Boliden Summary Report

Resources and Reserves | 2019

The Kristineberg Mine

Prepared by
The Kristineberg Mine
and
Rävliden North Technical Teams

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1 SUMMARY

This summary report is issued annually to inform the public (shareholders, potential investors and their advisers) of the mineral assets in the Kristineberg mining operation and the Rävliden North Mineral Resource held by Boliden Mineral AB.

The Kristineberg Mine is located approximately 100km west of the Boliden Area Operations Process Plant in Boliden, and produces from polymetallic mineralisations of Volcanogenic Hosted Massive Sulphide type. The mine has a production capacity of 750,000t per year and is the largest tonnage contributor to the Boliden Area Operations process plant. The Rävliden North Mineral Resource is located around 5km west of the Kristineberg Mine and was added to the mine's Mineral Resources in 2015.

In 2019, the mine produced some 600,000t of mineralised material grading 0.6g/t Au, 32g/t Ag, 0.5% Cu, 5.4% Zn, and 0.2% Pb. Historically, the mine has been operating since 1940 and has in total produced 32.1Mt of mineralised material with average grades of 1.2g/t Au, 37,7g/t Ag, 1% Cu and 3.7% Zn. A summary table of Mineral Resources and Mineral Reserves is presented in Table 1 below.

Table 1. Summary of Mineral Resources and Mineral Reserves for the Kristineberg Mine and Rävliden North in 2019, as well as Mineral Resources and Mineral Reserves for 2018

Classification	2019 kton	2019 Au (g/t)	2019 Ag (g/t)	2019 Cu (%)	2019 Zn (%)	2019 Pb (%)	2018 kton	2018 Au (g/t)	2018 Ag (g/t)	2018 Cu (%)	2018 Zn (%)	2018 Pb (%)
Mineral Reserves												
Proved	120	1.0	34	0.4	6.7	0.6	5	1.0	15	1.4	0.4	0.1
Probable	3,530	0.5	35	0.6	5.4	0.3	4,280	0.5	37	0.5	5.3	0.3
Total P&P	**3,660**	**0.5**	**35**	**0.6**	**5.4**	**0.3**	**4,290**	**0.5**	**37**	**0.5**	**5.3**	**0.3**
Mineral Resources												
Measured	50	0.7	45	1.3	4.2	0.2	50	0.7	45	1.3	4.2	0.2
Indicated	5,190	0.4	65	0.9	5.0	0.5	5,210	0.4	64	0.9	4.6	0.5
Total M&I	**5,240**	**0.4**	**65**	**0.9**	**5.0**	**0.5**	**5,260**	**0.4**	**64**	**0.9**	**4.6**	**0.5**
Inferred	6,120	0.4	57	0.9	2.9	0.4	5,950	0.4	61	0.9	2.5	0.4

1.1 Major changes

Major changes in the Kristineberg Mineral Resources and Mineral Reserve figures from 2019 are listed below:

- Net reduction in Mineral Reserves by around 630kt; -601kt by mining activities, and due to the following: -17kt technical factors, -32kt geological interpretation changes and -52kt written off.
- Increase in Mineral Resources by around 150kt. approximately 490kt addition from exploration, -300kt technical factors and -24kt written off due to lack of Reasonable Prospects for Eventual Economic Extraction ("RPEEE").

2 GENERAL INTRODUCTION

This summary report is issued annually to inform the public (shareholders, potential investors and their advisers) of the mineral assets in the Kristineberg mining operation ("The Kristineberg Mine") and the Rävliden North Mineral Resource ("Rävliden North") held by Boliden Mineral AB ("Boliden"). The report is a summary of internal reports and technical reports produced for public reporting under the "Recommended Rules for Public Reporting of Exploration Results, Surveys, Feasibility Studies and Estimates of Mineral Resources and Mineral Reserves in Sweden, Finland and Norway" ("The FRB Standard") of 2012 set by the Fennoscandian Review Board ("FRB"). Boliden's reporting of Mineral Resources and Mineral Reserves is currently changing to the Pan-European Standard for reporting of Exploration results, Mineral Resources and Mineral Reserves of 2017 ("The PERC Standard"). The PERC Standard is an international reporting standard recognised by the Committee for Mineral Reserves International Reporting Standards ("CRIRSCO") that has been adopted by the mining associations in Sweden (SveMin), Finland (FinnMin) and Norway (Norsk Bergindustri), to be used for exploration and mining companies within the Nordic countries (Svemin Press Release, 12th March 2018, (Svemin, 2018)).

Until 2017 Boliden used the FRB Standard (Boliden Press Release 14th February 2018, (Boliden Mineral AB, 2018)) which will be no longer updated, and was not recognised by CRIRSCO. Many of the Mineral Resource and Mineral Reserve estimations summarised in this report were made before the change from the FRB Standard to the PERC Standard. Boliden consider these estimations accurate enough to directly be reported according to the PERC Standard under chapter 17 of the standard, although the process of replacing them with PERC Standard compliant Mineral Resource estimations has started.

2.1 The PERC standard

The Pan European Resources and Reserves Committee ("PERC") is the organisation responsible for setting standards for public reporting of Exploration Results, Mineral Resources and Mineral Reserves by companies listed on markets in Europe. PERC is a member of CRIRSCO, and the PERC Standard is fully aligned with the CRIRSCO Reporting Template of 2012.

The PERC Standard sets out minimum standards, recommendations and guidelines for Public Reporting of Exploration Results, Mineral Resources and Mineral Reserves in Europe (PERC, 2017). Boliden is listed on the Stockholm stock exchange (OMX:BOL), and as such falls under the European Securities and Markets Authority ("ESMA") directive recommending stock exchanges and their listed companies across European member countries to abide by International Reporting Standards as defined in Commission Regulation (EC) No 809/2004 (ESMA Press Release , 2012, (ESMA, 2012)).

2.2 Definitions

Public Reports on Exploration Results, Mineral Resources and/or Mineral Reserves must only use terms set out in the PERC Standard. The relationship between Mineral Resources and Mineral Reserves is displayed in Figure 1 below. Generally the figure represents increasing geological confidence and knowledge moving downwards and increased consideration and accuracy of the application of "Modifying Factors" towards the right.

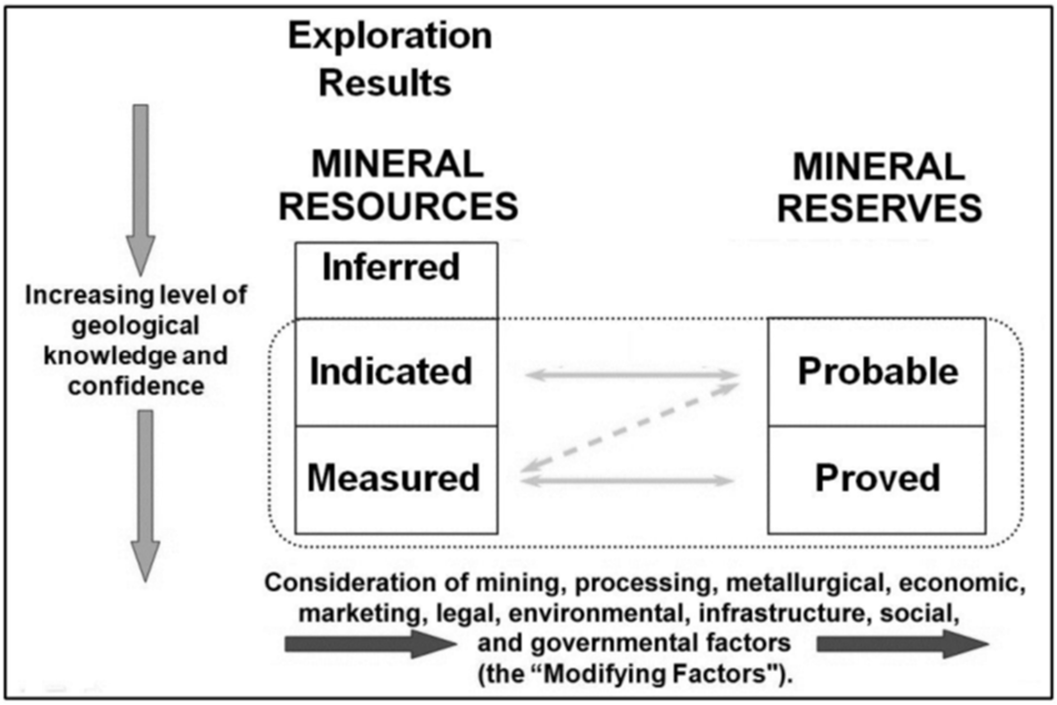

Figure 1. General relationship between Exploration Results, Mineral Resources and Mineral Reservers (PERC, 2017)

2.2.1 Mineral Resource

A Mineral Resource is a concentration or occurrence of solid material of economic interest in or on the Earth's crust in such form, grade or quality and quantity that there are reasonable prospects for eventual economic extraction. The location, quantity, grade or quality, continuity and other geological characteristics of a Mineral Resource are known, estimated or interpreted from specific geological evidence and knowledge, including sampling.

2.2.2 Mineral Reserve

A Mineral Reserve is the economically mineable part of a Measured and/or Indicated Mineral Resource. It includes diluting materials and allowances for losses, which may occur when the material is mined or extracted and is defined by studies at Pre-Feasibility or Feasibility level as appropriate that include application of Modifying Factors. Such studies demonstrate that, at the time of reporting, extraction could reasonably be justified.

2.3 Competence

The compilation of this report has been completed by a team of professionals who work directly for Boliden Mineral AB, and are listed as contributors in Table 2 below. The report has been verified and approved by Gunnar Agmalm, who is Boliden's Ore Reserves and Project Evaluation department's manager and a Member of The Australasian Institute of Mining and Metallurgy (AusIMM) and a Member of The Fennoscandian Association for Metals and Minerals Professionals (FAMMP).

Table 2. Contributors and responsible competent persons for the Kristineberg Mine summary report

Description	Contributors	Responsible CP
Report Compilation	Samuel Baldwin	Gunnar Agmalm
Summary and introduction	Samuel Baldwin	
Project location	Samuel Baldwin	
History	Maria Tuomi	
Ownership and permits	Samuel Baldwin, Jon Lundh	
Environmental studies, permitting and social impact	Seth Mueller, Anton Lundqvist	
Geologic setting and mineralisations	Samuel Baldwin, Jon Lundh, Mac Fjellrad Persson	
Exploration procedures and data	Samuel Baldwin, Jon Lundh, Mac Fjellerad Persson	
Exploration activities	Jon Lundh, Erik Nordfeldt	
Mineral processing and metallurgical testing	Samuel Baldwin, Nils-Johan Bolin, Iris McElroy	
Mining methods, infrastructure and recovery methods	Akos Csicsek, Linda Bjurén, Marie Lundberg	
Prices, terms and costs	Gunnar Agmalm, Samuel Baldwin	
Mineral resource estimates	Maria Tuomi, Samuel Baldwin	
Mineral reserve estimates	Maria Tuomi, Samuel Baldwin	
Reconciliation	Maria Tuomi, Samuel Baldwin	

3 KRISTINEBERG

The Kristineberg Mine is located approximately 100km west of the Boliden Area Operations ("BAO") Process Plant in Boliden, and produces from polymetallic mineralisations of Volcanogenic Hosted Massive Sulphide ("VHMS") type. The VHMS mineralisations range in thickness from 1m to 7m, and have been explored to a depth of 1400m, along a plunge of around 3km. To date, the Kristineberg Mine has produced upwards of 31 Mt of material, and has been operating for the last 79 years. The Kristineberg Mine has a production capacity of around 750,000t/year and is the largest by volume contributor to the BAO Process Plant. Cu and Zn are the main mined metals at The Kristineberg Mine, with Au, Ag and Pb credits. Mining activity is currently taking place in the L-Zone and M-Zone mineralisations at various levels between 900m and 1250m depth and takes place mainly by cut and fill methods.

3.1 Technical studies

Three major technical studies have been completed on the Kristineberg Mine during 2019. Details can be found in Table 3 below.

Table 3. Summary of major technical studies which have been completed at the Kristineberg Mine and Rävliden North Mineral Resource during 2019

Study	**Date Completed**	**Main Findings**
Ag-Zone Mineral Resource Estimate (2019 update)	April 2019	Update of NSR figures based on new metallurgical test work. Majority of tonnage written off due to technical factors.
L-West Mineral Resource Estimate	September 2019	Increase in Mineral Resources based on exploration drilling along the plunge direction of the L-Zone mineralisation.
Koppar Klumpen (M-Zone) Mineral Resource Estimate	December 2019	Increase in Mineral Resources based on exploration drilling around current Mineral Resources.

3.2 Location

The Kristineberg Mine is located within the village of Kristineberg and is accessible year round by good quality all weather road. The village of Kristineberg is located approximately 100km to the west of the village of Boliden (see Figure 2). The Kristineberg Mine is connected to Boliden and Skellefteå to the west by highways 370 and 95. A local all-weather sealed road links the main Malå 370 highway to Kristineberg. Total driving distance between the BAO Processing Plant and the Kristineberg Mine is approximately 95km.

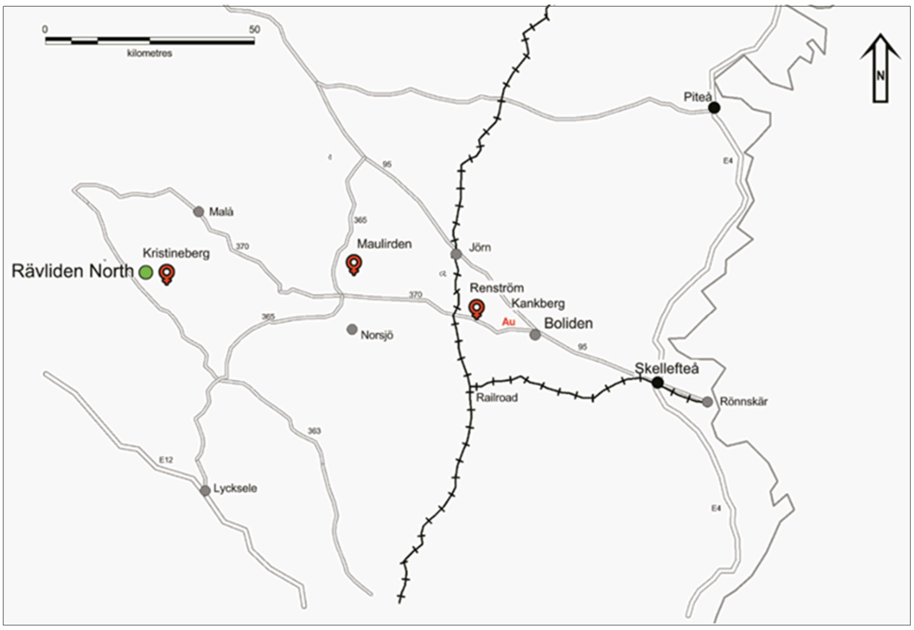

Figure 2. Schematic map showing the location of the Village of Kristineberg, and the aprioximate location of the Rävliden North Mineral Resource.

A schematic map is presented in Figure 3 showing the Kristineberg Camp. This includes the locations of the Kristineberg Mine, as well as the approximate location of the Rävliden North Mineral Resource and historic mines located in Rävliden, Rävlidmyran, and Hornträsk.

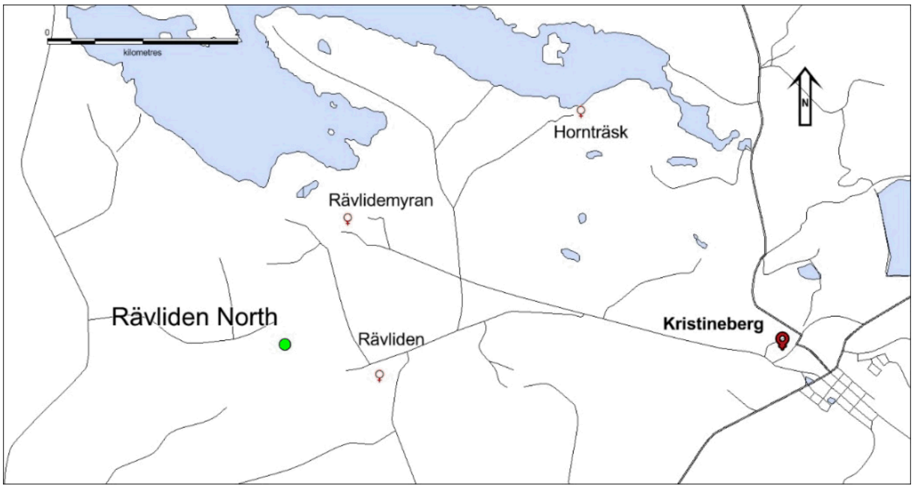

Figure 3. Schematic map of the Kristineberg Camp

3.2.1 Coordinate systems

Rävliden North exploration programmes and Mineral Resource estimates are produced in the SWEREF99 coordinate system with a TM projection and is the standard coordinate system which is used in Sweden. The Kristineberg Mine's local coordinate system ("KRIBERGSYSTEMET") is a translated and rotated local Cartesian coordinate system. The original definition of the translation of the origin was based on an old RT system of unknown age; however, the coordinates of the system have been verified according to SWEREF99 TM projection. In KRIBERGSYSTEMET, the Y and X axes are switched so that the relative longitudinal axis becomes Y and the relative latitudinal axis becomes X.

3.3 History

A summary of the history of the Kristineberg Mine is presented in Table 4. The Kristineberg Mine has been operating continuously for 79 years since 1940. In total during this time, the mine has produced around 32.1Mt of mineralised material with average grades of 1.2g/t Au, 37,7g/t Ag, 1% Cu and 3.7% Zn.

Table 4. Brief history of the Kristineberg mine

Year	Events
Pre-1918	Mineralised boulders found on surface in the vicinity of Kristineberg, however no mineralised bodies found in bedrock due to thick glacial cover. Exploration activities commence.
1918	Mineralised body found in the subsurface by Boliden's Electro Magnetic geophysics.
1935	A test shaft was sunk down to 90m and 170m levels.
1940	First production year in Kristineberg. Approximately 40,000t of mineralised material was produced.
1943	Cable skip transport was constructed between Boliden and Kristineberg in order to transport mineralised material to the BAO Processing Plant.
1955	The central shaft was sunk to the 560m level and the crusher was moved to the 410m level.
1968	The central shaft was sunk to the 790m level. The crusher and the skipping station was placed at the 690m and 751m levels respectively.
1979-1983	The main ramp was built in order to connect the 690m level to the surface.
1991	Mill and Process plant decommissioned
1993	The main ramp reaches the 1000m level
1996	Decision taken to develop the main ramp down to 1100m level. Einarsson Zone (E-Zone) is intersected.
2000	The decision is taken to build a cyanide leach facility in the BAO Process Plant. Production from the Einarsson Au/Cu Zone in Kristineberg begins. Intersection of the K-Zone.
2001	J-Zone is intersected by exploration drilling.
2002	Production starts from the K-Zone (Zn).
2004	L-Zone is intersected by exploration drilling following up on a downhole geophysical anomaly. Production starts in the J-Zone.
2006	M-Zone is intersected by drilling.
2010	Pre-Feasibility on the L-Zone is completed. Development of drifts towards the L-Zone is started. Silver Zone is intersected by drilling. Tommy and Raimo mineralisations intersected with drilling.
2011	K-Zone mined out.
2012	L-Zone production started.
2014	E-Zone mined out. M-Zone extension to the west discovered through drilling.
2015	Rävliden Norra added to Kristineberg's Mineral Resources after a field exploration campaign around the abandoned Rävliden and Rävlidmyran mines.
2016	Drifting started between Kristineberg L-Zone and Rävliden North total 3km. Update to Raimo & Tommy Mineral Resource
2018	Update to Silver Zone and Rävliden North Mineral Resources.
2019	Update to Silver Zone, L-Zone and M-Zone Mineral Resources

3.4 Ownership

The Kristineberg Mine is 100% owned by Boliden Mineral AB. No other owners have operated on the property.

3.5 Permits

Boliden Mineral AB is in possession of all required permits required to mine Zn, Cu, Pb, Ag and Au at the Kristineberg Mine, in addition to owning wholly the rights for exploration covering the Kristineberg Mine and much of the surrounding area. Exploration and Mining permits are issued by Bergstaten and are governed by the Minerals Act (1991:45), issued on the 24th January 1991, which came into force on the 1st july 1992.

All Mining permits within the Kristineberg Area are subject a standard legally prescribed royalty of 0.2% of the annual value of metal recovered after mineral processing. Calculation and other details of this royalty is also governed by the Minerals Act. According to this law the royalty payment is to be distributed at a rate of ¾ to the surface owner and ¼ to the Swedish state. No additional royalties currently apply to the Kristineberg Mine.

3.5.1 Exploration permits

Boliden Mineral AB wholly owns exploration permits around much of The Kristineberg mine. Valid exploration permits are presented in Table 5. A map of valid exploration permits are displayed in Figure 4.

Table 5. Valid exploration permits which are held by Boliden Mineral AB around the Kristineberg Mine

Name	Owner	Diary Nr.	Area (ha)	Mineral	Valid from	Valid to
Kristineberg nr 1010	Boliden Mineral AB	2004001081	1056.5802	Cu	2005-02-03	2020-02-03
Kristineberg nr 1012	Boliden Mineral AB	2010000673	125.7400	Zn	2010-10-26	2020-10-26
Kristineberg nr 1013	Boliden Mineral AB	2012001075	106.1792	Zn	2012-11-07	2022-11-07
Kristineberg nr 1014	Boliden Mineral AB	2012001189	81.2280	Zn	2013-01-24	2023-01-24
Kristineberg nr 1016	Boliden Mineral AB	2015001137	4027.40	Zn, Cu, Ag, Au	2016-01-19	2022-01-19
Kristineberg nr 1017	Boliden Mineral AB	2016000267	136.9600	Zn, Cu	2016-05-27	2019-05-27
Kristineberg nr 1019	Boliden Mineral AB	2017001038	826,9600	Zn, Cu, Ag, Au	2018-01-11	2021-01-11
Kristineberg nr 1020	Boliden Mineral AB	2018000260	3022.1000	Zn, Cu, Pb, Ag, Au	2018-06-05	2021-06-05
Rävliden nr 1006	Boliden Mineral AB	2018001422	930.56	Zn, Cu, Pb, Ag, Au	2019-03-04	2022-03-04
Ullusdal nr 1001	Boliden Mineral AB	2016000253	1511.3300	Zn, Cu	2016-05-31	2019-05-31
Mörkliden nr 1001	Boliden Mineral AB	2005001459	1404.7000	Cu	2006-02-10	2021-02-10

3.5.2 Mining permits

Boliden Mineral AB wholly owns the exploitation permits as presented in Table 6. A map of the exploitation permits is presented in Figure 4.

Table 6. Valid Exploitation permits which are held by Boliden Mineral AB around the Kristineberg Mine

Name	Owner	Diary Nr.	Area (ha)	Mineral	Valid from	Valid to
Kristineberg K nr 1	Boliden Mineral AB	1997000366	68.2950	Zn, Cu, Pb, Ag, Au	1998-02-20	2023-02-20
Kristineberg K nr 2	Boliden Mineral AB	1998000700:R	257.2557	Zn, Cu, Pb, Ag, Au	2000-01-01	2025-01-01
Kristineberg K nr 3	Boliden Mineral AB	2001000461	20.2031	Zn, Cu, Pb, Ag, Au	2001-10-16	2026-10-16
Kristineberg K nr 4	Boliden Mineral AB	2001000462	37.3106	Zn, Cu, Pb, Ag, Au	2001-10-01	2026-10-01
Kristineberg K nr 5	Boliden Mineral AB	2007000825:R	204.4713	Zn, Cu, Pb, Ag, Au	2007-09-07	2032-09-07
Kristineberg K nr 6	Boliden Mineral AB	2017001080	77.8600	Zn, Cu, Pb, Ag, Au	2018-10-16	2043-10-16
Viterliden K nr 1	Boliden Mineral AB	2000000028:R	31.9353	Zn, Cu, Pb, Ag, Au	2002-08-26	2027-08-26
Kimheden K nr 1	Boliden Mineral AB	2002000056:R	63.9905	Zn, Cu, Pb, Ag, Au	2002-12-05	2027-12-05

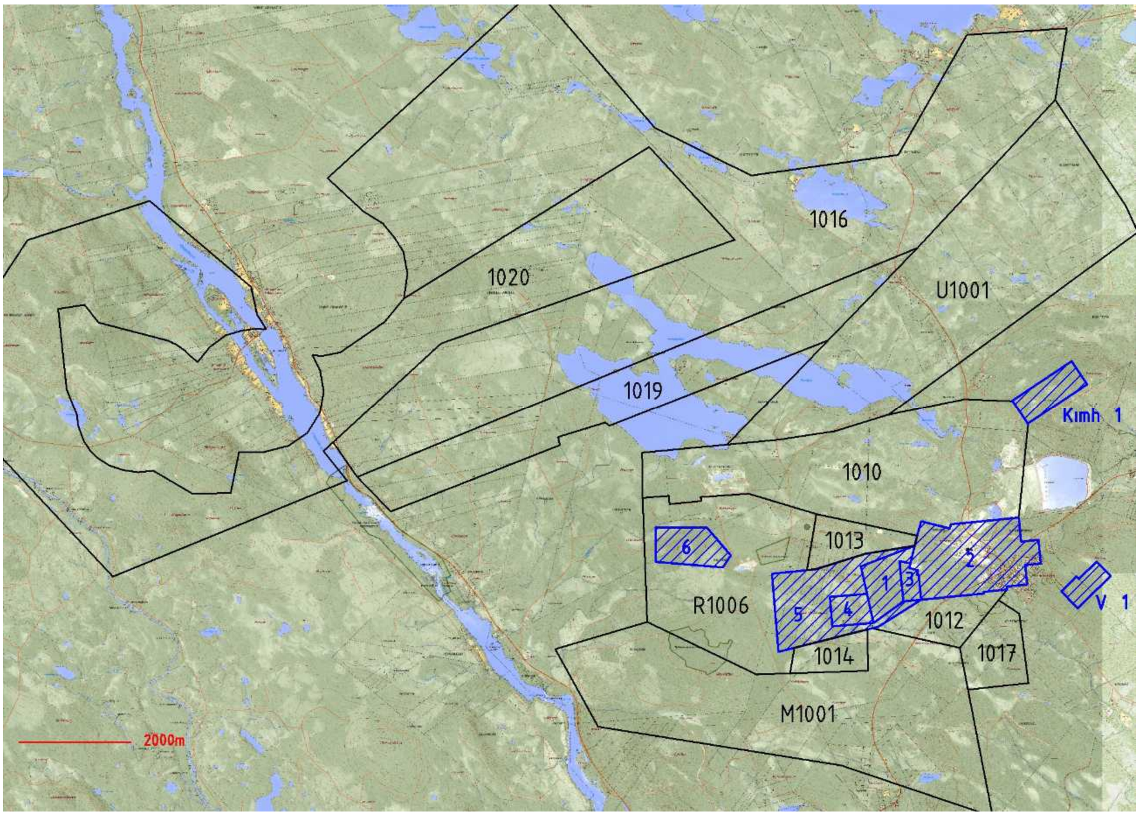

Figure 4. Map of the Kristineberg Camp with Exploitation permits (blue), and exploration permits (black).

3.6 Environmental studies, permitting and social impact

Boliden Mineral AB completed an Environmental Consequence Description, or environmental impact assessment in 2012 (Eriksson & Rönnblom-Pärson, 2012), which is the basis for the current environmental permit. The Kristineberg Mine has a valid environmental permit from the Swedish Environmental Court issued in 2014 with an amendment in 2018, shown in Table 7. The Permit is valid for the life of mine under current operating conditions and production levels, any major changes in operations, increase in production or changes to discharge will require a new permit. The permit is in accordance with Swedish national environmental legislation and European Union mining regulations.

Table 7. Valid Environmental permits held by Boliden Mineral AB for the Kristineberg Mine

Owner	Permit	Date
Boliden Mineral AB	Umeå Tingsrätt M 1993-12 Deldom 2014-04-30	2014-04-30
Boliden Mineral AB	Umeå Tingsrätt M 1993-12 Deldom 2018-02-09	2018-02-09

The Environmental permit for the Kristineberg Mine encompasses the following aspects:

- production rates for mineralised and waste rock,
- placement of waste rock, management of waste rock
- water management and water treatment,
- discharge water quality,
- Noise and vibrations associated with blasting, transport and other operations,
- Monitoring programs for dusting, noise, and water quality,
- Dam safety and management,
- Mine closure and rehabilitation,
- The economic security for mine closure and rehabilitation,
- Chemicals and chemical management.

The mine is located on the property designated Kristineberg 1:215 and is wholly owned by Boliden. The Kristineberg Mine is located directly next to the Kristineberg community. The area, including the existing mine and associated infrastructure, are designated as an area of national interest for mining. Vormbäcken is the recipient of discharge water from Kristineberg Mine's operations and is a tributary to Vindel River, which is a nationally protected river and classed as a Nature 2000 area. There are no other national interest areas or protected areas.

The Kristineberg Mine has been in operation since 1940. The mine operated as 4 smaller open pits prior to the development of underground infrastructure. Until 1991 there was a mill and concentrator on site. The tailings from the concentrator was deposited in five tailings facilities in the valley below the mine. All of the tailings facilities, with the exception of Magazine 4, have been closed and reclaimed or are being reclaimed. Today Magazine 4 functions as a settling pond after water treatment with slaked lime. A small quantity of waste rock is temporarily stored in the footprint of Magazine 2, this rock will be used as fill under the life of the mine.

Land usage in the area around the Kristineberg Mine is predominately forestry and reindeer herding and grazing. Hunting, fishing and other outdoor activities also take place here. Boliden maintains good working relationships with the Sámi people and forestry companies.

There are a number of closed mines in the area, including the Rävliden field, and Kimheden that were closed over 15 years ago. Only complementary closure and rehabilitation measures are ongoing.

The nearest inhabited area is the Kristineberg community, with houses located approximately 200 m from the industrial area. There are approximately 195 residents in Kristineberg. There are also a few small villages and single homes located approximately 2 km from the industrial area.

3.7 Geologic setting, mineralisations and deposit types

3.7.1 Regional geology

The Kristineberg Camp is located on the western extent of the Skellefteå district Figure 5. The Skellefte district is a Paleoproterozoic (1.89 Ga) Volcanic sedimentary area Located in Västerbotten, northern Sweden. The area stretches roughly 100 km from the village of Kristineberg in the west to the village of Boliden in the east. The Skellefte district hosts more than 85 VHMS deposits, of which 26 have been, or are currently hosting mining operations. The VHMS deposits of the area are mostly hosted in the upper parts of a volcanic sequence of intermediate to felsic juvenile volcanoclastic rocks, sub volcanic intrusions and lavas. These rocks together form the Skellefte group, which in turn is the lowest stratigraphic sequence in the Skellefte district. (Allen, Weihed, & Svenson, 1996).

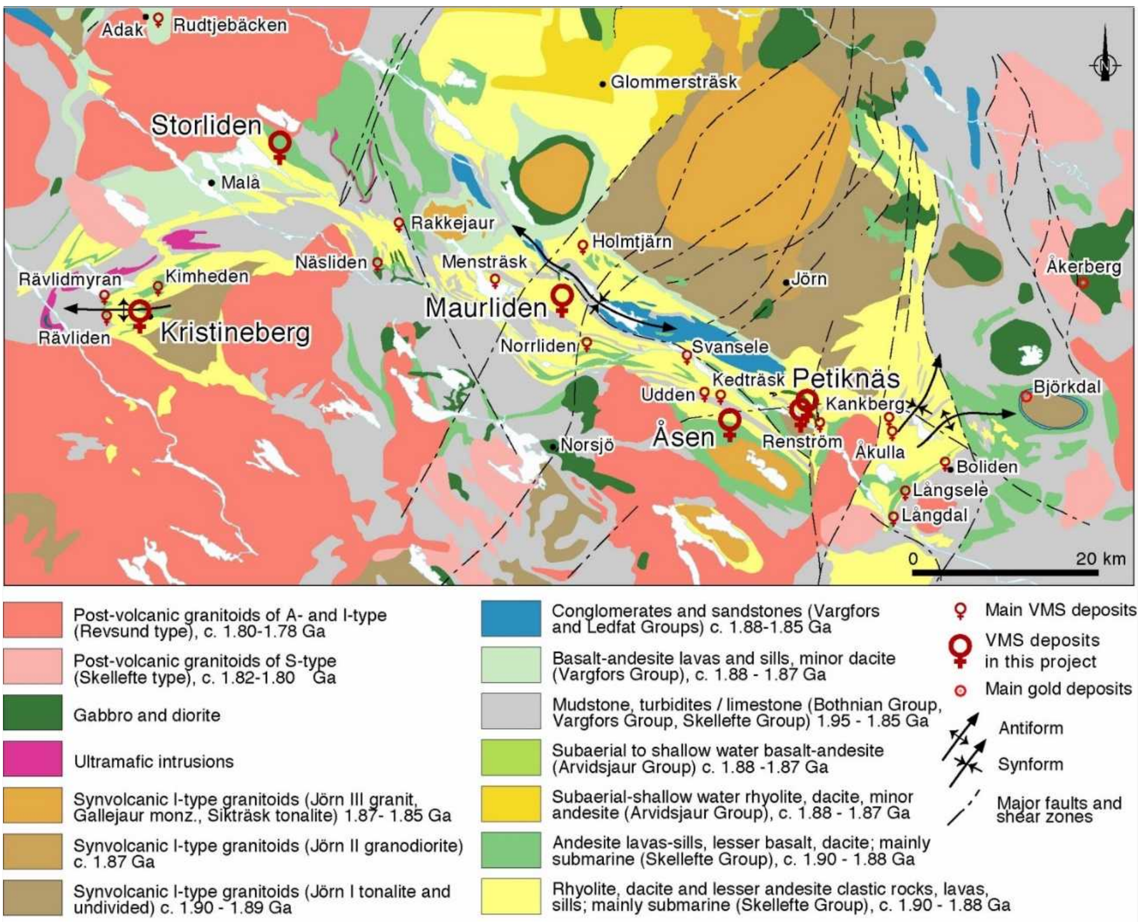

Figure 5. Regional geologic map of the Skellefte District (Allen et al., 1996)

The rocks of the Skellefte group in turn are overlain by the Vargfors group, a unit of shales, tubiditic clastic sedimentary rocks and conglomerates. There are local intercalations of volcanic rocks and rare occurrences of limestone.

The Skellefte District is bordered by syn-volcanic granitiods to the north and south. Peak metamorphism is interpreted to have occurred at ~1.84-1.82 Ga and reached upper green schist facies, and amphibolite isograds at the margins to the west and south. (Allen et al., 1996).

3.7.2 Local and property geology

The Kristineberg Camp mineralisations of the Kristineberg Mine and surrounding mineralisations of Rävliden, Rävliden North, Rävlidmyran, Hornsträsksviken and Kimheden are considered examples of VHMS mineralisations Figure 6.

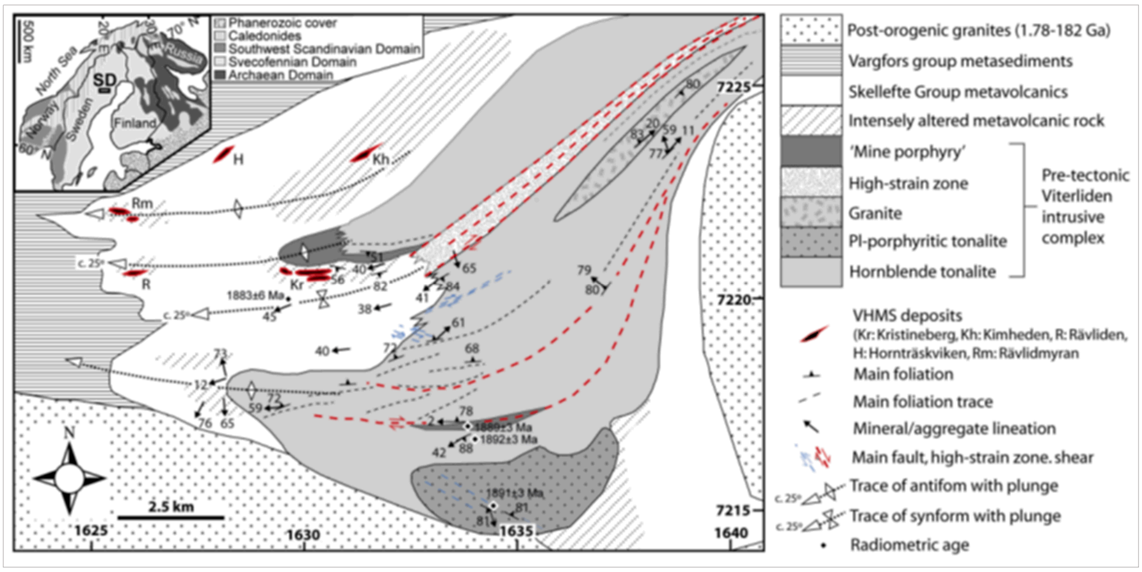

Figure 6.Geologic map showing the Kristineberg Camp, and associated VHMS deposits. Modfied after (Skyttä, Hermansson, Andersson, Whitehouse, & Weihed, 2011)

The mineralisations of the Kristineberg Camp are situated on separate stratigraphic horizons that relating to differing ages and mineralisation events. The economically important Kristineberg Mine mineralisations as well as the Kimheden mineralisation is located on the "Kristineberg Horizon" and Rävliden North deposits are located on the "Rävliden Horizon" along with the Rävliden and Rävlidmyran mineralisations (Lindberg, 1979). The Rävliden horizon is hypothesised to be representative of a distinct stratigraphic and chemostratigraphic shift in the lithology where replacement deposits have been emplaced, whereas the Kristineberg Horizon is assumed to be representative of more primary mineralisation emplacement following a more traditional VHMS formation model (Jansson & Fjellerad Persson, 2014).

The Rävliden North and Kristineberg Mine mineralisations are located within "local" antiformal structures. Rävliden North consists of two major first order antiforms and an intervening synform, or major shear zone (Jansson & Fjellerad Persson, 2014). The Kristineberg Mine mineralisations are located within multiple layers of stacked "lenses" of intensely chlorite altered schists which have been accumulated by thrusting and associated crustal shortening in a NNE-SSW direction (Hermansson, 2012).

3.7.3 Mineralisations

3.7.3.1 The Kristineberg Mine

In Table 8 is presented a summary of current and historical mineralisations within the Kristineberg Mine, along with a brief and general description of the mineralisation types: Of the listed mineralisations, the L-Zone and M-Zone are currently being mined. An overview of the mine and its mineralisations can be found in Figure 3.6.

Table 8. Summary table of mineralisations that are currently and have been present within the Kristineberg Mine

Mineralisation	Type	Host Rock	Metals	Status
A-Zone	VHMS	Chlorite Schist	Cu-Zn-Au	Historic
B-Zone	VHMS	Chlorite Schist	Cu-Au	Historic
E-Zone	VHMS	Quartzites	Au-Cu	Historic
J-Zone	VHMS	Chlorite Schist	Zn-Cu-Au	Historic
K-Zone	VHMS	Chlorite Schist	Zn	Historic
L-Zone	VHMS	Chlorite Schist	Zn-Cu-Au	Mining Area
M-Zone	VHMS	Chlorite Schist	Zn-Cu	Mining Area
Raimo & Tommy	VHMS	Chlorite Schist	Zn-Cu	Mineral Resource
Ag-Zone	Remobilised	Quartzites	Ag-Pb	Mineral Resource

Mineralisations of the Kristineberg Mine are hosted in steeply-gently dipping Chlorite Schist lenses, with a gentle plunge towards the SW. The mineralisation generally appears as two "arms", the southern arm consisting of the B-, E-, J-, K-, M-,and Ag-Zones as well as the Raimo and Tommy mineralisations, see Figure 7. On the northern "arm" lies the L-Zone and A-Zones. Mineralisations can be generally split into two types:

- Chlorite Schist hosted mineralisations, and
- Ag-Pb "remobilised" mineralisation.

Chlorite schist hosted mineralisation generally contains sulphide mineralisation that is semi-massive to massive in nature with variable abundances of economically important minerals: chalcopyrite (CuFeS2), sphalerite ((Zn, Fe)S) and galena (PbS), with minor silver and gold. The schists themselves contain variable amounts of muscovite, quartz, chlorite, phlogopite, biotite, cordierite, andalusite, pyrite and magnetite. The chlorite schists appear as lenses within colloquially named "quartzites" which are hypothesised to be highly altered rhyolitic to dacitic rocks (Barrett & MacLean, 2000). Chlorite, cordierite, sericite and andalusite as well as quartz overprint the original rock textures making primary rock identification difficult.

The "remobilised" Ag-Pb type is hosted within silicified cordierite and chlorite quartzites. Five silver bearing minerals are present within the Ag-Zone; freibergite ((Ag,Cu,Fe)12(Sb,As)4S13) being the dominant one with minor amounts of hessite (Ag2Te) often present. High silver grades are often present in narrow zones associated with galena veins or fracture fillings.

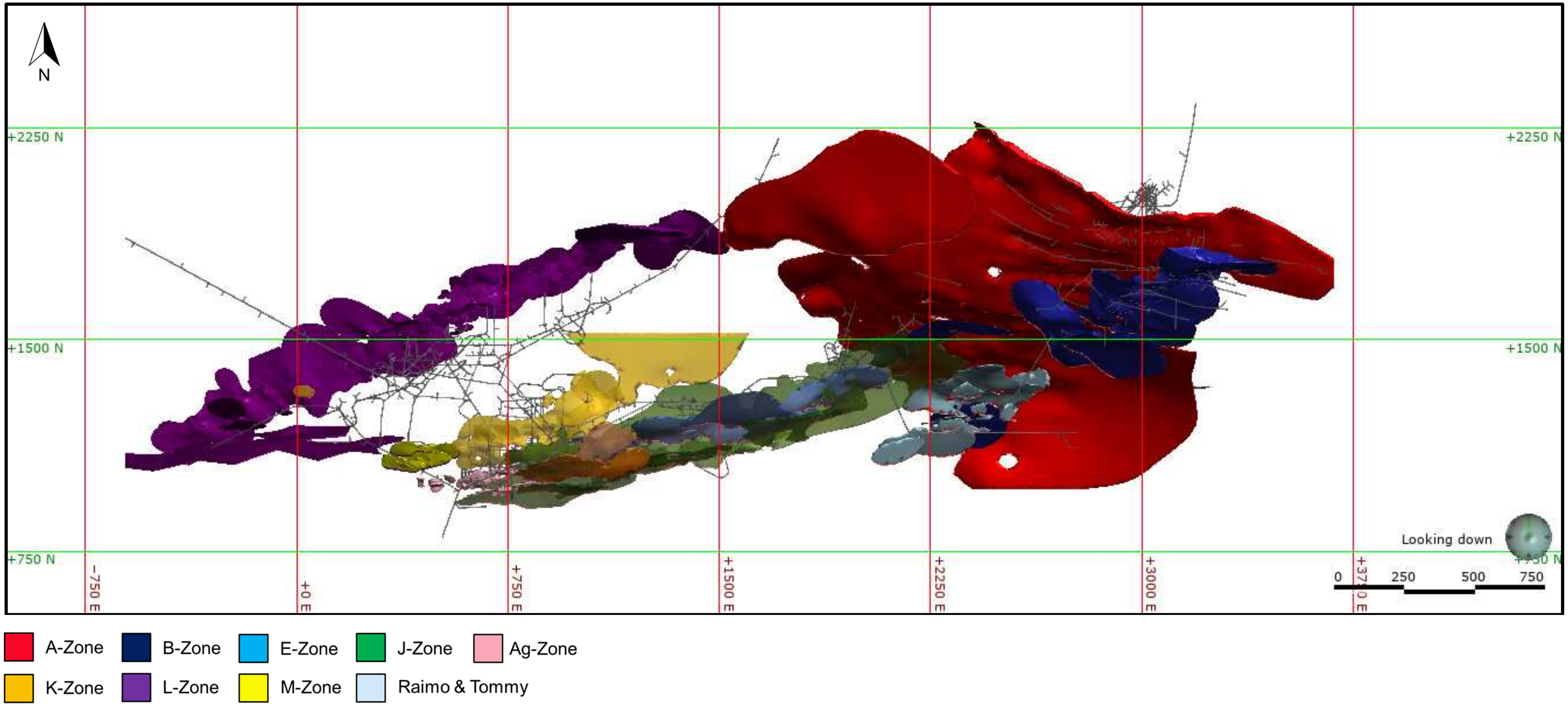

Figure 7. Overview map of mine and location of mineralisations. This map does not show Mineral Resources, This image is taken from the working geological model of the mine, and is updated as of December 31st 2018. Mine infrastructure is shown in grey. This map is displaying coordinates in KRIBERGSYSTEMET.

3.7.3.2 Rävliden North

Exploration drilling and direct structural measurements in oriented core (Jansson & Fjellerad Persson, 2014) suggest that Rävliden North constitutes a sub-vertical to steeply S-dipping, c. 5 to 25m wide and c. 150 m high mineralised lens, or system of lenses, with a length extent of at least 900 m along plunge (See figure 8). Mineralisation types can be split broadly into two categories:

- massive to semi-massive sphalerite-dominated mineralization, and
- breccia-type Cu>Zn mineralization.

The sphalerite-dominated mineralisation is most commonly associated with tremolite skarns, talc schists, chlorite schists and dolomitic marble. The massive sphalerite mineralization locally carries porphyroblasts of pyrite. Furthermore, it has been observed to be accompanied by zones of massive pyrrhotite mineralisation. Locally, the pyrite porphyroblasts are gathered in bands, giving the mineralisation a crudely banded appearance.

Sulphide-bearing stringers, veins and breccias are present stratigraphically and structurally below the sphalerite mineralization. Large parts of these zones are dominated by pyrrhotite and pyrite, and only carry traces of sphalerite and chalcopyrite. A c. 10-30 m wide part of this zone proximal to, and stratigraphically directly below, the main sulphide lens carries substantially elevated contents of chalcopyrite in association with minor idiomorphic arsenopyrite crystals and sphalerite. Grades are in the range of c. 2-3 % Cu over several meters, and network-style breccias are a common texture.

Lithologically, these zones are predominantly associated with strongly to intensely silicified footwall rhyolite (in which the sulphides are hosted by hydraulic breccias) and strongly to intensely chlorite-altered (dark green) footwall rhyolite. In schistose parts of the latter, the sulphides form a subtle (compared with the veins) but strong impregnation. In contrast, the more common quartz-sericite-altered footwall rhyolite appears to be less endowed in metals, even though it commonly carries minute crystals of pyrite.

Even though the deposits of Rävliden and Rävlidmyran appear to be bound to a certain stratigraphic interval, no universal stratigraphic marker horizon for this given interval has been recognised. Consequently, it is to a large extent identified based on alteration patterns as primary textures are rarely preserved. (Jansson & Fjellerad Persson, 2014).

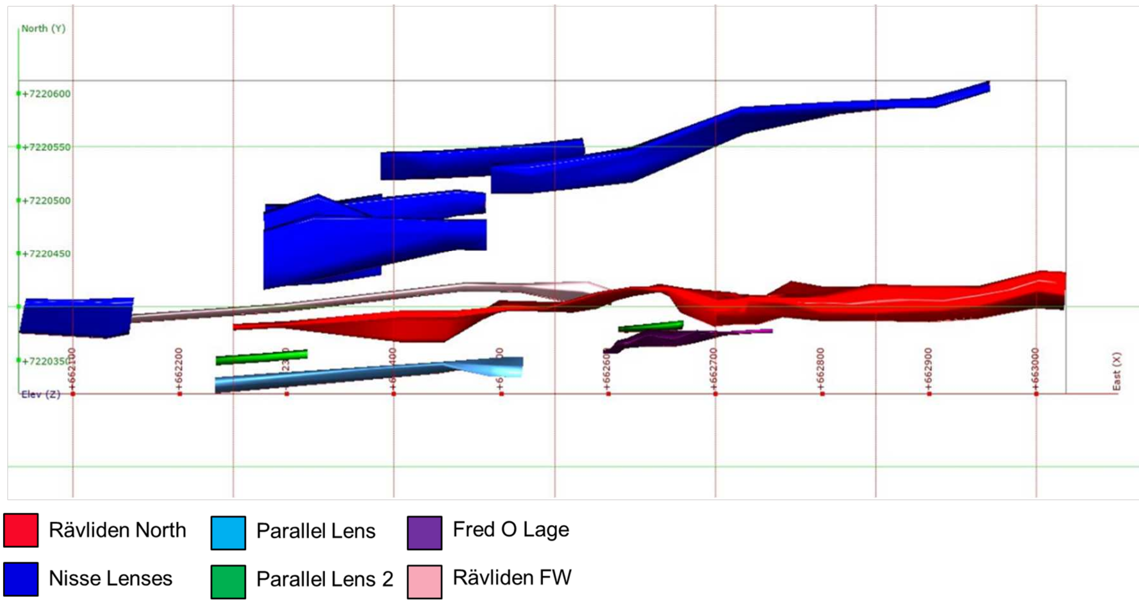

Figure 8.overview map of The Rävliden Norra mineralisations. This map does not show Mineral Resources. This image is taken from the working geological model of the deposit, and is updated as of December 31st 2018. This map is displaying coordinates in SWEREF99TM

3.8 Exploration procedures and data

3.8.1 Drilling techniques

Current drilling for Near Mine Exploration and Mine Infill Drilling is carried out by the mine's own drill rigs. The drill rigs which are currently being used are Atlas Copco rigs of model Diamec PHC 4 or PHC 6 which are adapted to drill a 39mm drill core from a wireline 56 system. Drilling for field exploration in Rävliden North is currently carried out by diamond drilling of a 47mm core in combination with directional "navi" drilling.

Core is retrieved using a typical wireline and overshot system on the core barrel. When the core is retrieved by the driller, the core is placed carefully into a core box and labelled according to depth. Each run is marked by a core block with its corresponding depth written onto the block. Core boxes are transported to the Kristineberg Mine core shed facilities for logging by a geologist.

3.8.2 Downhole surveying

Near Mine Exploration and Mine Geology departments use a combined deviation and BHEM sonde for down hole surveying. This tool utilises a non-magnetic accelerometer and gyroscopic instrument for deviation measurements. When "navi" drilling at Rävliden Norra, drillers will suvey the hole with a gyroscopic tool every 20-50m to control deviation, as well as a complete survey at the end of the drill hole.

Once the measurements are completed, the data is sent to Boliden's Geodata department, which validates the data and inputs it into the database. The project responsible geologist will verify the survey measurements.

3.8.3 Sampling preparation, analysis and security

Samples are sent to ALS in Piteå, which complete the Prep 31 method to prep the samples for analysis. This involves drying and fine crushing of the core material to 70% passing 2 mm, splitting, and finally a pulverisation stage to 85% passing 75 µm to create the pulps for analysis.

Samples are sent from ALS Piteå prep lab to ALS Vancouver for further analysis. ALS Vancouver is an accredited laboratory, completely independent from Boliden AB. The laboratory is accredited by the Standards Council of Canada under ISO:17025:2005, with the scope of accreditation covering the analysis methods used for the Kristineberg Mine and Rävliden North. Analysis packages used are found presented in Table 9.

Table 9. Analysis packages used ant The Kristineberg Mine and Rävliden North Mineral Resource

	Prep	Cu	Zn	Pb	Ag	As	Au	S
ALS Analysis Package	Prep-31	OG46	OG46/ME-ICPORE (over range)	OG46	OG46	OG46	ICP21/GRA21 (over range)	IR08

Internal measures are taken within Boliden to ensure that tampering of core and other samples does not occur. In addition, internal procedures are in place to prevent contamination and spoiling of samples prior to packaging and shipping to preparation and analysis laboratories in order to preserve sample integrity.

3.8.4 Density

Density in the Kristineberg Mine is calculated by a density formula. Currently density samples are not routinely taken in the Kristineberg Mine, with the exception of the Silver Zone. The density formula is as follows for mineralised material:
Density = 0.0043*Cu+0.004*Zn+0.02*Pb+0.0375*S+0.027*As+2.70
Non-mineralised rock is given a density of 2.7. The density formula is based on a regression formula based on test work which was completed historically (Larsson & Agmalm, 1994). A verification of the formula was completed in 2002 (Agmalm, 2003) which concluded that the density formula was suitable.

Density samples have been taken in the Rävliden Norra deposit routinely since 2012, in order to confirm the above regression formula with satisfactory results (McGimpsey, 2018). During estimation and reporting of tonnages, density calculated from the standard density formula is used.

3.8.5 QA/QC

Near Mine Exploration, Mine and Field Exploration teams use QA/QC samples to verify the assay results returned from the laboratory.

Each team uses different QA/QC programmes which will not be detailed in this summary report. QA/QC samples used are a combination of in-house standards and international standards. All standards used are certified reference materials having been analysed by round-robin at various external accredited laboratories. Blank samples are also used, as well as repeat duplicate samples completed internally by the laboratory. Pulp duplicates are also sent to umpire laboratories for external verification.

Assay results are verified by the geologist against geology logs and core photos, and any suspect results are sent back to the laboratory for re-analysis. Assay results are also validated when they are uploaded into the database, and accepted by the geologist.

3.9 Exploration activities

Field Exploration work conducted on the Rävliden North deposit in 2019 totaled 2 new diamond drill holes from surface. RAVLD791 and RAVLD792 were drilled from surface to test a gap in the resource model from 2018, (figure 9). Good assay results came back and confirmed the geological model that the Nisse lenses continues down plunge without a significant gap. Drill holes were surveyed with Bolidens electromagnetic tool and ISGYRO from Inertial Sensing.

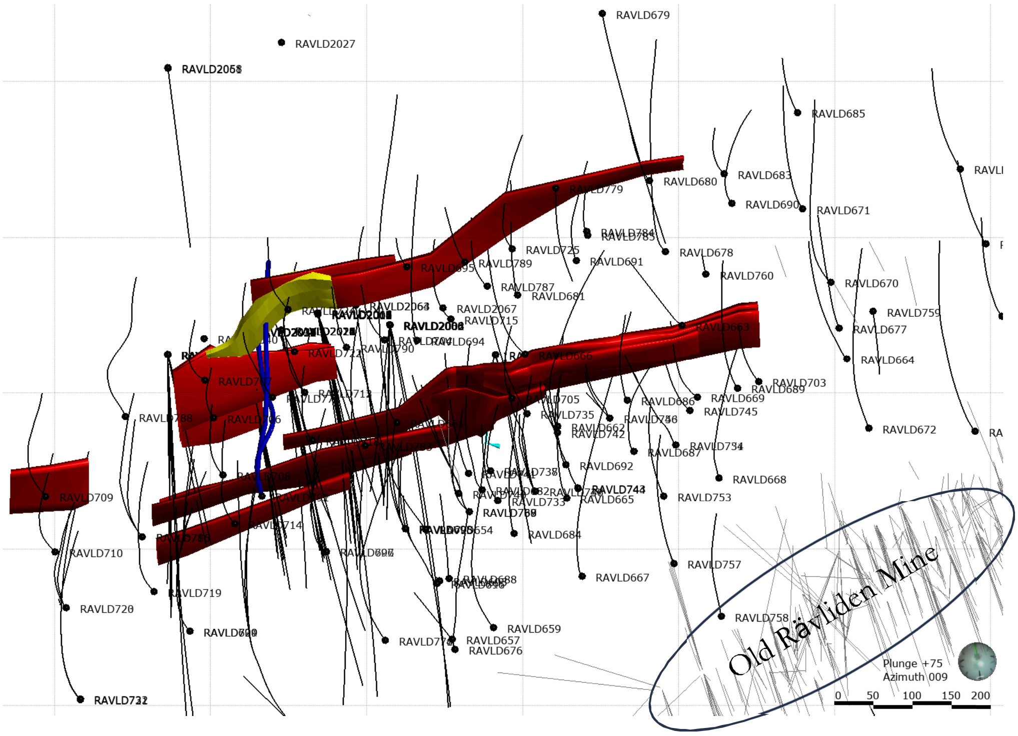

Figure 9.Map of the Rävliden North Mineral Resource showing drilled holes in 2018 in blue. Mineralised lenses ar shown in red

The primary focus for Near Mine during 2019 has been to execute more dens drilling for areas that are about to go into production or in areas where production has already commenced (see Figure 10). Also, a large focus was put in the western parts where information is sparse but the potential is substantial. The geology in the western area appears to be less continuous and more primary textures can be seen than in the 'traditional' Kristineberg altered rocks. This year's campaign has highlighted the complexity of the geological setting, shown by several faults and/or shear zones coupled with moderate to strongly altered rocks with different alteration assemblages and within different blocks. The geological observations coupled with the geophysical interpretations further increases the general interest and potential of the area.

The Rävliden drift was finalised in early 2019, allowing better access to the area. The aim for the year was to increase the geological knowledge as much as possible and to re-evaluate the geometry of the mineralisation and the extent. Test mining will commence in 2020 to test the mineral extraction feasibility on a large scale.

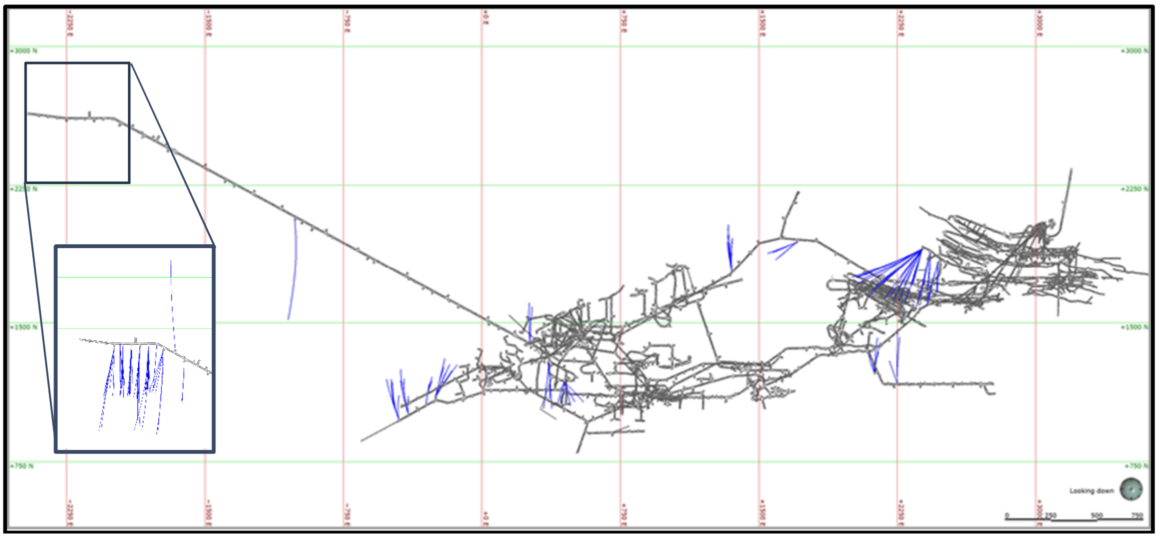

Figure 10. Top view of the Kristineberg Mine infrastructure with this year's drill holes highlighted in blue. Rävliden North shown in upper left.

3.10 Mineral processing and metallurgical testing

Metallurgical testing is carried out in Kristineberg in order to test the properties of the mineralisation and its suitability for processing into a concentrate that can be profitably sold.

Currently, these tests are carried out at Boliden's pilot plant which is located at the BAO Processing Plant, and are performed on ½ core samples which are taken from exploration drill cores, or bulk samples which are "test" mined in-situ.

Tests which can be carried out in house include comprehensive comminution, flotation and hydrometallurgical tests.

Test work which has been carried out in Kristineberg this year mainly focusses on the Silver Zone and Rävliden North mineralisations in support of ongoing technical work to prove the economic viability of the deposits.

Flotation test work continued on lens No 8 from the silver zone in 2019. Lens No 8 gave good flotation results while the other lenses gave poor results.

Test work completed on the Rävliden North mineralisations revealed difficulties in Zn flotation. Froth stability is drastically reduced in cleaning flotation for laboratory test work. This includes both Cu and Zn flotation, however is most prominent on flotation tests with material from mixed Cu-Zn lenses (e.g. parallel lens), where froth has collapsed completely in certain cases. One suggested explanation is that the mineralisation contains high quantities of Pyrrhotite. Pyrrhotite has a high surface area which can absorb reagents, although this is currently unproven as a cause. It is also questioned if this problem only appears in laboratory scale. In 2020 a full scale test campaign at the processing plant in Boliden with 20kt of ore will be carried out to determine its feasibility.

3.11 Mining methods, infrastructure and recovery methods

3.11.1 Mining methods

At the Kristineberg Mine, cut and fill mining and drift and fill mining methods are utilised to mine the mineralised material underground. Generally, levels wider than 10m are mined with drift and fill mining. Both cut and fill and drift and fill are bottom-up mining methods, since the lowermost level is mined first, then backfilled either with Hydraulic Fill (HF) or with Cemented Hydraulic Fill (CHF) depending on the fill requirements. In all cases, waste rock from development headings is transported to the mined out level prior to HF/ CHF filling in order to achieve better stability in the levels above and to avoid transporting waste rock to the surface. In levels with widths between 6-10m, slashing is used to mine any remaining mineralised material on the walls of the mining room. In the uppermost slices, residual mining is also practiced in order to mine the sill pillars.

If the geological and rock mechanical conditions allow, then mineralised bodies are mined with the so-called "Rill" mining method. In Rill mining, a variation of longitudinal open stoping, the mined stope is continuously backfilled with un-cemented rock fill to stabilise the unsupported walls of the stope. The stope height is usually 10-12 m between the roof of the underdrift to the bottom of the drift above.

3.11.2 Infrastructure

From the active mining areas, trucks transport the mined mineralised material to the underground crusher, located at 620m level through underground transport drifts. Transportation of the material to the surface is handled by the skip hoist, which has a capacity of 160tph. The mine is able to produce up to 750,000t of material per year.

Once the material is at surface it is stockpiled at the surface material handling station, where it is then trucked 95km to the BAO Process Plant. The route from Boliden to Kristineberg is via an all-weather road, which presents little difficulties for transporting the mined material. Both underground and surface material handling is outsourced to contractors. Media supplied directly to operational areas including electricity, ventilation, water control etc. are all handled by the mine operations.

Tailings facilities exist both at the mine site and at the BAO Process Plant. The tailings facilities at Kristineberg are currently decommissioned.

Facilities and infrastructure for filling mined rooms also exist where cut and fill operations are conducted. These include a fill mixing station and all other ancillary vehicles necessary for the filling of completed mining rooms.

Other site infrastructure includes offices, and meeting rooms as well as a core logging and sampling facility.

3.11.3 Recovery methods

The mined, crushed material is delivered by truck to the BAO Process Plant where each truck is weighed on a truck scale in order to determine the tonnage arriving to the process plant. The crushed material is then either taken into the processing plant or stored in a stockpile. Separate stockpiles are kept for each of the individual mines in the BAO. Material from the Kristineberg Mine is processed in campaigns where fresh material delivered from the mine is combined with material from the Kristineberg Mine stockpile. The feed tonnage to the process 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. A simplified diagram of the BAO Process Plant can be found below in Figure 11

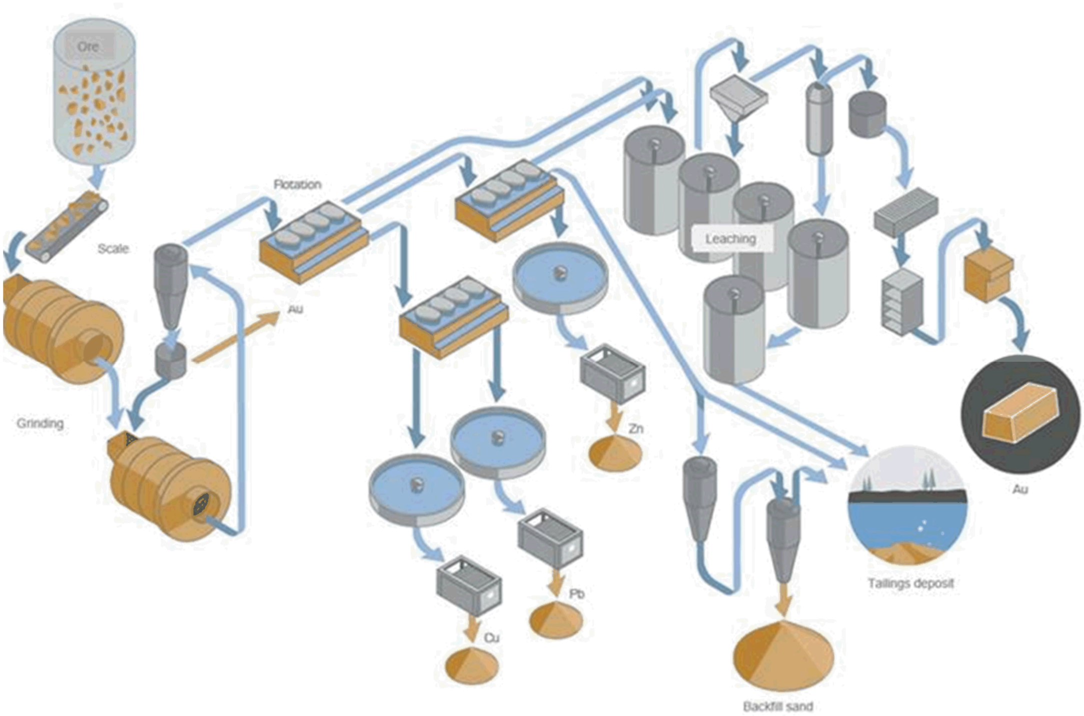

Figure 11.Schematic diagram of the Boliden Area Operations processing plant

In the process plant the material is ground in two stages. 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 material is classified using screens and hydrocyclones. 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 floatability. The gravimetric concentrate is packed in large bags 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.

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 delivered material for that campaign.

3.11.4 Prices, terms and costs

The following section lists the long term prices currently used in the creation of the Net Smelter Return (NSR) formula for the Kristineberg Mine, as well as describing the cut-offs used in the Kristineberg Mine.

The NSR formula will not be described in detail here, however it takes into account metal recoveries, smelter treatment charges and costs for penalty elements. As the Kristineberg Mine has been operating for 79 years, Boliden has a large amount of experience and data on which to verify the NSR factors, which are based on figures produced by the BAO Processing Plant.

NSR cash values are used as a proxy to determine the value or "equivalent grade" of a volume of a planned mining area, or drill hole section. Considering that there are multiple payable elements, which vary in their respective metal constituents in the Kristineberg and Rävliden mineralisations, it makes sense to represent the value of the total mineralisation as one cash value rather than only one metal equivalent.

Table 10. Long term planning prices currently used in the Kristineberg Mine. Including exchange rates.

	Planning prices, 2019
Copper	USD 6,600/tonne
Zinc	USD 2,400/tonne
Lead	USD 2,100/tonne
Gold	USD 1,200/tr.oz
Silver	USD 17/tr.oz
USD/SEK	8.00

The NSR Formula for Kristineberg is shown below. NSR Values are expressed in SEK/t.

NSR_LTP(19LTP20) = (165*AU_PPM) + (2.18*AG_PPM) + (401*CU_PCT) + (126*ZN_PCT) + (51,5*PB_PCT)

The Kristineberg Mine's operational cut-offs are calculated yearly, and are calculated inclusive of mining, processing and transportation costs. Marginal cut-offs are also used in operations whether material encountered during mining should be considered as waste or sent for processing. Marginal cut-off 1 is the value of a final blast which can be taken in a position. i.e it does not need to pay for infrastructure investments. Marginal cut-off 2 is the lowest value of any blasted material which can be processed in the BAO Processing Plant. Cut-off values are presented in Table 11.

Table 11.operating and marginal cut-off values for the Kristineberg Mine

Cut-Off	**Cut-Off Value (SEK/t)**	**Costs included**
Operational cut-off - Cut & Fill	675	Mining, Processing, Transport and Mine + Infrastructure
Operational cut-off – Rill	575	Mining, Processing, Transport and Mine + Infrastructure
Marginal Cut-Off 1	525	Mining, Processing, Transport
Marginal Cut-Off 2	350	Processing, Transport

3.12 Mineral resource estimates

Mineral Resource estimates which have been produced for the Kristineberg Mine prior to January 1st 2018 should be considered estimates which have previously been reported under a classification scheme other than PERC, namely the FRB Standard. The FRB Standard and PERC Standard uses similar classification terminology, and therefore definitions of Mineral Resource classification categories should be considered interchangeable.

Mineral Resource statements of tonnages and grades which are included in the "Table of Mineral Resources" are included under chapter 17 of the PERC Standard and were reported under the FRB Standard in Boliden's 2017 annual report, with the exception of the Silver Zone, Rävliden Norra, L-West and Koppar Klumpen (M-Zone) estimates which were estimated in 2018/2019 and are accompanied by a PERC Compliant Mineral Resource statement and report, as well as sign-off by a FAMMP CP.

Boliden views previous estimates reported under the FRB Standard to be on the whole reliable, and can be backed up by past reconciliation data, however these Mineral Resources cannot be approved by the Competent Person according to the PERC Standard, and therefore cannot be aggregated with other Mineral Resource estimates at the Kristineberg Mine according to Chapter 17 of the PERC Standard.

Boliden is currently in process of updating the previously reported grades and tonnages under the FRB Standard with new estimates, which will review and if necessary re-classify and re-define Mineral Resource grades and tonnages as presented in the "Table of Mineral Resources" for the Kristineberg Mine. On-going work includes an update to the A-Zone. A planned update to the Raimo mineralisation as well as the Silver Zone will be completed during 2020.

Table 12 outlines each reported Mineral Resource at the Kristineberg Mine and its relationship to chapter 17 of the PERC Standard.

Table 12.Summary of estimations carried out at the Kristineberg mine and their relation to PERC Standard chapter 17

Minerali-sation	Author (internal)	Software	Estimation method	Reporting code	Comments	Actions
A	Internal (historic)	Propack	IDW	FRB	No documentation exists – unreliable estimate	MRE Ongoing
B	Internal (historic)	Propack	IDW	FRB	No documentation exists – unreliable estimate	New MRE required as an audit
J	Kruuna (2011)	Propack	IDW	FRB	Reconciliation results provide confidence	New MRE required as an audit
M	Wiik (2009) Baldwin (2019)	Propack	IDW/OK	FRB/ PERC	Reconciliation results provide confidence	MRE Completed for Koppar Klumpen
L	Kruuna (2011) Baldwin (2019)	Propack	IDW/OK	FRB/ PERC		MRE Complete for L-West
Raimo	McGimpsey (2016)	Datamine	IDW	FRB		New MRE required
Tommy	McGimpsey (2016)	Datamine	IDW	FRB		New MRE required
Ag-Zone	Baldwin (2018)	Datamine	OK	PERC	PERC compliant	None
Rävliden norra	McGimpsey (2018)	Datamine	IDW	PERC	PERC compliant	None

Estimation parameters used in the interpolation of grades varies depending on the lens which is being estimated. Generally estimates are carried out using the Inverse Distance Weighting (IDW) squared method at Kristineberg, however Ordinary Kriging (OK) has been used in the Silver Zone, L-West and Koppar Klumpen.

To estimate metal grades and tonnages, wireframes are constructed in Microstation or Datamine software from 2D geological vertical sections drawn by either the mine or exploration geologist. These wireframes are usually based on a Net Smelter Return (NSR) value of the analysis section of 675 SEK. Wireframes are not extended beyond these intersections if the value is lower than 675 SEK. The NSR value is defined by a formula based on prices and terms outlined in section 3.12. The sections inside the wireframe are then subject to geostatistical analysis to decide on composite length, evaluation of outliers and evaluation of domains in order to preserve the integrity of the grade interpolations.

Propack, a module for Microstation, or Datamine is then used to draw a block model within the constructed wireframe. Blocks are set to the Smallest Mining Unit (SMU) in Kristineberg, which are defined in Table 13.

Table 13.Block dimensions for the Kristineberg Mine production models. Dimensions in KRIBERGSYSTEMET

Models	Y	X	Z
L, A, B	5	4	6
J, M	2	10	2

Following the construction of the block model, Propack or Datamine is then used to interpolate grades. A 3D search ellipsoid is defined for the IDW, which is set to reflect the wireframe's geometry. Variography is used to define a search ellipsoid for OK interpolations. Grades are interpolated for Au, Ag, Cu, Zn, Pb, and S.

After interpolation, blocks are classified according to geological confidence into Mineral Resource categories. In the Kristineberg Mine a drilling spacing of 100m is used to generate sampling data, giving geological confidence for an Inferred Mineral Resource and 50m for an Indicated Mineral Resource. Other factors such as local geological conditions and assay quality also play a role in classification, as well as the mineralisations "Reasonable Prospects for Eventual Economic Extraction" (RPEEE).

Mineral Resources at the Kristineberg Mine are reported with a 15% dilution of zero-grades, with a 675SEK/t cut-off, with the exception of the Silver Zone, which is reported to a minimum width of 4.5m, and a cut-off grade of 550SEK/t without dilution. Currently a 70% portion of remaining mineralised pillars are also included in the Mineral Resource. Mineral Resources for The Kristineberg Mine including Rävliden Norra, are presented in Table 16 exclusive of Mineral Reserves. A diagram of Mineral Resources and Mineral Reserves for Kristineberg Mine are presented in Figure 12, the Rävliden North Mineral Resource is presented in Figure 13.

3.13 Mineral reserve estimates

Mineral Resources are converted to Mineral Reserves through careful planning and application of Modifying Factors. No Inferred Mineral Resources can be converted to Mineral Reserve. The largest technical risks to the operation include poor rock quality and variable geometry and grade of the mineralised bodies.

New positions in the mine, such as the Silver Zone, or Rävliden Norra will be converted by completing a large scale technical and financial evaluation of the mineralisation, and includes pre-feasibility studies and feasibility studies, as well as updates to the Mineral Resource block models. If the Mineral Resource or parts of the Mineral Resource are found to be economically viable to mine, then that portion of the Mineral Resource will be converted to a Mineral Reserve.

Mineralisation which is located adjacent to existing mining positions is taken into the Mineral Reserve at the discretion of the Mine Geologist. This conversion happens after infill drilling at a normal spacing of 25m or where drilling provides suitable geologic confidence, and the estimated grades and tonnages indicate that the volume is above operational cut-off. Mining engineers then plan their mining on the volume with the assumption that all of the material can be mined profitably. A 15% dilution of zero grades is calculated into the value of the tonnage. A 30% portion of remaining mineralised pillars are included in the Mineral Reserve.

Classification of Mineral Reserves into Proved or Probable categories depending on the confidence of the underlying modifying factors, as well as geological confidence. This may include permitting, environmental or social factors as well as technical and economic factors.

All reported Mineral Reserves for the Kristineberg Mine have been previously reported in Boliden's 2017 Annual Report and as such have been reported under the FRB Standard. Mineral Reserves from 2018 therefore are reported under Chapter 17 of the PERC Standard. Mineral Reserves are presented in Table 15 and Figure 12.

Table 14. PERC Compliant Mineral Resource statement for the Kristineberg Mine and Rävliden North Mineral Resources as of 31-12-2019. Ag-Zone Mineral Resources are reported to a minimum width of 4.5m, and a cut off of 550SEK/t (Baldwin, 2018). Rävliden Mineral Resources are reported to a minimum width of 5m and a cut-off of 470SEK/t (McGimpsey, 2018). Koppar Klumpen Mineral Resources reported to a minimum width of 4.5m and a cut-off of 550SEK/t.

PERC Compliant Mineral Resource Statement Classification	**kton**	**Au (g/t)**	**2018 Ag (g/t)**	**Cu (%)**	**Zn (%)**	**Pb (%)**
Indicated Mineral Resources						
Rävliden North	2,837	0.19	89	1.0	5.3	0.7
M-Zone (Koppar Klumpen)	128	0.17	9	0.1	5.9	0.1
L-Zone (L-West)	156	0.30	52	0.1	5.5	0.5
Total M&I	**3,121**	**0.19**	**84**	**0.9**	**5.3**	**0.7**
Inferred Mineral Resources						
Rävliden North	2,895	0.23	82	1.2	2.8	0.5
M-Zone (Koppar Klumpen)	31	0.14	8	0.2	4.8	0.0
Silver Zone	143	0.15	230	0.0	5.8	1.9
L-Zone (L-West)	231	0.30	43	0.5	3.0	0.3
Total Inferred	**3,300**	**0.23**	**85**	**1.1**	**3.0**	**0.5**

Table 15. Total aggregated FRB & PERC Mineral Resources and Mineral Reserves Kristineberg Mine including Rävliden North and Silver Zone Mineral Resource Estimates as of 31-12-2018

	2019						2018					
Classification	kton	Au (g/t)	Ag (g/t)	Cu (%)	Zn (%)	Pb (%)	kton	Au (g/t)	Ag (g/t)	Cu (%)	Zn (%)	Pb (%)
Mineral Reserves												
Proved	125	1.0	34	0.4	6.7	0.6	5	1.0	15	1.4	0.4	0.1
Probable	3,534	0.5	35	0.6	5.4	0.3	4,282	0.5	37	0.5	5.3	0.3
Total P&P	**3,658**	**0.5**	**35**	**0.6**	**5.4**	**0.3**	**4,287**	**0.5**	**37**	**0.5**	**5.3**	**0.3**
Mineral Resources												
Measured	49	0.7	45	1.3	4.2	0.2	49	0.7	45	1.3	4.2	0.2
Indicated	5,191	0.4	65	0.9	5.0	0.5	5,211	0.4	64	0.9	4.6	0.5
Total M&I	**5,239**	**0.4**	**65**	**0.9**	**4.9**	**0.5**	**5,260**	**0.4**	**64**	**0.9**	**4.6**	**0.5**
Inferred	6,116	0.4	57	0.9	2.9	0.4	5,945	0.4	61	0.9	2.5	0.4

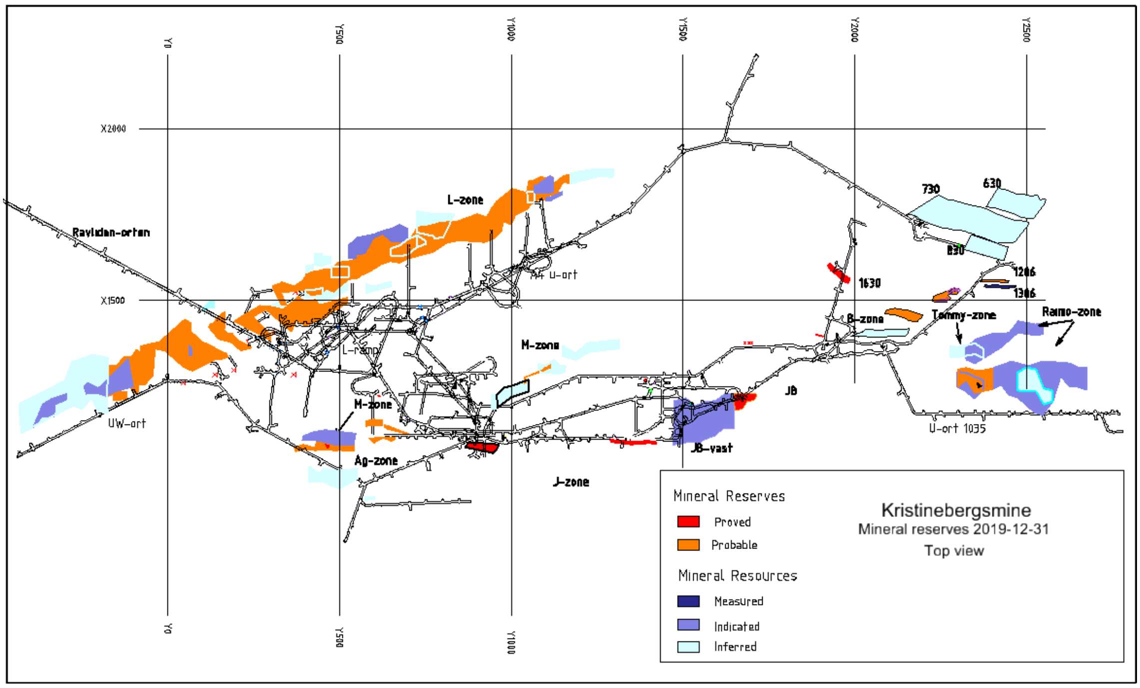

Figure 12.Plan view of the Kristineberg Mine showing mine infrastructure and locations of Mineral Resources and Mineral Reserves

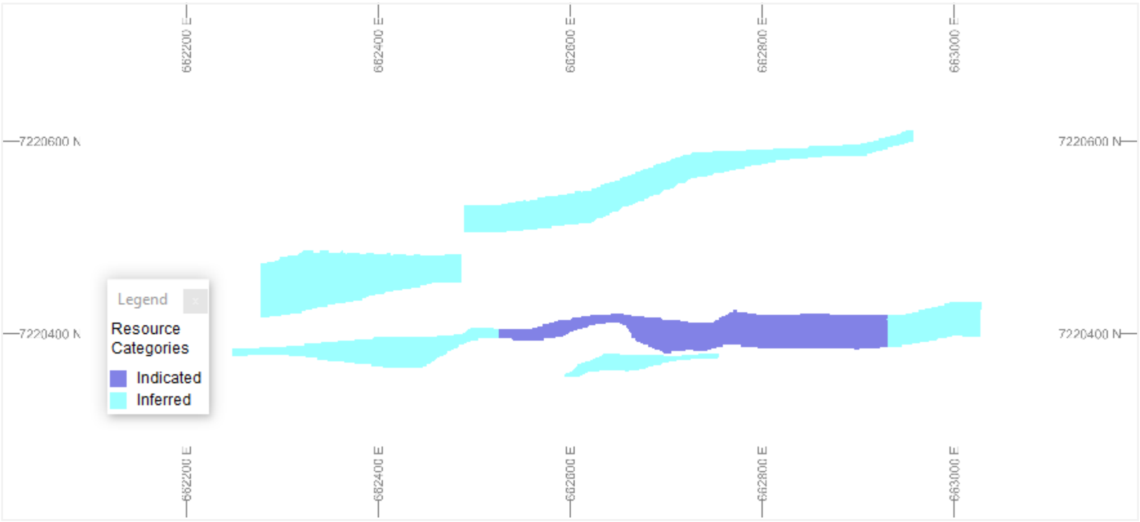

Figure 13.Plan view of the classified Rävliden Norra Mineral Resource block model (McGimpsey, 2018)

3.14 Comparison with previous year

2019 shows a reduction in Mineral Reserves and an increase in Mineral Resources. The breakdown of changes are outlined below.

3.14.1 Mineral Resources

- Total increase of 152kt.
- 9kt mined from the A-Zone Mineral Resource.
- 299kt Mineral Resources converted to Mineral Reserve in A-zone and Raimo.
- 301kt downgraded from Mineral Reserve in the L-Zone.
- 493kt added to L-Zone and M-zone Mineral Resource from updated Mineral Resource Estimates.
- 95kt written off Raimo due to a reinterpretation of the geology
- 88kt added to A-Zone and Ag-Zone due to reinterpretation of the geology.
- 300kt written off from Ag-zone due to technical factors.
- 24kt written off from J-Zone due to lack of RPEEE.

3.14.2 Mineral Reserves

- Overall net reduction in Mineral Reserves by around 630kt
- 601kt mined from A, J-, M-, and L-Zones.
- Added 369kt from conversion of Mineral Resources to Mineral Reserves in A-Zone, Raimo and Koppar Klumpen
- 301kt downgraded to Mineral Resources from L-Zone Mineral Reserves
- 32kt written off due to changed geological interpretations.
- 52kt written off due to roof failures and pillars which now will not be mined.
- 17kt written off due to technical problems.

3.15 Reconciliation

Reconciliation at the Kristineberg Mine is completed for every month of production, and aggregated for the year. Mined grades and tonnages are read out from the production block model for every position that has been mined. These predicted grades are then summarised, where the average grade for that month is compared with the average grade and tonnage which has been measured and estimated by the BAO Processing Plant.

The Reconciliation for the year 2019 is shown in Table 17. Reconciliation data shows that trucked tonnages show a small deviation from the sum of products figures from the BAO processing plant. Reconciliation with predicted grades shows good correlation with Zn and Cu, however Pb and Au reconciliation shows that there is 15% less Pb and 16% more Au produced from the plant than predicted from the production block model. On the whole, the Competent Person judges this to be reasonable and sufficient.

Table 15. Reconciliation data for the Kristineberg mine 2019, aggregated

2019 Reconciliation - Kristineberg								
Category	**Tonnes kt**	**Au g/t**	**Ag g/t**	**Cu %**	**Zn %**	**Pb %**	**S %**	**Dilution %**
Mined	603 824	0.5	31	0.5	5.1	0.3	17	15
Sum of Products	589 377	0.6	32	0.5	5.4	0.2	21	
Difference vs. BAO PP	14 447	0.1	1.7	0.0	0.3	0	3.8	
Difference vs. Plant (%)	-2.4	15.6	5.7	2	4.9	-14.6	21.6	

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