core have been produced in 2021.

Some special measures have been used to drill through chlorite-rich zones in the deeper parts of the mine.

Infill drilling: Planned and executed by the mine geology and planning group. Underground infill drilling is carried out within the existing define mineralised zones with to further define mineralised contacts ahead of production. Drilling is typically on a pattern of 20m x 15m or 15m x 15m, with core diameter of 39 mm (WL56) and hole length typically ranging from 100m to 200m. The Mineral Resource models, originally prepared by Boliden's mine services group, are subsequently updated by the mine geology group using infill drilling data. 11 200 infillcore meters have been produced in 2021.

Both exploration drilling and infill drilling are undertaken by contractors.

3.8.3 Downhole surveying

Downhole surveying is done by either EM-measurements or Gyro measurements. Most of the EM-surveys done by exploration are for longer exploration holes and account for approximately 10% of measurements. The EM-surveys are carried out by Boliden's geophysics department. while the Gyro-measurements are done by the contracted drilling team. All infill drillholes are surveyed by the drilling company using a reflex gyro ®tool. Exploration drill holes are surveyed by a IS-gyro tool.

3.8.4 Sampling

Samples with a typical length of 1.5–2m are taken for the extent of visible sulphide mineralization. Sampling is started up to 10m before the mineralized zones and extended up to 10m beyond the mineralized zone to ensure any associated gold is captured.

Exploration holes are sampled as half-cores, where core is split length-ways by diamond saw at the core shed facility in Boliden, adjacent to the logging facility. One half is sent for sample preparation and assaying. The other half is stored for reference at Boliden's drill core archive. Between 5 and 10 samples are collected each year for litho-geochemistry. In these instances, a 20-30cm intersection of core is collected per sample.

For infill drill core, of those intersections that are sampled, the whole core is submitted to the ALS Chemex lab in Malå for preparation. Unsampled core is stored for a few months after which it is discarded.

3.8.5 Logging

Core drilled on behalf of Near Mine Exploration are transported to the core storage and logging facilities in Boliden, whilst infill drill core drilled by the Renström Mine remains on site at Renström for logging. All logging data is captured in WellCAD™ software and uploaded to Boliden's acQuire™ database. Samples are labeled and entered into the database during core logging.

3.8.6 Density

Densities at Renström are estimated using two regression formulae as follows:
For main ore:
Density = 2.7 + 0.0043*Cu + 0.004*Zn + 0.02*Pb + 0.027*As+**0.0375*S**
For all other lenses:
Density = 2.7 + 0.0043*Cu + 0.004*Zn + 0.02*Pb + 0.027*As+**0.034*S**

Regular specific gravity measurements are undertaken by the assaying laboratory during the year and continue to demonstrate good correlation with estimated densities based on the regression formulae above.

3.8.7 Sample Preparation, Analysis and QAQC

Exploration group primary samples and QAQC samples, are bagged by Boliden technical staff and sent via contracted courier service to MS Analytical Laboratory, SE-923 41 Stensele, Sweden. Sample preparation method PRP920 is used to prepare the samples for analysis.

Infill drill core samples from the mine are currently prepared by ALS Chemex, Fabriksgatan 1, SE-930 70, Malå. Sample preparation method Prep-31B is used to prepare the samples for analysis. Both ALS Chemex and MS Analytical Laboratory maintain both ISO 17025 (Testing and Calibration Laboratories) and ISO 9001 (Quality Management Systems) accreditation. Prepared exploration core samples are currently sent directly from the affiliate laboratory in Stensele to partner MS Analytical laboratory in Canada. Infill drill core samples are sent directly from the preparation laboratory in Malå to partner ALS Chemex laboratories for analysis.

Table 5 below shows an overview of the preparation and analytical methods used by each laboratory. The "over-range method" applies to samples where assay results reached upper detection limit of the primary method.

Table 5: Overview of preparation and analytical methods by laboratory. Over-range method (in brackets) apply to samples where assay result reached upper detection limit of the primary method

	Prep	Cu	Zn	Pb	Ag	As	Au	S
MS Analytical Laboratory	PRP920	ICA-6	ICA-6 (ICF-6)	ICA-6 (ICF-6)	ICA-6 (FAS418)	ICA-6	FAS214 (FAS415)	SPM210
ALS Chemex	Prep-31B	OG46	OG46 (ME-ICPORE)	OG46	OG46	OG46	AU-ICP-21 (Au-GRA21)	S-IR08

QAQC guidelines and workflow are described in an internal document (INST-24685v.1.O), which resides in Boliden's intranet-based business management system. Currently, only the Renström exploration group drill samples are subject to a QAQC programme. The Renström mine geology group does not submit QA/QC samples as part of infill drilling campaigns, although this process is currently under review.

QAQC samples are inserted into the sample run by the geologist responsible for logging the drill hole and setting the sampling intervals. Quality control of results are carried out by the same geologist, or another geologist in the group, on a batch-by-batch basis in acQuire™. Batches that include assays outside accepted ranges are reviewed with an in-house specialist before agreeing on a course of action. Any rejected batches are discussed in the geologist's monthly report.

During the calendar year, no metal assay batches were rejected and in total 17 batches were received and accepted, having passed quality control measures.

Table 6 below provides an overview of exploration group QAQC sample frequency for the calendar year ("CRM" = Certified Reference Material).

Table 6: QAQC sample frequency (exploration group only) for the calendar year under review. "CRM" = Certified Reference Material.

	Boliden CRM	International CRM	Blanks	Check Assays	Rig Duplicates	Total
Renström Actual QC Frequency	2.9%	0.0%	3.8%	1.7%	-	8.3%

3.9 Exploration activities and infill drilling

Exploration drilling focused on the depth extensions of Vilma and Julia orebodies. Infill drilling focused on the upwards continuity of Simon, for accessing the possibility of expanding large-scale production methods in this direction.

3.10 Mining methods, mineral processing and infrastructure

3.10.1 Mining methods

The dominating mining method at Renström is cut and fill, although since 2016, an increasing proportion of production is from long hole stoping methods. All stopes are backfilled with either hydraulic fill (tailings from mill), cemented rock fill or uncemented rock fill (Barren rock from developments). The proportion of different mining methods is outlined in Table 7.

Table 7: Proportion of different mining methods used in Renström

Methods	Proportions
Cut & fill	72%
Open stoping	24%
Retreat mining	3%
Bench	1%

Cut and fill mining is a selective open-stope mining method suitable for steeply dipping, high grade deposits. The overhand cut and fill technique is used at Renström, where mining begins at the bottom of the ore lens and progresses upward.

At Renström, cut and fill is selected where:

- Ore is hosted in long, thin lenses;
- Mineralisation is geometrically complex and difficult to follow; and
- Wall rock is too weak to support larger scale production methods.

Stopes are 5-6m high and typically 6-8m wide, subject to orebody thickness.

Main levels are typically 65m high, including sill pillars of around 14m thickness, subject to local geotechnical conditions. Wider ore lenses are mined in panels, using CHF (cemented hydraulic fill) as backfill to provide stable sidewalls.

Long hole open stoping was introduced in 2016. The current LOMP assumes an increasing proportion of production from this method from the Simon orebody. Both longitudinal and transverse stopes are planned.

Primary stopes are backfilled with CHF (cemented hydraulic fill) or CRF (cemented rock fill). The secondary fills are backfilled with waste rock, unless these need to be filled in campaigns, if which case the first filling consists of CHF or CRF.

With the cut and fill method, sill pillars are left between the main levels. These are mined in sequence from upper to lower pillars, once cut and fill production from higher levels within the same lens is complete. This technique is called **"opping" or uppers on retreat** and uses long-hole, 5-10m rounds. Stopes are either left open, in which case pillars are left at regular intervals, or backfilled with waste rock and CHF.

For narrow lenses with CHF hydraulic fill, a 3-4m thick pillar is left. For wider lenses, the full width of the pillar cannot be mined and a larger proportion is left. To date, this method has been longitudinal to the ore lens. A review is underway to assess the applicability of mining pillars transverse to the ore lens, for wider ore bodies, which could lead to improve ore recovery. The length of round and type of fill is decided on a case by case basis, depending on local ground conditions.

The rill or **Avoca mining** is used in cases where local conditions suit cut and fill, but the wall rock is unusually competent. Costs associated with development may be reduced slightly using this method. The LOMP does not include any positions where this technique is planned.

Bench technique is occasionally used at bottom of the ore lens, provided extraction of the sill pillar is still deemed to be feasible. Typically stope heights are 3-4m drilled with close spaced vertical holes and mucked with an excavator. A common reason for using this method is if mineralization extends beyond the original design. The method does not feature in the current LOMP and is generally adopted after infill drilling and/or mapping has been completed.

3.10.2 Mineral processing

The process used for treating run of mine ore (ROM) from Renström is well established. Ore is delivered by truck (40 tonne payload) weighed by weigh-bridge and either delivered directly into the plant or stockpiled separately from ore from the other BAO mines.

Ore from the different mines is processed in campaigns. The feed tonnage to the processing plant is determined using a weighing system with a stationary belt scale. Feed tonnage and weights from the trucks scale are used to determine current tonnage on the stockpiles.

As shown in Figure 2 below, there are two stages of grinding. The primary mill is a fully autogenous mill and the secondary mill is a pebble mill fed with pebbles extracted from the primary mill. The ground ore is classified using screens and hydro-cyclones. Typical mill throughput varies between 80 to 140 tonnes per hour (tph), depending on ore type, but is usually above 110 tph for Renström ore. Ground ore is classified using screens and hydrocyclones.

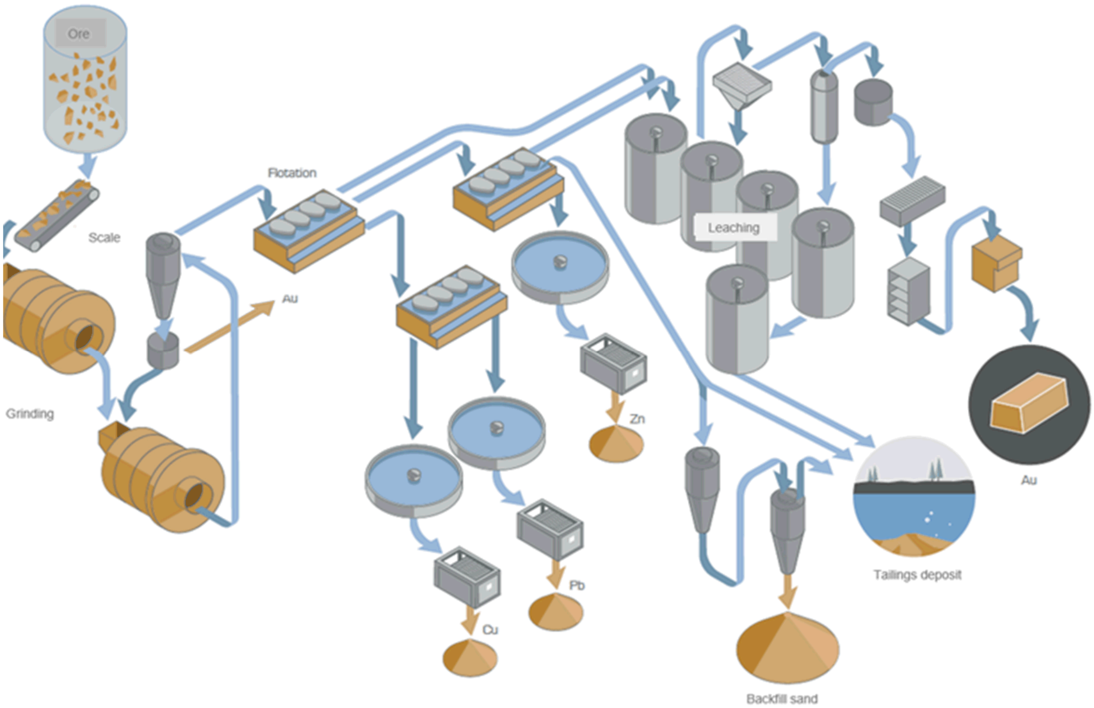


Figure 2: Simplified overview of the different stages of Renström ore processing at BAOPP

A gravimetric concentrate containing coarse grained gold bearing minerals is produced in the grinding circuit and a flash flotation cell is used to extract mainly copper minerals with high flotability. The gravimetric concentrate is packed in big bags of about 800 kg and delivered by truck to the Rönnskär smelter.

Flotation is done in a three-stage process: copper-lead bulk flotation, copper-lead separation and zinc flotation producing three concentrate qualities, copper, lead and zinc.

The mineral concentrates are dewatered using thickeners and vertical plate pressure filters. The concentrates are transported by truck to the Rönnskär smelter and shipping port. Lead and zinc are transported by boat to Boliden smelters in Norway and Finland or to external buyers.

Cyanide leaching is performed on flotation tailings when the leaching plant is available. Priority at the leaching plant is otherwise given to run of mine ore from the Kankberg gold mine. Gold and silver are recovered through to a precious metal sludge, which is transported to the Rönnskär smelter for further processing.

Metallurgical accounting where a sum of products calculated using assays from daily composite samples of main process streams and assays and tonnage for delivered products together with feed tonnage is used to determine the head grade of the ore.

Average metallurgical recovery factors are presented in Table 8 below.

Table 8: Metallurgical Recovery

Product	Metallurgical Recovery
Au	84,5%
Ag	85,0%
Cu	74,4%
Zn	89,6%
Pb	55,9%

3.10.3 Mine infrastructure

Mine access is via a hoisting shaft that extends to 880 m level and through an underground drive at 800 m level connecting the operation to the surface ramp at the nearby, historic Petiknäs mine. The shaft provides access for personnel and is used for ore and waste rock hoisting, while the Petiknäs drive provides direct vehicle access to surface (Figure 3).

The majority of run of mine ore (ROM) is transported by truck to a jaw crusher at level 810m. The crushed ore is then transported via conveyor belt to two ore passes, where it is stored before being hoisted to surface. Loading of the hoist from ore passes is via a series of conveyors at the 883m level. On occasion, ore and waste rock are driven by truck via the Petiknäs ramp to surface.

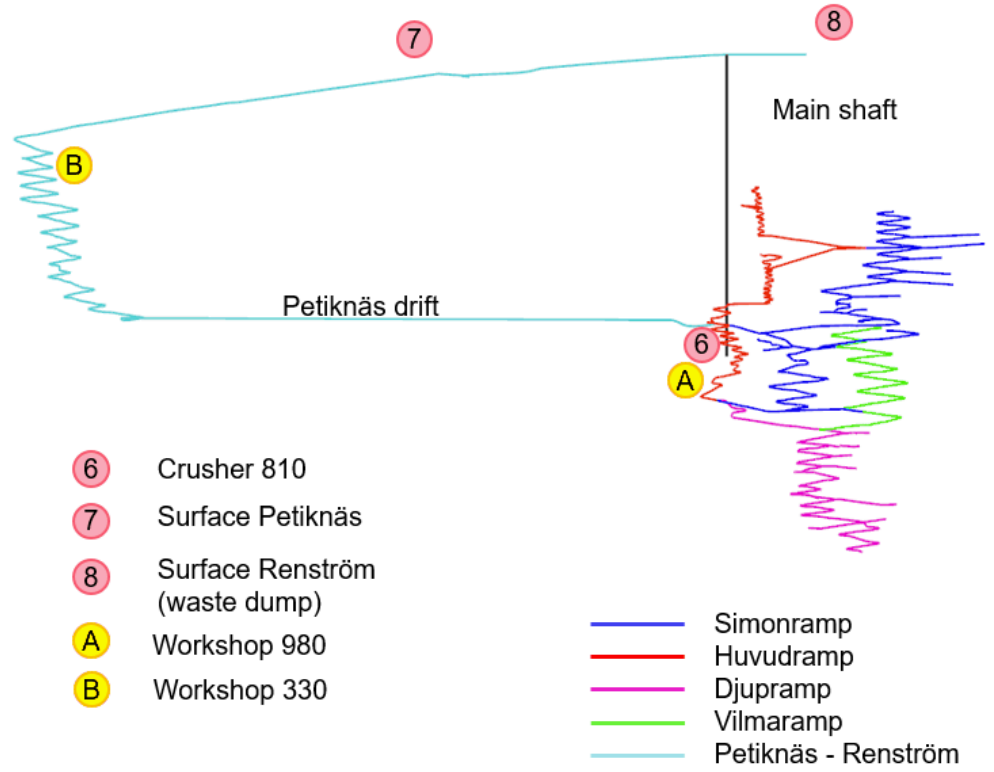


Figure 3: Schematic cross section of the Renström ramp system and Petiknäs decline with crusher and workshop location (looking due north. field of view ~3km horizontal & 1.5km vertical).

Air intake to the mine is via two vent shafts equipped with 1800 mm fans on surface. To avoid freezing during winter months, air is heated via two immersion heaters, which are supplemented by diesel heaters as required during the coldest winter temperatures. Current capacity amounts to approximately 600,000 m3 / hour. Air is distributed underground via 1600 mm fans, followed by 900 mm fans which to individual stopes. Active stopes require ventilation at around 12.5 m^3 / s and 16 m^3 / s during loading. Return air exits the mine via the ramp systems and through an exhaust air shaft located within the mines industrial area.

The underground facilities for managing water at the mine consist of a system of pump stations and sumps, where mine water is collected and pumped to surface in stages. Several oil separators are installed adjacent to workshops and filling stations.
Surface water from both the Renström and Petiknäs industrial areas flow via drainage ditches to collection ponds for subsequent pumping to the mine water treatment plant

3.11 Prices, terms and costs

3.11.1 Metal prices

Boliden's planning prices, which are an expression of the anticipated future average prices for approximately 10 years, are presented in Table 9 below, along with foreign exchange rate assumptions.

Table 9. Long-term metal prices and currency exchange rates

Metal prices		**LTP 2023->**
Gold	USD/tr.oz	1 300
	SEK/kg	334 368
Silver	USD/tr.oz	17.0
	SEK/kg	4 373
Copper	USc/lb	308
	SEK/tonne	54 400
Zinc	USc/lb	109
	SEK/tonne	19 200
Lead	USc/lb	95
	SEK/tonne	16 800

Currency rates	**LTP 2023->**
USD/SEK	8.00

3.11.2 Costs and Cut-off

Table 10 below presents a summary of costs and defines the basis for cut-off assumptions at Renström.

Table 10: Renström cost summary

Item	SEK/t	Cut-off 1	Cut-off 3	Cut-off 4
Mining (cut & fill)*	72	X	X	
Ground support	61	X	X	

Loading & hauling	65	X	X	
Hoisting	18	X	X	X
Transport (mine to mill)	14	X	X	X
Processing	109	X	X	X
Other	42	X	X	X
Overhead	57	X	X	X
Infill drilling	36	X		
Development & sustaining investments	446	X		
Total (rounded)		**920**	**450**	**240**

**Cut & fill is a selective mining method with higher costs than large-scale methods such as open stoping, which also used at Renström.*

Cut-off 1: Breakeven cost, which can be used as a guide for mine planning and Mineral Reserve estimation. Material with NSR above this breakeven cost is sent to the mill

Cut-off 3: Used to constrain Mineral Resources. Material with an average NSR above this cut-off can be included within Mineral Resource wireframes.

Cut-off 4: Marginal cost. When material with an average NSR between 920 SEK/t and 240 SEK/t must be mined to access higher-grade material, the marginal cut-off is applied and this material trucked as ore. Rock below 240 SEK/t would be mined as waste and may be used within the mine as backfill.

3.11.3 Net Smelter Return

NSR (Net Smelter Return) is a revenue evaluation calculated for each intersection (or model block) based on metal prices, costs of processing and smelting, and metallurgical recoveries. The NSR is effectively the value in Swedish Kronor (SEK) from the contribution of each contained product or by-product metal attributed to ore arriving at the process plant. Being a combined product value, it is used as a grade to describe tonnages in terms of SEK/t. The long-term NSR Factors are given for each metal below:

NSR_21LTP23 = 245 * Au_ppm + 2.93 * Ag_ppm + 355 * Cu_pct + 114 * Zn_pct + 71.5 * Pb_pct

3.11.4 Cut-off grades

The operational costs and NSR factors provided above together define the cut-off grade, which is expressed as a combined NSR value / tonne. The relative contribution of individual metals to this cut-off grade will vary according to ore body, but in general Zn, Au and Ag together typically account over 80% of revenue for any single block, with exception of the Fingal lens, which has a higher copper / zinc ratio.

3.12 Mineral Resources

Mineral Resource estimates for Renström are prepared by Boliden's Ore Reserves and Project Evaluation group (UDV). Mineral Recourses at Renström are normally reported with 15% waste dilution and are exclusive of Reserves. Datamine Studio RM is predominantly used for estimation, although historically Propack, an add-on to the CAD program Microstation has also been used.
Boliden's Ore Reserves and Project Evaluation group estimation follows the workflow outlined in Figure 4.

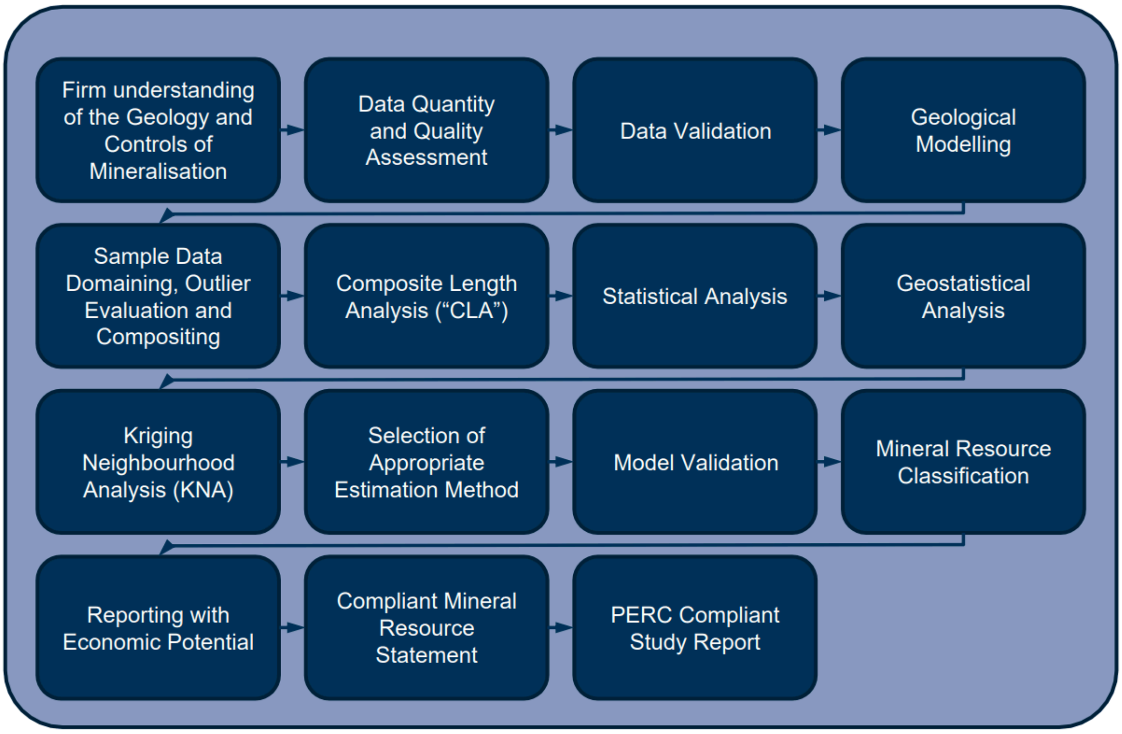


Figure 4: Ore Reserves and Project Evaluation group Mineral Resource estimation workflow

After checking geological models and data provided by the Near Mine exploration group, mineral resource domaining is undertaken by UDV using commercial software (CAD Microstation, Leapfrog or Datamine). This wireframing is based on geology, mining assumptions and NSR value.

Exploratory data analysis is performed for the assay samples within the wireframed domains to determine that the data populations have been sufficiently delineated for a robust resource estimate. Outliers within the data that could cause an overestimation of the grades are identified using log-probability plots and histograms. Top-caps are applied to mitigate this issue and a cap of 10-20g/t Au and 1000g/t Ag has been used historically in the UDV estimates. Zinc is commonly uncut although local capping has been applied for lower grade domains (i.e., Simon – Eskil and Fingal). The statistics of the capped and uncapped samples are compared to assess the effect on the mean, standard deviation, and coefficient of variation of the sample populations.

The samples are then composited to either 1m or 2m lengths, depending on the dominant sample lengths. The effect of using different composite lengths is also assessed through composite length analysis (CLA). The statistics of the composited samples are examined to check the effect of the compositing on the sample populations. The spatial continuity of the samples is assessed using geostatistical techniques including the variography and based on this assessment an estimation methodology is selected for the domain. At Renström this has increasingly moved from Inverse Distance Weighted (IDW^2) to Ordinary Kriging (OK).

Kriging Neighborhood Analysis (KNA) is then used to determine the effect of using different block sizes, as well as the effect of varying the minimum and maximum numbers of samples for the estimation pass, on the predicted quality of the estimate.

A block size of 6m (x) * 5m (y) * 5m (z) is typically used at Renström which has been shown to be within acceptable ranges by the KNA and is suitable for the selective mining unit at the mine. Locally a block size of 5m (x) * 6m (y) * 5m (z) is used where more appropriate for the geometry of the ore bodies. The UDV estimates typically utilize Dynamic Anisotropy to vary the estimation search ellipse with that of the ore bodies orientation.

The statistics of the estimated blocks are then checked to ensure that a reasonable estimate has been made for each domain. Continuous checking of the statistics facilitates validation of each step of the process, from raw samples, capped samples, composites though to estimated block grades. Other validation checks include visual checks of assayed drillholes and estimated block grades and swath plots. The swath plots geographically divide the model into slices and compare the average grade of the samples, composites and estimated block grades for each slice. This helps to assess the level of smoothing in the estimate and determine whether there is a systematic bias causing either over or under-estimation.

The classification of the resources is based on geological understanding and continuity, quality and quantity of informing drill hole data and confidence in the block estimates. This is often related to the drillhole spacing and typically, for Boliden VMS deposits, a drill spacing grid of 100 m x 100 m is used as a guide for Inferred Mineral Resource and 40 m by 40 m for Indicated Mineral Resource. Measured Mineral Resources require 20 m by 20 m drilling and local mine mapping of the underlying slice to support the geological and grade continuity required for this level of confidence. As such this upgrade is commonly part of the MRE production update.

These drill hole spacing guidelines are based upon Boliden´s history of mining massive sulphides in the Skellefte district.

The Mineral Resource statement for the period is presented in Table 1 above.

3.13 Mineral Reserves

Conversion of Mineral Resources to Reserves requires:

- development designs;
- determination of appropriate mining method;
- stope design;
- a high-level plan for ventilation and electricity; and
- a pre-feasibility level study demonstrating acceptable profitability.

Scheduling is carried out using both Deswik and GanttScheduler software. Mineralisation wireframes used as a basis for the Mineral Resource estimate are adjusted to the minimum mining unit, based on the applicable mining method, equipment and geotechnical design criteria. These are restricted to material above cut-off grade and any Inferred material contained within the wireframes is excluded prior reporting Mineral Reserves.

Further adjustments are made where appropriate to account for waste rock dilution and ore losses, with respect to a factor of 15% waste rock dilution, which is already included in Mineral Resource estimates. Where possible, dilution and losses are based on monthly stope reconciliation data. In the absence of this, the generic assumptions presented in Table 11 are applied.

Table 11: Waste rock dilution and ore recovery factors by mining method

Mining method	Waste rock dilution (zero grade)	Ore losses
Cut and fill	15%	2%
Avoca / Uppers on retreat	20%	5%
Sub-level open stoping primary / secondary	2% / 6%	22% / 0%

Figure 5 below provides a schematic illustration of the principles for reporting of Mineral Resource and Mineral Reserve at the Renström mine.

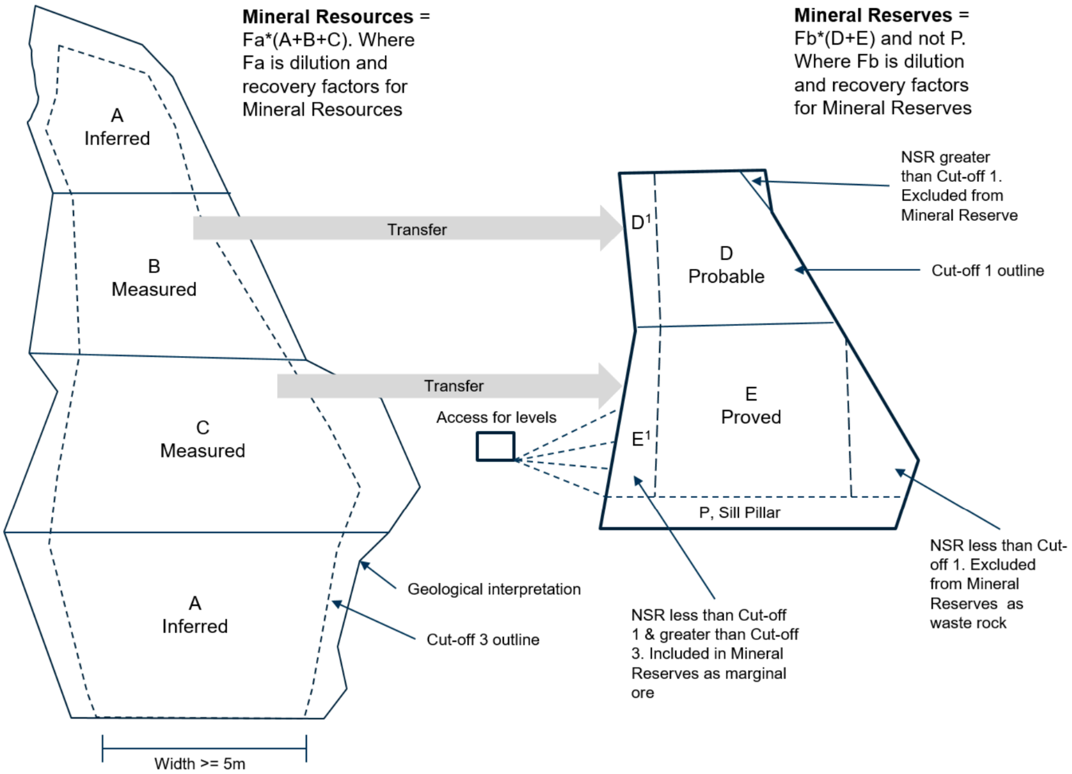


Figure 5: Schematic illustration of the principles for reporting of Mineral Resource and Mineral Reserve at Renström

The above sketch on the left side shows Mineral Resource volumes defined by an NSR equivalent to Cut-off 3(see Table 10). Mine planning transfers much of the Indicated and Measured categories to Mineral Reserve volumes shown on the right. These are defined mainly by Cut-off 1 (see Table 10), which is shown on the right as a dashed line. Mineral Reserves may also include marginal material (D^1 and E^1) which were previously classified as Mineral Resources are above Cut-off 3 and which need to be mined to access higher grade material.

After LOMP planning, there may be small quantities of Mineral Resources with grade above Cut-off 1 that cannot be included in rooms to be mined. This is generally because to access these would require inclusion of low-grade material such that the average NSR value of the room would be less than Cut-off 1. Such material is illustrated in the sketch above as 'NSR greater than Cut-off 1. Excluded from Mineral Reserve.' This would not be transferred into Mineral Reserves and it would cease to be included in Mineral Resources.

Indicated Mineral Resources are transferred to Probable Mineral Reserves and Measured Mineral Resources are transferred to Proved Mineral Reserves, in each case by the application of a mining plan, which includes application of local Cut-off 1 costs.

When a level is planned to be included in the LOMP, any Mineral Resources that are excluded from the LOMP are dropped from the reported Mineral Resources. This is because once a level is mined and backfilled, these volumes would no longer be accessible for economic extraction.

The Mineral Resource statement for the period is presented in Table 1 above.

3.14 Comparison with previous year

The two figures below present an overview of changes to Mineral Reserves (Figure 6, Proved + Probable) and Mineral Resources (Figure 7, Inferred + Indicated + Measured).

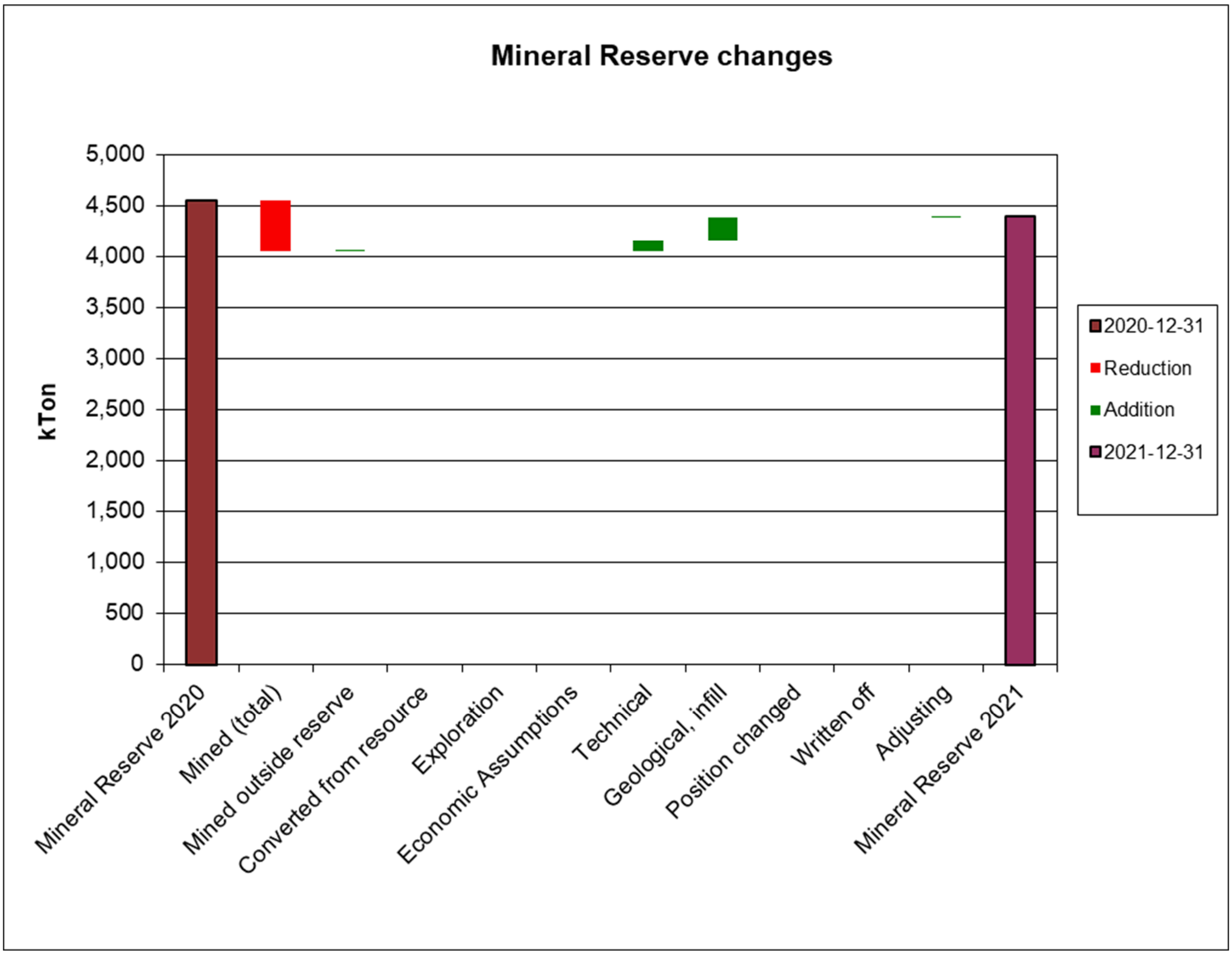


Figure 6.Changes to mineral reserve (P+P)

Gains in mineral reserves do not offset the 501 kton of output. The net balance is negative by 151 kton. Conversion of sillpillar (technical, +112 kton) and updates of interpretations (Geological, infill; +221kton) contributed positively to the balance.

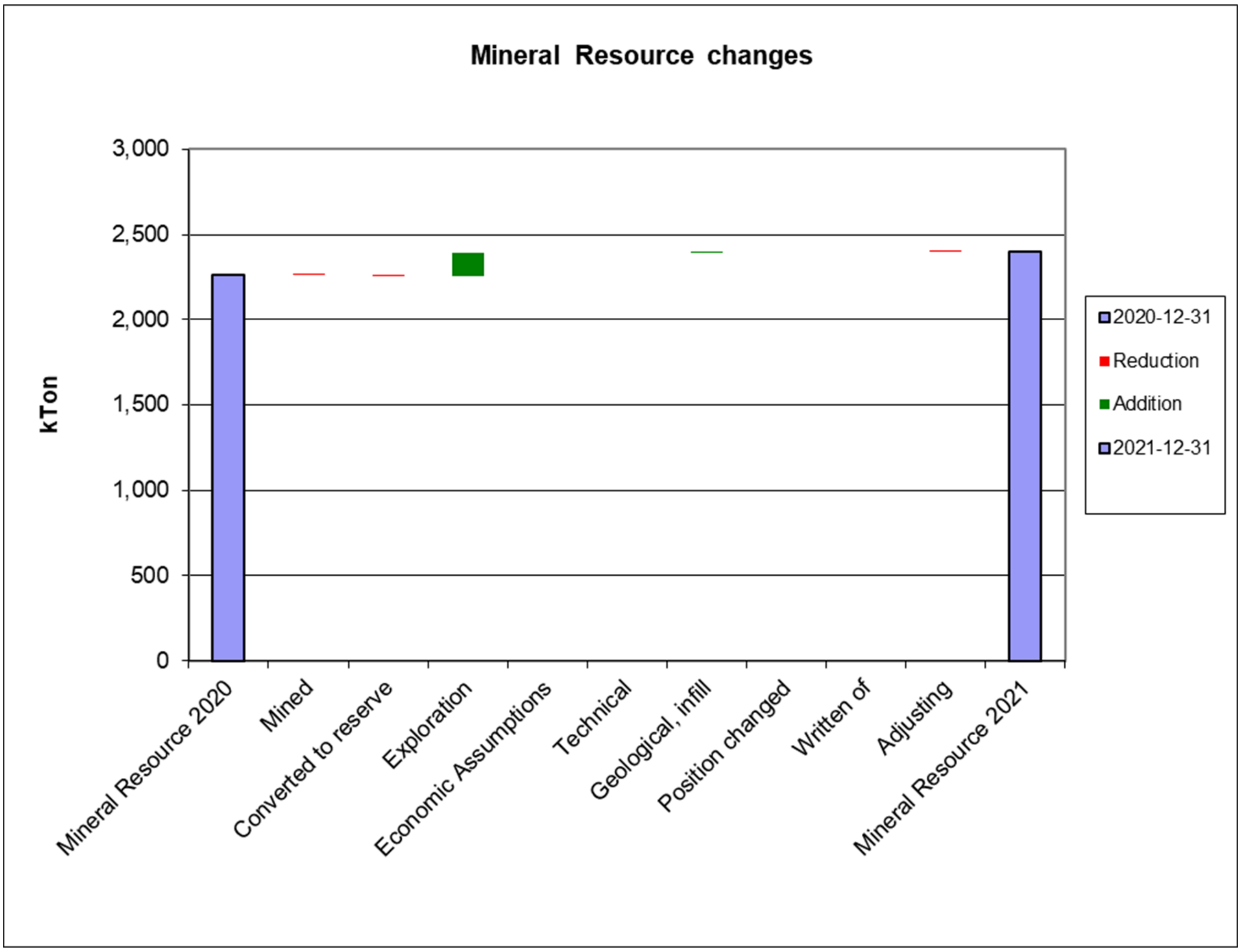


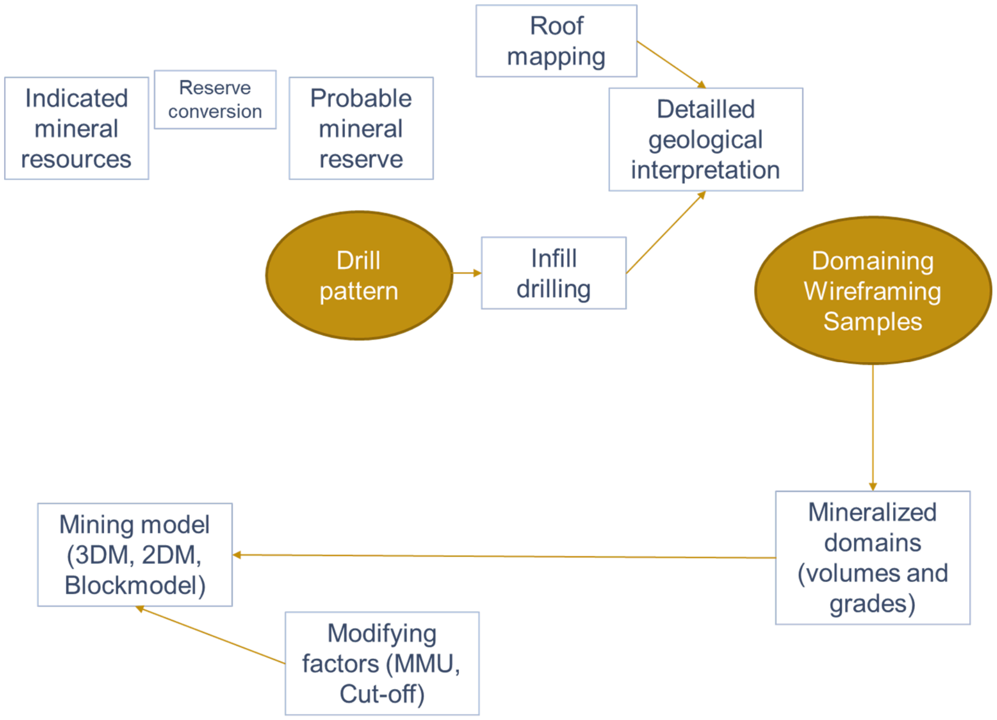
Figure 7: Changes to mineral resource (I+I+M)

Mineral resources increase by 140 kton from 2 263 kton to 2 403 kton. Exploration at Simon J contributed almost entirely to this increase.

3.15 Reconciliation

3.15.1 Mine Production Models

Subsequent to the conversion of resources into reserves in a mine position, infill drilling is completed on a grid of either 15m x 15m or 20m x 15m. This allows for a more detailed interpretation of the extents of the geology and mineralization. The updated geological interpretation, which includes face mapping, is prepared by the mine geologist. Out of the geological interpretation, the geologist decides the mineralized domains for the position in focus and draws wireframes over these domains. Then grades are interpolated within these domains. The sample search ellipsoid is always anisotropic and generally dynamic. The interpolation method is commonly inverse square distance, but this is currently under review. By taking into account modifying factors such as minimum mining unit and cut-off, the wireframes of the mineralization are adjusted to reflect mineable volumes.



The production model is used as a basis for reconciliation between the mine and the BAOPP. Production model grades are currently factored (see Table 12) to achieve acceptable reconciliation performance.

Table 12: Production model correction factors

Au	Ag	Cu	Zn	Pb	S
1,07	0,92	0,91	0,87	0,85	0,98

The data selection methodology, initial block size, estimation method and validation workflow used by the mine to prepare the production models are currently under review. A revised production model methodology is expected to be implemented in 2022, which is hoped will improve reconciliation performance and eliminate the need for correction factors as outlined above.

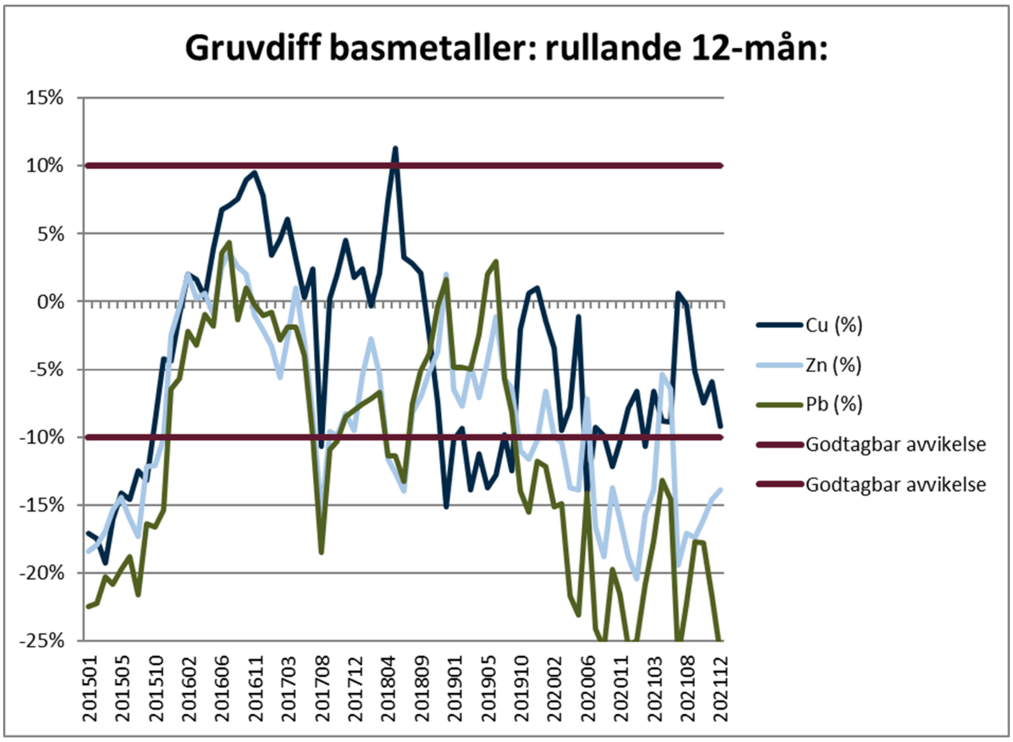
3.15.2 Reconciliation

Reconciliation blockmodel versus mill shows high but acceptable discrepancies for Au (-7%); Ag (-11%) and Cu (-9%) and very high and above threshold ones for Zn (-14%) and Pb (-26%), see Table 13. A general review by Renström´s mine geologist and Mineral Reserves & Resources section geologist is about to be undertaken and aims to give some solution to the problem by summer 2022.

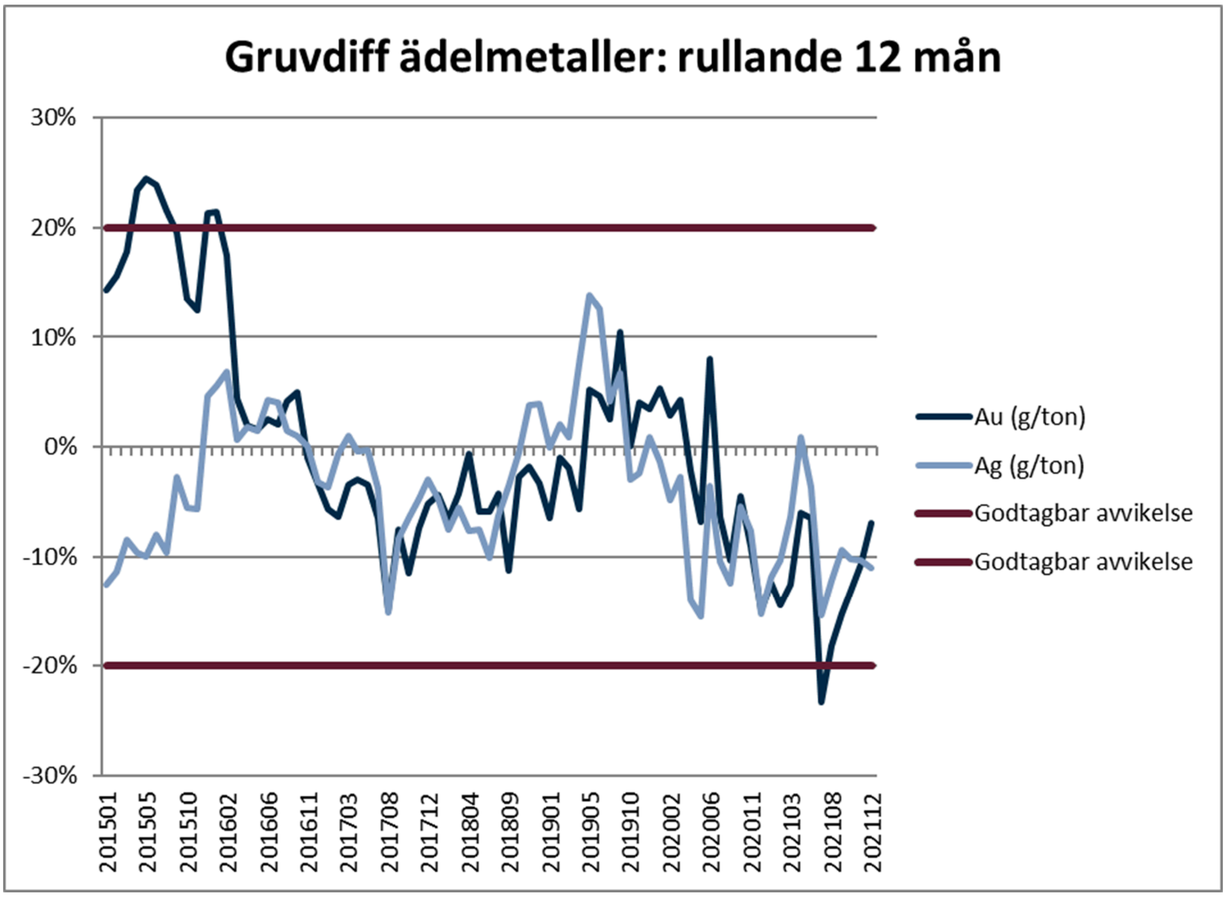
Table 13: 2021 Reconciliation mine versus mill

	Ton	Au	Ag	Cu	Zn	Pb	S	Dilution
		g/t	g/t	%	%	%	%	
Mine output[2]	499,255	2.1	126	0.50	5.0	1.2	9.6	8%
Mill throughput	*508,491*	*1.9*	*112*	*0.41*	*4.3*	*0.9*	*9*	
Deviation versus mill	9,236	-0.1	-14.1	0.0	-0.7	-0.3	-0.4	
Deviation versus mill (%)	1.8	-7.0	-11.1	-9.2	-13.9	-26.0	-4.4	

Figure 5. Rolling 12 months reconciliation for base metals and precious metals since 2015



[2] Includes surface stockpile balance at the mill.



Gruvdiff ädelmetaller: rullande 12 mån
30%
20%
10%
0%
-10%
-20%
-30%
201501
201505
201510
201602
201606
201611
201703
201708
201712
201804
201809
201901
201905
201910
202002
202006
202011
202103
202108
202112
Au (g/ton)
Ag (g/ton)
Godtagbar avvikelse
Godtagbar avvikelse

4 REFERENCES

Internal References:

- Renström_PERC_TechnicalReport_Final, 24-06-2021 (DMS #1787623)

External References (public domain):

- Pan-European Standard for reporting of Exploration results, Mineral Resources and Mineral Reserves (The PERC Reporting standard 2017.) www.percstandard.eu