Boliden Summary Report

Mineral Resources and Mineral Reserves | 2021

Garpenberg

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1 SUMMARY

In 2021 the total mineral reserves in Garpenberg increased by 4.2 Mt (million metric tonnes) to 93.7 Mt. Measured and indicated resource in Garpenberg decreased by 6.0 Mt to 30.6 Mt. Inferred resource increased by 23.0 Mt to 48.5 Mt.

Table 1-1 Mineral Resources and Mineral Reserves in Garpenberg 2021-12-31

Classification	2021 kton	Au (g/t)	Ag (g/t)	Cu (%)	Zn (%)	Pb (%)	2020 kton	Au (g/t)	Ag (g/t)	Cu (%)	Zn (%)	Pb (%)
Mineral Reserves												
Proved	**7 700**	**0.18**	**135**	**0.03**	**3.3**	**1.2**	23 500	0.23	97	0.03	3.1	1.2
Probable	**86 000**	**0.32**	**90**	**0.05**	**2.8**	**1.3**	66 000	0.35	93	0.05	2.7	1.3
Total	*93 700*	0.31	93	0.04	2.8	1.3	*89 500*	0.32	94	0.04	2.8	1.3
Mineral Resources												
Measured	**100**	**0.24**	**108**	**0.03**	**2.8**	**1.0**	3 900	0.33	94	0.06	3.4	1.7
Indicated	**30 500**	**0.40**	**83**	**0.06**	**2.6**	**1.3**	32 600	0.35	89	0.05	2.7	1.3
Total M&I	*30 600*	0.40	83	0.06	2.6	1.3	*36 600*	0.35	90	0.06	2.8	1.4
Inferred	**48 400**	**0.35**	**50**	**0.06**	**2.3**	**1.1**	25 500	0.42	57	0.07	2.5	1.4

1.1 Competence

Multiple participants have been involved and contributed to this summary report. Roles and responsibilities are listed in Table 1-2.

Table 1-2. Contributors and responsible competent persons for this report

Description	Contributors	Responsible CP
Compilation of this report	Morvan Derrien	Thomas Hedberg
Geology	Morvan Derrien	Sofia Höglund
Resource estimation	Sofia Höglund	Sofia Höglund
Metallurgy	Anders Sand	Anders Sand
Mining	Catarina Barreira	Thomas Hedberg
Environmental and legal permits	Lotta Tanse	Nils Eriksson

Thomas Hedberg has a background in numerous Managerial positions in Boliden from Mining Engineering to Mine Manager in Sweden and Canada. Currently as Senior Project Manager for Boliden Mines. This experience gives the general view and understanding of the whole mining process from exploration to concentrate. Member in FAMMP[1] since 2018.

[1] Fennoscandian Association for Metals and Minerals Professionals

2 GENERAL INTRODUCTION

This report is issued annually to inform the public (shareholders and potential investors) of the mineral assets in Garpenberg held by Boliden. The report is a summary of internal / Competent Persons' Reports for Garpenberg. Boliden method of reporting Mineral Resources and Mineral Reserves intends to comply with the Pan-European Reserves and Resources Reporting Committee (PERC) "PERC Reporting Standard 2021".

The PERC Reporting Standard is an international reporting standard 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.

2.1 Pan-European Standard for Reporting of Exploration Results, Mineral Resources and Mineral Reserves – The PERC Reporting Standard

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, the Committee for Mineral Reserves International Reporting Standards, and the PERC Reporting Standard is fully aligned with the CRIRSCO Reporting Template.

The PERC standard sets out minimum standards, recommendations and guidelines for Public Reporting of Exploration Results, Mineral Resources and Mineral Reserves in Europe.

2.2 Definitions

Public Reports on Exploration Results, Mineral Resources and/or Mineral Reserves must only use terms set out in the PERC standard.

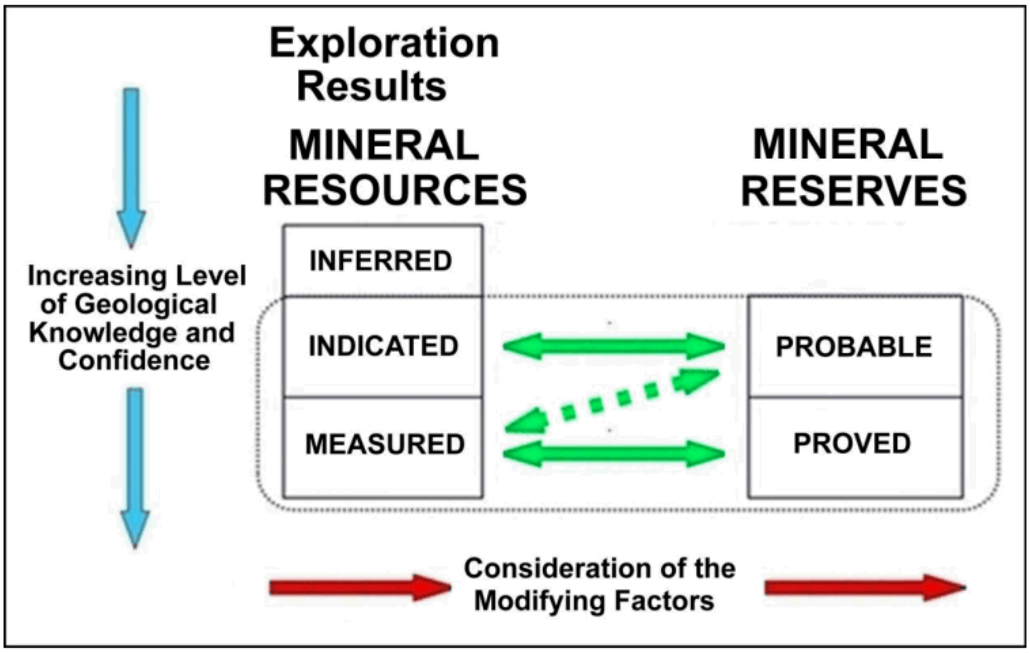

Figure 2-1. General relationship between Exploration Results, Mineral Resources and Mineral Reserves (PERC 2021).

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. Boliden reports Mineral Resources exclusive of Mineral Reserves.

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.

3 GARPENBERG

3.1 Project Outline

Garpenberg is a Zn-Pb-Ag-(Cu-Au) underground mine where the ore is mined from between 450 meters to more than 1 400 meters below surface. The mine encompasses several polymetallic ore bodies. See Figure 3-4 and Figure 3-.

The mined out ore tonnage in 2021 totaled 3052 Kton which is an increase of 51 Kton from previous year. Almost 80 % of the mined tonnage derives from the largest ore body, Lappberget.

Zinc and silver are the most valuable commodities in Garpenberg. Zinc accounted for about 44 % of the revenue, followed by silver at 35%, lead at 14% and copper-gold at 7%

3.2 Major changes 2020

In 2021 the total mineral reserves in Garpenberg increased by 4.2 Mt (million metric tonnes) to 93.7 Mt. Measured and indicated resource in Garpenberg decreased by 6.0 Mt to 30.6 Mt. Inferred resource increased by 23.0 Mt to 48.5 Mt.

3.2.1 Technical studies

In 2021, a technical report was completed regarding the upgrade of parts of Finnhyttan mineral resources into ore reserve (Derrien 2021). The upgrade from resource to reserve concerns the positions Finnhyttan 595-845z and Kyrkan 589-779.5z.

3.3 Location

Garpenberg is located in the Hedemora municipality in central Sweden 180 km NW of Stockholm at coordinates (WGS84) latitude 60° 19’ 27”N, longitude 16° 13’ 38”. Figure 3-1 and Figure 3-2 show the geographic location and the mining concessions of Garpenberg.

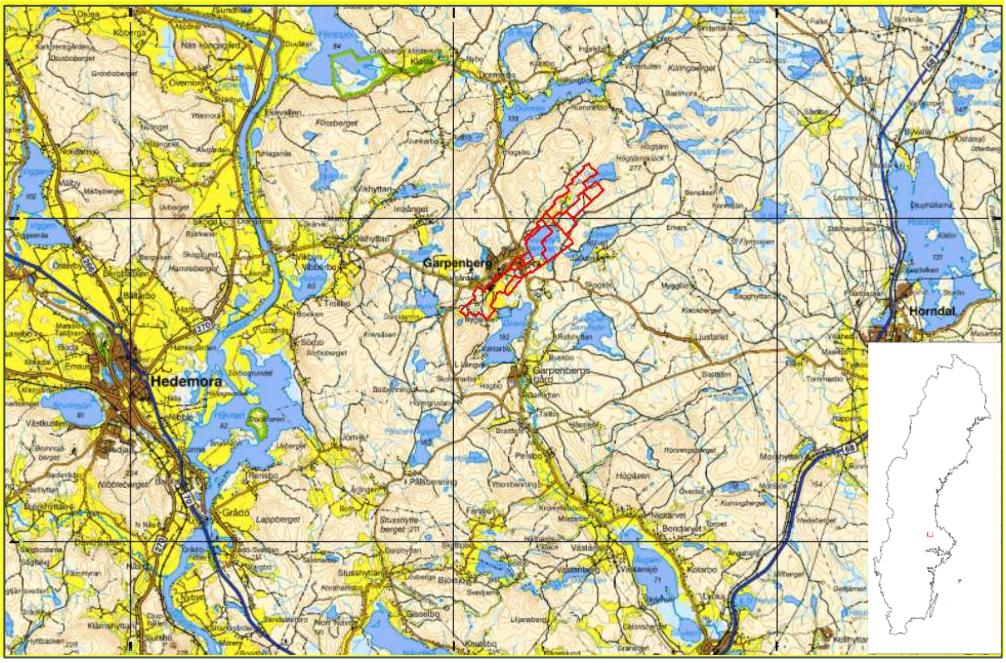

Figure 3-1. Regional map showing Garpenberg mining concession licenses in red colour. Coordinate system in the map is RT90 2.5 gon W.

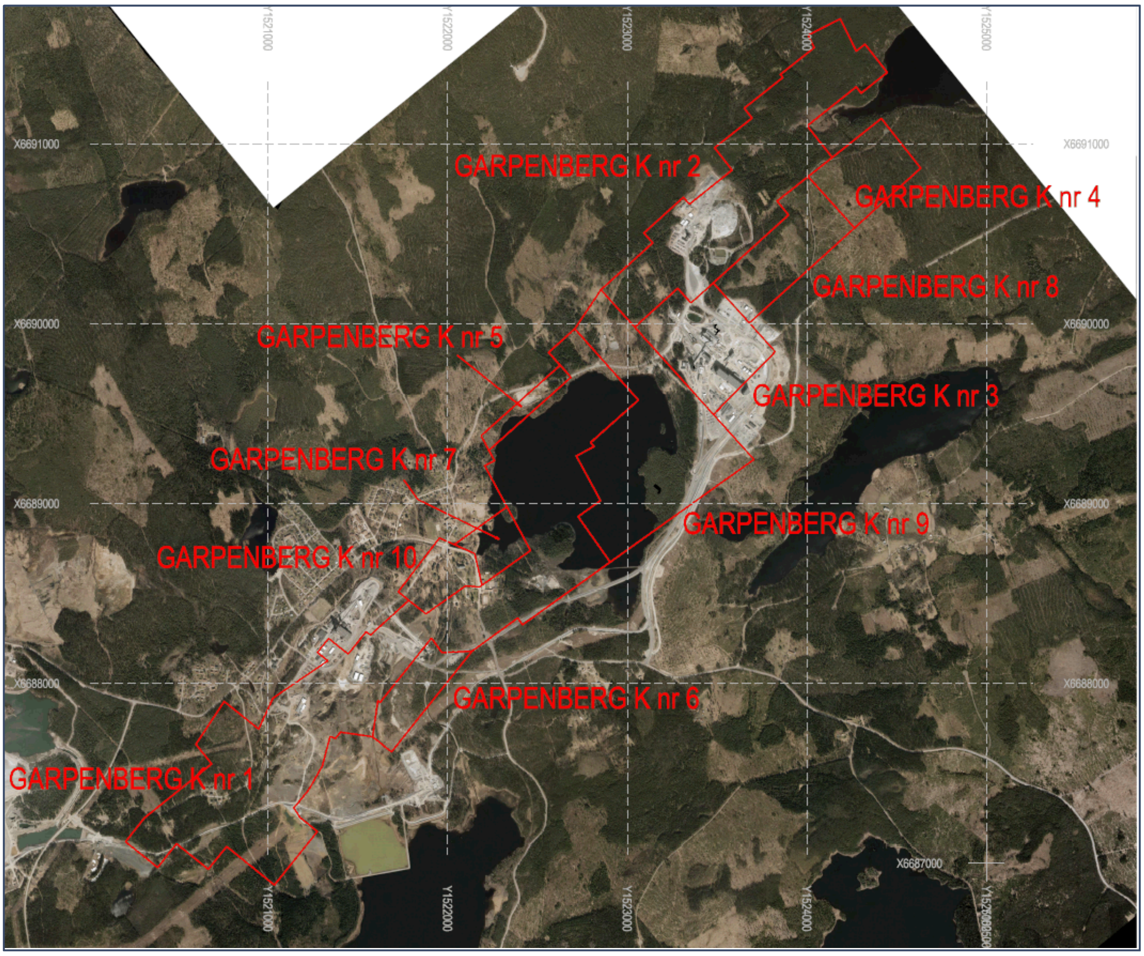

Figure 3-2. Detailed map of Garpenberg mining concessions.

3.4 History

Historical documents show that systematic mining has been conducted in Garpenberg since the 13th century. Recent studies from lake sediments 2017 however push back the evidence for early ore mining in Garpenberg even further, from the Middle Ages to the pre-Roman Iron Age around 400 BC (Bindler et al., 2017).

In 1957 Boliden acquired the Garpenberg mine from AB Zinkgruvor. A total of 60.4 Mt of ore has been processed since Boliden took over the operations (Table 3-1).
A chronological list of historically significant events is presented in appendix 1.

Table 3-1. Annual production numbers 1957-2021. Between 1957 and 1995 the processed ore tonnes and grades are presented with 5-year intervals, while figures for mined ore are missing. From 2005 to 2014 ore from the Lovisagruvan mine was also processed in Garpenberg. A total of 60.4 Mt of ore has been processed since Boliden acquired the mine from AB Zinkgruvor in 1957.

Year	Mined Ore	Processed Ore	Grades				Lovisa
	Kton	Kton	Au g/t	Ag g/t	Zn %	Pb %	Kton
1957		260	1.2	69	2.84	2.34	
1960		306	0.7	81	4.3	3.0	
1965		297	0.9	116	4.9	3.3	
1970		307	0.9	110	4.2	2.7	
1975		349	0.6	114	3.2	1.9	
1980		427	0.5	112	3.0	1.8	
1985		534	0.4	138	3.0	1.9	
1990		747	0.5	135	3.6	2.0	
1995		750	0.4	133	4.3	2.2	
2000	1003	976	0.5	141	3.9	1.9	
2001	1018	984	0.4	136	3.9	1.8	
2002	997	1058	0.4	153	4.0	1.8	
2003	1067	1062	0.4	151	4.6	1.9	
2004	1087	1074	0.3	124	5.6	2.2	
2005	1115	1102	0.3	117	5.8	2.3	13.3
2006	1167	1182	0.4	123	5.7	2.2	17.1
2007	1218	1255	0.3	126	6.3	2.5	17.1
2008	1341	1365	0.3	130	6.9	2.6	27.7
2009	1425	1394	0.3	139	7.3	2.8	31.7

2010	1369	1443	0.3	133	6.6	2.5	28.9
2011	1441	1456	0.3	134	6.1	2.4	37.5
2012	1602	1484	0.27	130	5.6	2.1	39.0
2013	1600	1495	0.3	153	5.2	2.1	39.8
2014	1891	2224	0.31	136	5.1	2.1	38.7
2015	2304	2367	0.32	156	5.0	2.1	
2016	2610	2622	0.31	150	4.4	1.8	
2017	2630	2634	0.30	134	4.3	1.8	
2018	2625	2622	0.29	135	4.1	1.6	
2019	2865	2861	0.26	118	4.1	1.5	
2020	3000	3000	0.31	109	3.8	1.5	
2021	3052	3056	0.30	119	3.8	1.5	

Resource estimates for new ore bodies are produced by the exploration department by drilling the mineralized rock body in a 50 x 50 m grid, producing an inferred or indicated resource. This is typically followed up by denser drilling carried out by the mine department resulting in a measured resource and eventually a mineral reserve. More on mineral resources and mineral reserves in chapters 3.12 and 3.13, respectively.

The mineral reserve estimates are constantly being revised against the metal grades of the actual mined tonnage through the reconciliation process, see chapter 3.15.

3.5 Ownership

Boliden Mineral AB owns 100 % of the Garpenberg mine.

3.6 Environmental, Social and Governance

3.6.1 Permits

3.6.1.1 Existing permits

Boliden is the owner of all land where the mining operations are currently developed. Boliden has 10 mining concessions covering the mine area. The concessions are presented in Table 3-2, Figure 3-1 and Figure 3-2.

Table 3-2. Mining concessions in Garpenberg.

Name	Active from	Expires	Minerals
Garpenberg K nr 1	2000-01-01	2025-01-01	Zinc, lead, silver, copper, gold
Garpenberg K nr 2	2000-01-01	2025-01-01	Zinc, lead, silver, copper, gold
Garpenberg K nr 3	2001-06-18	2026-06-18	Zinc, lead, silver, copper, gold
Garpenberg K nr 4	2001-06-18	2026-06-18	Zinc, lead, silver, copper, gold
Garpenberg K nr 5	2002-12-13	2027-12-13	Zinc, lead, silver, copper, gold
Garpenberg K nr 6	2002-12-13	2027-12-13	Zinc, lead, silver, copper, gold
Garpenberg K nr 7	2002-12-13	2027-12-13	Zinc, lead, silver, copper, gold
Garpenberg K nr 8	2003-01-07	2028-01-07	Zinc, lead, silver, copper, gold
Garpenberg K nr 9	2003-04-17	2028-04-17	Zinc, lead, silver, copper, gold
Garpenberg K nr 10	2004-03-19	2029-03-19	Zinc, lead, silver, copper, gold

Boliden has the necessary environmental permits in place to operate the mine. The main permit, in accordance with the Swedish Environmental Act, was issued by the Swedish Environmental Court in 2012 (M461-11 2012-01-31) and the final discharge limits to water were set in 2016 (M461-11 2016-04-15). In 2018 applied for some changes in the permit which were approved in December 2018 (M467-18, 2018-12-20). These changes in the permit will allow Boliden to deposit waste-rock according to life-of-mine plan and tailings for 10 years (the longest building period allowed for activities under chapter 11 in the Swedish Environmental Act).

In 2021 Boliden got a new extension permit (M7041-20, 21-06-15) for extracting and processing up to 3.5 Mtpa of ore in Garpenberg, without changing anything else in the conditions of the environmental permit. The only supplement in the permit is a discharge limit for uranium to water.

The permit allows Boliden to operate the mine as described in the application and in particular to (chapter 9 Environmental Act):

- extract and process up to 3.5 Mtpa of ore in Garpenberg,
- deposit tailings in the Ryllshyttan tailings management facility (TMF) and backfill the mine.

In addition, the permit allows Boliden to (chapter 11 Environmental Act):

- raise the dams at Ryllshyttan TMF to the level of +256m with the maximum water level of +254 m and to construct a new outlet,
- extend the waste-rock dumps,
- set the financial guarantee for closure to 490 MSek,
- raise the water level in the clarification pond to the level of +227.9 m,
- extract mine water, and
- extract up to 1.9 Mm3/yr fresh water from the lakes Gruvsjön och Finnhytte-Dammsjön, of which a maximum of 0.95 Mm3 from Finnhytte-Dammsjön.

The permit is associated with a series of conditions and limit values regarding e.g., discharge water quality and noise levels in neighboring houses.

3.6.1.2 Necessary permits

Boliden has initiated the process of permitting a change in the dam construction method at Ryllshyttemagasinet TMF. The change implies building centerline dams instead of as currently up-stream dams. The application will be submitted to the Environmental court during year 2022. This change will result in even safer dams, allow for future raises above currently permitted heights and increase the capacity of the TMF within already permitted dam heights.

The existing permit limits the construction period of the dams surrounding the TMF to 2028 and also sets a maximum height of the dams. This implies that Boliden need a new permit in place by 2028 in order to be able to continue raising the TMF or depositing the tailings elsewhere.

3.6.2 Environmental, Social and Governance considerations

3.6.2.1 ESG Commitments

Boliden is a member of ICMM and the national mining associations in the countries where Boliden Mines operates. These commitments imply implementing relevant international and national EMS standards and guidelines, such as, e.g., the Global Industry Standard on Tailings Management on an international level and Mining RIDAS on a national level. In addition to this, Boliden Mines is certified according to a series of standards, such as:

- ISO 14001:2015 - Environmental management systems.
- ISO 45001:2018 - Occupational health and safety management systems.
- ISO 50001:2018 - Energy management systems.

Boliden has implemented an integrated management system (Boliden Management System, BMS) which sets a common base for all activities developed within the company.

Boliden strive to run a responsible business and expect it´s business partners to do the same. Good business ethics is essential for sustainable and successful business. Boliden has an ethics and compliance department to boost its compliance work. The department is responsible for the strategic development and coordination of Boliden’s work regarding anti-money laundering, anti-corruption, competition law, sanctions, human rights, data protection, whistleblowing and Boliden’s employees and management work together to create a compliance culture in which everyone knows what is expected of them - Boliden’s codes of conduct. Regular risk assessments, trainings, audits and effective controls are important parts of Boliden’s compliance efforts. The Group’s whistleblower channel enables all employees and external stakeholders to report suspected and actual misconduct confidentially and anonymously. If misconduct is proven, disciplinary actions must be taken. Reprisals against anyone reporting misconduct in good faith will not be tolerated. Group management and the Board of Directors receive regular reports on risks, non-compliance and the status of initiatives in progress.

Boliden’s Code of Conduct provides a framework for corporate responsibility based on the company’s values and ethical principles. All employees and members of the Board are subject to the Code, which is based on international standards and relevant legislation. As a complement to the

Code, there are internal policies that all employees are expected to comply with. Boliden strives for a sustainable value chain and therefore applies an overarching business ethics and risk management strategy when selecting business partners. The Business Partner Code of Conduct reflects the requirements placed on Boliden's own organization and sets the lowest standard of ethical conduct required of all parties in the value chain, whether Boliden is the buyer or seller. As with the internal Code of Conduct, this code is based on international standards such as the UN's Global Compact, the ILO's standard core conventions and guidance from the OECD. Compliance and sustainability risks are assessed when selecting business partners. If there is a risk of non-compliance by a business partner, a more detailed review is made. Depending on the outcome, an action plan may be developed and agreed upon, or the business relation may be terminated or rejected.

Boliden is a member of the United Nations Global Compact and works constantly to implement its ten principles, including preventing and limiting negative impact in the own operations and those of its external business partners. Boliden runs operations in countries where the risk of human rights violations is considered low. No operations are conducted anywhere in UNESCO's World Heritage List. Boliden supports the right of indigenous peoples to consultations under Svemin's interpretation of FPIC. Other important aspects are fair working conditions and the position Boliden has adopted against any form of harassment, discrimination and other behavior that may be considered as victimization by colleagues or related parties. In addition to this, aspects such as child and forced labor as well as the freedom to form and join trade unions are taken into account when evaluating business partners.

Anti-corruption forms a central part of the ethics and compliance work, and Boliden has a zero tolerance policy regarding all types of bribery and corruption. Boliden has an anti-money laundering policy for identifying and managing risks in various parts of the business and to strengthen its anti-money laundering efforts.

3.6.2.2 Socio-economical impact

Mining and metal processing has been the driving force in the local and regional economy and development in Bergsslagen for centuries if not millenniums. This means that the region lives in symbiosis with mining activities in Garpenberg and develops together with the mine. The large investments and developments that have taken place in Garpenberg over recent years has been a boost in the local economy and competence level which has created a lot of optimism regarding the future in the region. The Garpenberg mine is an important actor on the local and regional scale with 430 direct employees and creating a large number of indirect jobs. In total it has been assessed that the Garpenberg generates 2300 direct and indirect jobs. More than 85 % of the workforce lives withing the municipalities of Hedemora, Avesta and Säter. The importance and engagement of Garpenberg is also reflected in the support to local organization, cultural events and social projects.

3.6.2.3 Communities and land-owners

Boliden Garpenberg is located in the small town of Garpenberg. Many of the employees live in or close to the mine, actually, more than 20 % of the inhabitants in Garpenberg work at the mine. The dominating land use around the mine is forestry performed by private landowners and forestry companies. In addition, there is an active outdoor culture in the area where hunting is much appreciated.

Boliden holds regular information meetings with the local community and landowners. Relations with the local community and landowners are generally good. A grievance mechanism is in place through which anyone can file any complaints or improvement suggestions. During year 2021 local inhabitants raised vibrations and noise as priority areas to address. Previously dusting from the TMF has been an important issue, but implemented dust control measures have resulted in zero complaints regarding dusting during 2021.

3.6.2.4 Historical Legacy

The long history of mining in Garpenberg has resulted in a complex environmental situation with numerous historical objects on and around Boliden's land holdings in Garpenberg. Due to the age of these objects, Boliden is assessed to have very limited liability for any future remedial works to limit the environmental impact of these objects; however, Boliden has the responsibility as landowner to conduct investigations in order to determine the impact of these historical objects. These investigations are ongoing, as well as a dialogue with the competent authority regarding the extent of the liability for any future remedial actions on these objects. A process has been initiated by the Water Authority to assess if it necessary to modify the environmental quality standards (EQS) for Gruvsjön and downstream lying water bodies as it has been shown that it is not a realistic admission to meet current EQS, even in a long-term perspective.

3.7 Geology

The Garpenberg mine is situated in the mineralized Palaeoproterozoic igneous province of Bergslagen, south central Sweden, which is host to a variety of ore deposits, and especially Fe-oxide and polymetallic sulphide deposits. Garpenberg, which is the largest sulphide deposit in the region, consists of several individual ore bodies distributed over a distance of 4 km within the Garpenberg supracrustal inlier, see Figure 3-3. The main host rock to the ore is calcitic marble (limestone) altered to dolomite and Mg +/- Mn-rich skarns. The footwall consists of rhyolitic pumiceous, graded mass-flow breccia and rhyolitic ash-siltstone and sandstone affected by strong phlogopite-biotite-cordierite-sericite-quartz alteration. The hanging wall includes polymict conglomerates and rhyolitic pumiceous breccias. The stratigraphic succession is attributed to the volcanic cycle of a felsic caldera complex. The pumiceous breccias in the hanging-wall record a climactic eruption that formed a caldera over 500 m deep and over 9 km in diameter in the Garpenberg area. The limestone horizon is interpreted as a stromatolitic carbonate platform, formed in a shallow, marine environment during a hiatus in volcanism.

The Garpenberg inlier has been interpreted as a NE-SW trending, tight to isoclinal complex syncline with a sub-vertical axial plane (Allen et al., 2003). The structure is compressed at the southern end and opens to the north. The ore-host limestone shows a complex geometry due to large scale folding, shearing and faulting. These structural features have resulted in complex synforms and antiforms, and have a major influence on the position, geometry and metal grades of the ore bodies. The largest ore bodies are linked to antiforms, such as Lappberget and Huvudmalmen.

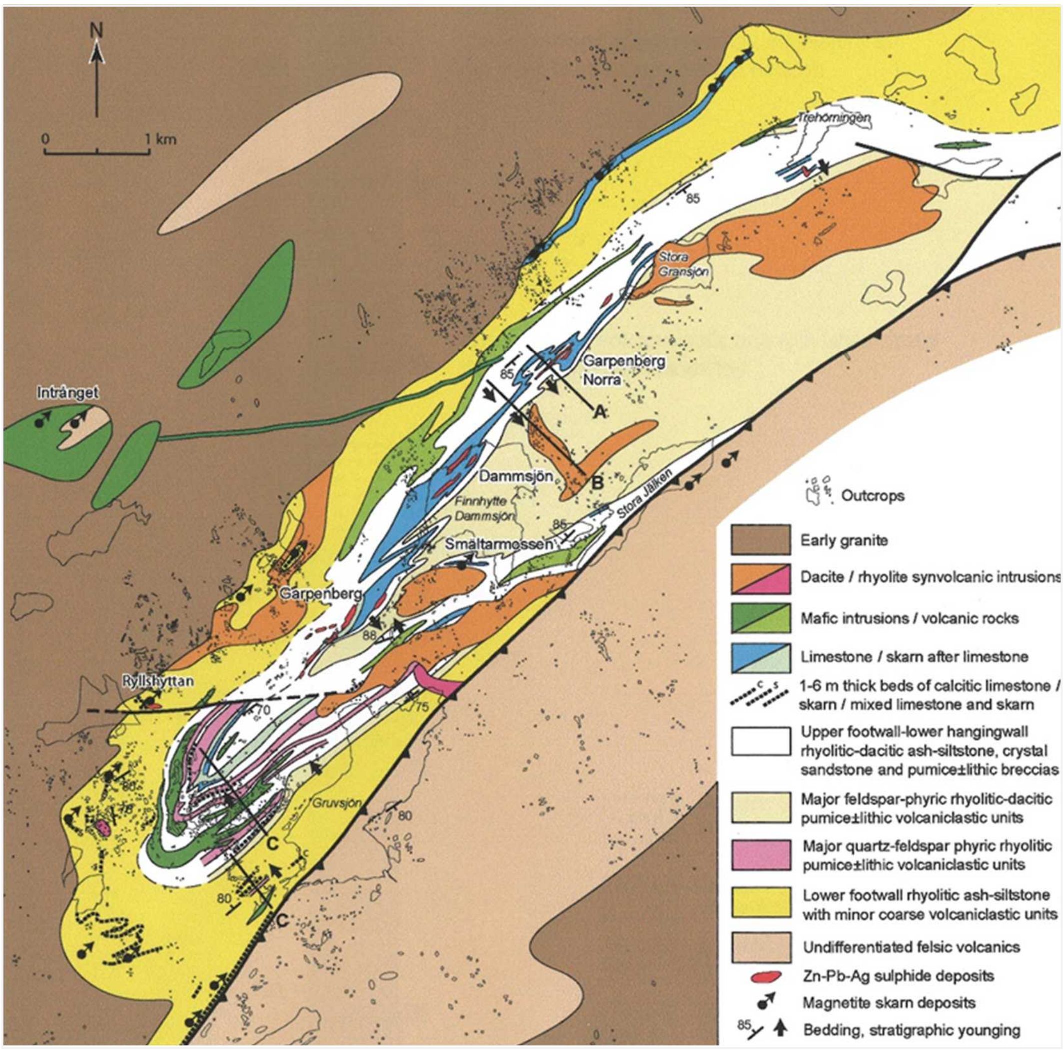

Figure 3-3. Geological map of Garpenberg. From Allen et al., 2003.

Mineralization in Garpenberg mainly consists of pyrite, sphalerite, galena and silver minerals. The ore bodies occur at the heavily skarn- and dolomite-altered contact zone between the limestone and underlying metavolcanic rocks, forming massive to semi-massive sulphides ore lenses. There is also significant mineralization in the footwall metavolcanic rocks (mica quartzites) that are stratigraphically underlying the marble horizon. The footwall mineralization is tectonically controlled and forms remobilized semi-compact thin veins that are often associated to mica-rich shear zones. Mineralization is mainly of replacement style and is likely to have taken place where metal-bearing fluids penetrated up along synvolcanic, extensional faults and came in contact with reactive limestone to form large, massive sulphide bodies. The initial main stage of mineralization and alteration at all the known Garpenberg ore bodies is interpreted to be essentially syn-volcanic in timing and to pre-date regional metamorphism and deformation (Jansson & Allen, 2011).

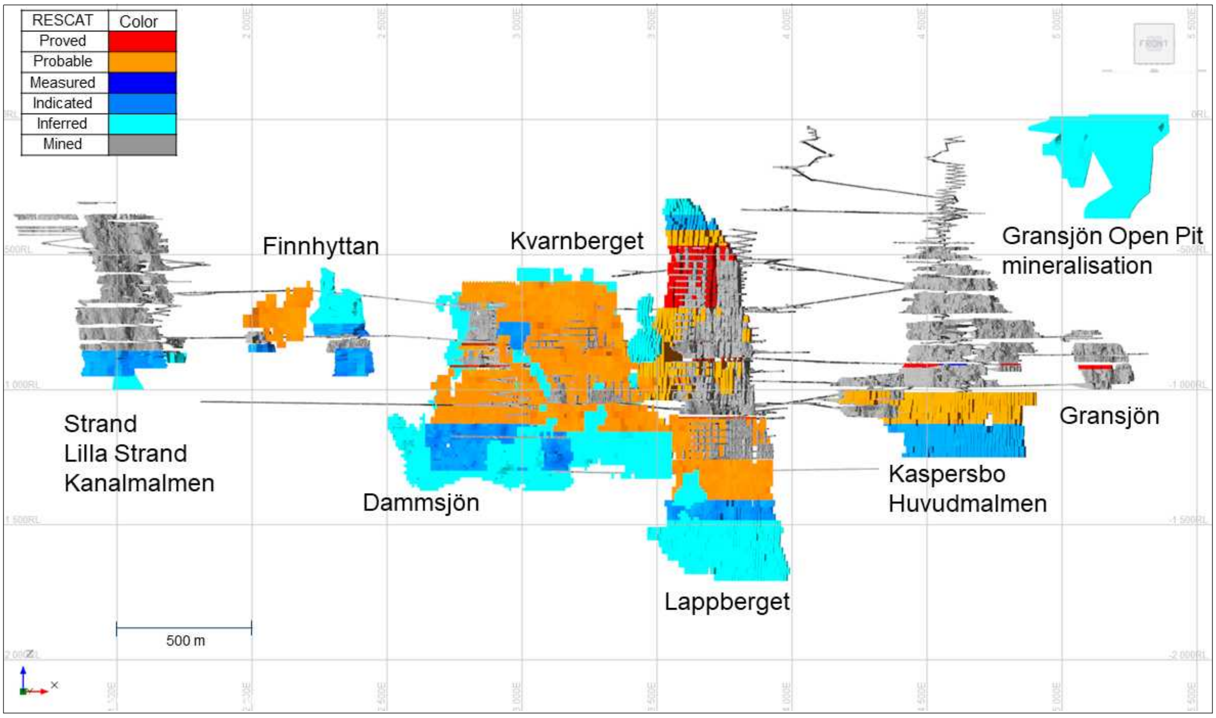

Figure 3-4. Front view of the Garpenberg ore bodies looking north in the local coordinate system. Colors according to resource category.

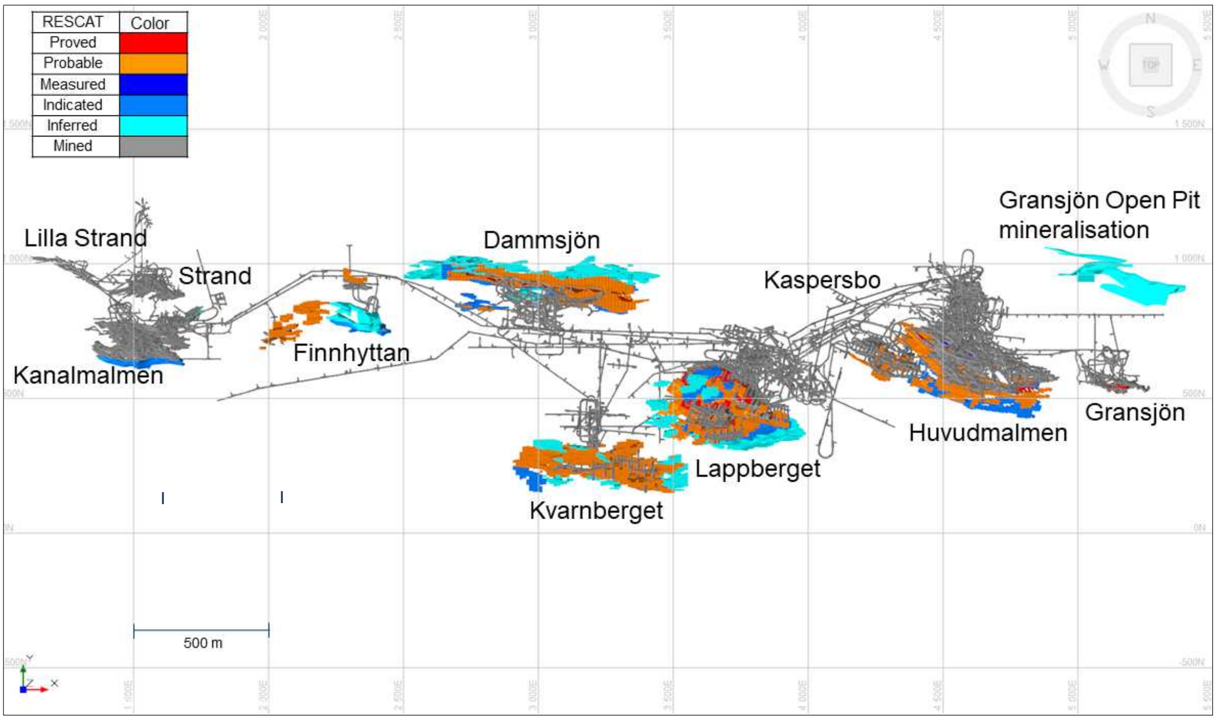

Figure 3-5. Top view of the Garpenberg ore bodies. Colors according to resource category.

3.8 Exploration procedures and data

3.8.1 Drilling techniques and downhole survey

Diamond drilling assay data is used for mineral resource estimation. Diamond drilling is performed by drilling contractor Drillcon and supervised by Boliden personnel. By default, drilling dimension in Garpenberg is B-size with a core diameter of 39 mm. The current practice is to measure all drillholes longer than 100 m for deviation with Reflex Maxibor2. Drill holes longer than 400 m are measured with IS Gyro.

3.8.2 Logging and sampling

The drill core is logged by Boliden geologists and sampled by Boliden technical personnel. Different levels of logging detail are applied depending on whether drill holes are exploration or infill drill holes. However, features that are always logged are: lithological units, fractures, level of schistosity and content of talc. For infill drill holes, the whole core is usually sampled, leaving no core left in the core boxes. Exploration drill holes are sawed in half along the drill core axis and one half is sent for analysis while the other half is stored in Boliden's core archive.

3.8.3 Density

Density data has been collected from bulk samples from each ore lens. This data has been used to produce individual density formulas for each ore lens based on metal content and host rock to the ore.

For example there are two different density formulas used for Lappberget. There is one formula for the ore lenses where the main host rocks are mica quartzites, and another the formula or ore hosted in dolomite and skarn.

- Mica quartzites: 2.7+0.004*Cu+0.004*Zn+0.02*Pb+0.0365*S
- Dolomite and skarn: 2.9+0.004*Cu+0.004*Zn+0.02*Pb+0.0365*S

The exhaustive list of the density formulas used in Garpenberg can be found in Boliden's internal document "Beskrivning av Blockmodeller i Garpenberg" (Höglund, 2020). Average bulk densities for the different ore bodies vary between 2.71 (Garpenberg south) and 3.15 (Gransjön).

3.8.4 Analysis and QAQC

Drill core analyses are carried out by ALS laboratories. Sample preparation is done in Piteå, Sweden and assays are carried out in ALS's hub-lab in Loughrea, Ireland. ALS laboratories are accredited according to ISO/IEC 17025. Umpire lab check assays are done by MS Analytical. An overview of the different analytical methods is presented in table Table 3-3.

Preparation of the samples, coded PREP-31B, comprises crushing the rock to 70% less than 2mm, riffle splitting off 1 kg and pulverizing the split to better than 85% passing 75 microns.

Au-ICP21 is a package of fire assay with an ICP-AES analysis. In ME-OG46, Aqua Regia is used to dissolve base metals and silver while assay is done with ICP-AES. IR08 is used for total sulphur analysis using a Leco Sulphur analyzer. ME-MS61 is a package of a 4-acid digestion process with an ICP-MS analysis. Specific gravity is measured either directly on drill core (OA-GRA08), or on pulps using a pycnometer (OA-GRA08b).

Table 3-3. Overview of ALS's designation of analytical methods. Over-range method applies to samples where assay result reached upper detection limit of primary method.

	Method	Over-range method
Preparation	PREP-31B	
Assay Au	Au-ICP21	Au-AA25/Au-GRA21
Assay Ag, Cu, Pb, Zn	ME-OG46	Ag - GRA21 Pb - AAORE Zn - ME-ICPORE
Assay S	IR08	
Assay other (48 elements)	ME-MS61	
Specific gravity (core)	OA-GRA08	
Specific gravity (pulp)	OA-GRA08b	

All samples are prepared and analyzed with Au-ICP21, ME-OG46 and IR08 while selected drillholes are analyzed with ME-MS61 and Specific Gravity as well. For the latter, analysis on pulp is the preferred method. Table 3-4 shows which elements are analyzed with lab codes ME-OG46 and ME-MS61.

Table 3-4. Elements analyzed with ME-OG46 and ME-MS61.

H																	He
Li	Be											B	C	N	O	F	Ne
Na	Mg											Al	Si	P	S	Cl	Ar
K	Ca	Sc	Ti	V	Cr	Mn	Fe	Co	Ni	**Cu**	**Zn**	Ga	Ge	As	Se	Br	Kr
Rb	Sr	Y	Zr	Nb	Mo	Tc	Ru	Rh	Pd	**Ag**	Cd	In	Sn	Sb	Te	I	Xe
Cs	Ba	La*	Hf	Ta	W	Re	Os	Ir	Pt	Au	Hg	Tl	**Pb**	Bi	Po	At	Rn
Fr	Ra	Ac¨	Ku	Ha													

*	La	Ce	Pr	Nd	Pm	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu
¨	Ac	Th	Pa	U	Np	Pu	Am	Cm	Bk	Cf	Es	Fm	Md	No	Lr

ME-OG46 ME-MS61

Quality assessment and quality control is continuously monitored using QAQC samples such as in-house standards, blanks and umpire lab checks (pulp duplicates). It is required that each sample batch is submitted with at least one blank sample and one standard sample. Batches with more than 16 samples also require a pulp duplicate sample. As the number of samples in a batch increases so does the required QAQC samples, for example a batch with 100 samples requires two blank samples, three standard samples and one pulp duplicate sample.

A review of all yearly QAQC samples utilized shows that the results fall within the predetermined acceptable limits. The results have been summarized in Boliden's internal QAQC report (Derrien, 2022).

3.9 Exploration activities and infill drilling

In 2021, a key objective at near mine exploration was to complete resource drilling from the Lappberget 1450 exploration drift with drill programme DP210005 (ca. 6266 metres drilled). This drilling, in conjunction with work performed in 2020 was conducted to delineate the Lappberget deposit below 1450 z and to facilitate a mineral resource estimate update between Lappberget 1407 and 1707 z (see chapter 3.14).

In addition to delineation drilling at Lappberget, follow-up exploration drilling was carried out in 2021 from the southern extent of the 1075 exploration drift targeting the "Station" mineralization located under the partially mined out Garpenberg South deposits. In 2021 five holes were drilled totaling 2324 meters (DP210003). These drillholes improved understanding of the mineralization and highlighted that significant drilling will be required there to delineate this mineralization which remains open along both strike directions and at depth.

Drifting at the 1300 exploration drift reached a point in 2021 whereby drill testing of the Huvudmalmen deposit at depth could be carried out. Two holes drilled in late 2021 (no assay results received at time of writing) indicate that the Huvudmalmen mineralization extends at depth to at least 1650 z on the western extent of the deposit. Further drifting will be prioritized to facilitate resource drilling from 1250 – 1650 z.

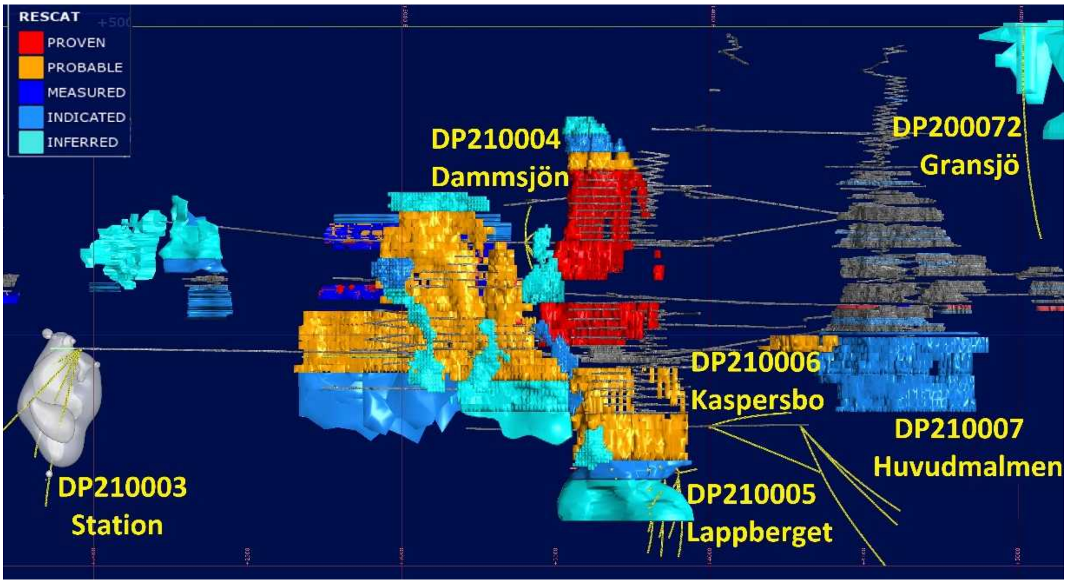

Figure 3-6.Drill programmes (yellow traces) carried out by near mine exploration in 2021 plotted over 2020 reserves and resources (front view looking north in mine grid).

Four holes were drilled to test the potential depth extent of the Kaspersbo mineralization. DP210007 targeted the area west of Huvudmalmen, collared from the 1300 exploration drift. A key objective was to determine whether the altered carbonates which host the Kaspersbo deposit extend to 1300z. Drilling in 2021 indicted that the altered carbonates do not appear to extend to 1300 z but broad intercepts of footwall style mineralization were intersected. No assay results have been received at time of writing, however exploration drilling of this area will continue into 2022.

Higher up within the mine, DP210004 is underway to test the eastern strike extent of the Dammsjön mineralization from the 700 level connection drift. 1531 metres were drilled in 2021 and the results show that Dammsjön mineralization continues west of the existing resource, however grades and intercepts are lower than what may be considered typical for the Dammsjön deposit. From surface, GARPN 4162 was the only hole drilled in DP2000072. The objective of this hole was to follow up prospective intercepts from surface drilling in 2020. This hole, ca. 150m north of drilling carried out in 2020 failed to intersect prospective mineralization and no further work is planned this far north from the surface.

Infill drilling conducted by the mine department in 2021 focused on Lappberget, Dammsjön and Huvudmalmen. In Lappberget, an infill program in the upper part above 410 z was completed (ca. 2245 m drilled), following up resource drilling from the exploration department. A smaller program was also completed around 1040z (ca. 1490 drilled) to better delineate the lenses situated on the southern side of the ore body outside of the main mineralization. Finally, a large drilling program was initiated from the 1432 exploration drift in order to target the area between 1400-1650z, following the exploration drilling that was finalized in 2021. 6510m were drilled in 2021, this program will continue in 2022 and 2023. In Huvudmalmen, drilling below 1100 z was resumed in 2021, and will continue in the coming years. In Dammsjön, ca. 4100m were drilled from level 843z, targeting the low-grade footwall mineralization. This low-grade mineralization area is quite poorly defined, because historically it has not been considered of interest. More drilling from other levels targeting that area is planned to better delineate the extents of the mineralized zone in the footwall.

3.10 Mining methods, processing and infrastructure

Almost 90% of the mined ore in Garpenberg is extracted by sublevel stoping (also called longhole stoping), where the ore is mined in layers between two drifts vertically 25 m apart. Most areas are mined with transversal longhole stoping, where the development and stope axis are perpendicular to the strike of the orebody. In some more narrow areas, longitudinal longhole stoping is used. The orientation of this method is along or parallel to the strike of the orebody. The ore body is split into primary and secondary stopes, which are mined in a predefined order and pyramid shape sequence. The standard stope dimensions are 24 - 25m high, 10 m wide for primary stopes and 15 m wide for secondary stopes. In general, the ore bodies are divided in mining blocks with 6 levels of stopes in each block.

The last level of each mining block is the sill pillar, which separates the different mining blocks. This division allows the mine to have several production areas being scheduled and mined at the same time.

Another consideration that was recently introduced concerning the mine design of Lappberget is the division into a main and a second pass sequence (2pass). The main sequence contains more of the high-grade areas and is scheduled prior to the second pass sequence, which in general contains lower grade ore (Figure 3-7).

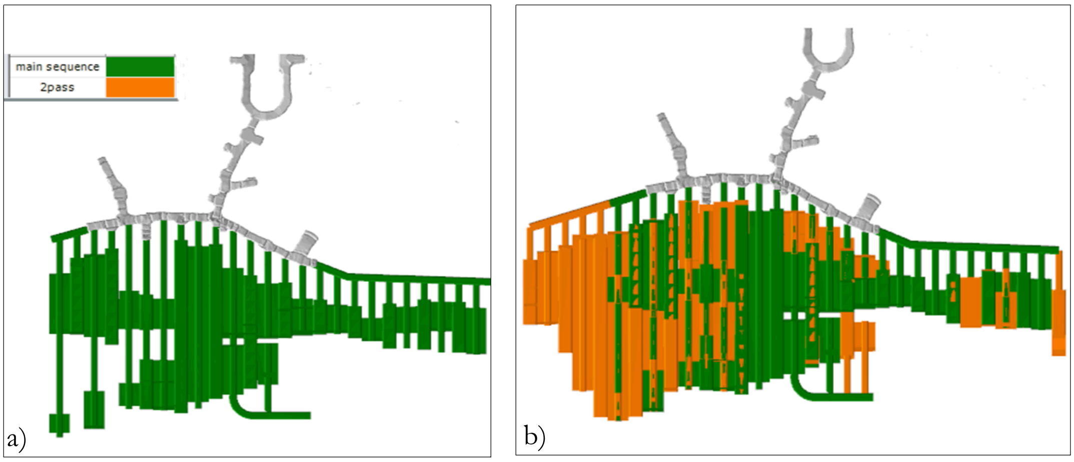

Figure 3-7. Example of mine design in Lappberget
a) High grades layout – main sequence; b) Main sequence (high grades) and 2pass (low grades).

Other mining methods include cut and fill and avoca (rill) (Table 3-5). With the cut and fill method mining is carried out in slices along the steeply dipping, narrow ore body. The bottom slice is mined first. The excavated area is then backfilled, so mining can continue with the slice above. The rill method used in Garpenberg is in fact similar to longitudinal stopping, but the stopes are split in 20 m long slices. After being blasted and mucked, the stopes are backfilled before the next slice is blasted. This process repeats until the full size of the stope is done.

Table 3-5. Mining method for Garpenberg ore bodies.

Mining method	Ore body	Min width (m)
Sublevel stoping	Lapp, Kvarn, Kasp, Damm, Huvudmalmen	10 alt 15
Cut and fill	Damm	7
Avoca (rill)	Damm	7

Mine reconciliation is the comparison of the planned stopes against the actual outcome.

Table 3-6 shows the reconciliation for the large-scale mining methods in 2019 and 2020.

Table 3-6. Reconciliation for sublevel stoping and rill in 2019.

Year	Stopes	Plan compliance	Average OverBreak	Sidewalls Dilution (m)
2019	Primary	87,71%	17,14	0,40
	RILL	88,36%	14,10	0,48
	Secondary	82,39%	17,41	0,55
	Total average	**86,35%**	**17,17**	**0,48**
2020	**Primary**	**93 %**	**12 %**	**-**
	Secondary	**94 %**	**11 %**	**-**
	Total	**94 %**	**12 %**	**0,52**

The expansion project to 2.5 Mt which was completed in 2014 increased the capacity of the mine with the construction of new crushers, shafts, ore hoists, etc. Today there are two underground crushing plants at 700 z and 1087 z. Transport to the crushers is done by trucks from the active mining areas. The crushed ore is hoisted to surface in a shaft, unloaded into a bin in the headframe and then transported by conveyor belts to an intermediate ore storage, which can hold approximately a week of production.

In the concentrator, the ore is ground in two stages with autogenous grinding in the primary stage and pebble mill grinding in the second. After grinding, the ore is screened, with the coarse fraction being returned to the primary mill and the fine fraction undergoing gravimetric separation (Knelson) in order to separate coarse gold out at an early stage of the process. Knelson concentrate is collected in big bags. After gravity separation, material is classified using hydrocyclones. The overflow constitutes the main flotation feed, while the underflow undergoes flash flotation in the grinding circuit, from which the concentrate is sent directly to CuPb separation in the flotation plant and the tailings back to the mills.

Flotation is carried out in a three-stage process flotation circuits: CuPb flotation, CuPb separation and Zn flotation. Regrind mills are installed both in the CuPb and Zn circuits. The mineral concentrates are dewatered using thickeners and pressure filters. Three mineral concentrates are produced in flotation: zinc, lead and copper concentrates. The precious metals report primarily to the copper and lead products. Of the flotation tailings, approximately 1/3 is utilized in the paste plant for producing backfill material for the mine and 2/3 is deposited at the tailings management facility.

The zinc and lead concentrates are transported by truck to Gävle port and from there by ship to Boliden's smelters in Finland, Sweden and Norway. The copper and Knelson concentrates are trucked, the copper concentrate later being reloaded to rail, for onward transport to the Boliden Rönnskär smelter in Skelleftehamn.

3.11 Prices, terms and costs

Mineral Resources and Mineral Reserves are the basis for the company's long-term planning and will be mined for many years to come. Planning prices, which are an expression of the anticipated future average prices for metals and currencies, are therefore primarily utilized in the estimations. The planning prices are used to calculate the NSR (Net Smelter Return), expressed in SEK/t, in the geological block models. Boliden currently uses the prices shown in Table 3-7 below.

Table 3-7.Long term planning prices currently used in Boliden.

Commodity / Currency	Planning prices 2021
Copper	USD 6 800/tonne
Zinc	USD 2 400/tonne
Lead	USD 2 100/tonne
Gold	USD 1 300/tr.oz
Silver	USD 17/tr.oz
USD/SEK	8.00
EUR/SEK	9.35
EUR/USD	1.17

The direct costs for mining and processing a tonne of ore are defined as the variable costs. Variable costs include for example consumables, transportation costs and mine sustaining investments. The variable costs are summarized to around 270 SEK/t.

The site operational costs include not only the variable costs, as defined above, but also fixed costs, such as personnel costs and facility maintenance, and costs for future strategic mine development. Depreciations and capital investments are not included in the site operational costs. The site operational costs are around 530 SEK/t.

The variable and site operational cut-offs respectively are based on the cost levels explained above. A table of the costs distributions and the cut-offs are summarized in Table 3-8.

Table 3-8.The different cut-offs considered for Garpenberg.

Costs distribution	Total											Cut-off value (SEK/t)
	Operational											
	Mine - fixed costs (F)	Mine - variable costs (V)	Mill plant - F	Mill plant - V	Structure services - F	Structure services - V	Reclamation fund	Investment (sustaining)	Investment (capital)	Costs for development	Depreciation	
Variable costs		X		X		X		X				**270 SEK/t**
Site operational costs	X	X	X	X	X	X	X	X		X		**530 SEK/t**

3.12 Mineral resources

In Garpenberg, mineralization is interpreted in Leapfrog Geo guided by grades, NSR-values (Net Smelter Return) and geological assumptions. The interpretation process results in 3D mineralization solids which are used as domains in resource estimation. Two different resource estimation methods are used in block models. Ordinary Kriging is usually used in areas where there is sufficient drillhole data and Inverse Distance is usually used in areas with less available data. Resource estimation is conducted in Datamine or Leapfrog Edge. Though, there are still some older mineralization models and block models in use that were created in Propack (add-on to the CAD program MicroStation). Table 3-9 shows estimation methods and software used for each of the ore bodies in Garpenberg and Table 3-10 shows block sizes for each model. The block sizes are selected from spacing in supporting data in combination with complexity in ore geometry and scale of mining.

Table 3-9 Garpenberg block models and estimation methods

Block model	Ore body code	Name	Method	Software
BLGAR		Garpenberg south *	Inv Dist	Datamine
BLTYS	FI1-6, TY1-3, KY1-2	Finnhyttan, Kyrkan-Tyskgården	Inv Dist	Datamine
BLDAM	DAM	Dammsjön	Kriging	Leapfrog Edge
BLKVB	KVA, KVB, KVC, KVD	Kvarnberget	Kriging	Datamine
BLLBP	LA, LB, LC	Lappberget	Kriging	Datamine
BLNOR	D, E, F, G	Huvudmalmen 881-918 Z	Inv Dist	Propack
BLNOR	HU1-HU6	Huvudmalmen 990-1250 Z	Kriging	Datamine
BLNOR	KA	Kaspersbo	Kriging	Propack
BLGRN	AAA, BBB, CCC, DDD	Gransjön Open Pit	Inv Dist	Propack

* Including Kanal, Strand and older parts of Finnhyttan and Kyrkan-Tyskgården

Table 3-10. Block sizes and subdivision for Garpenberg block models.

Model	Xsize	Ysize	Zsize	Subdivision
BLDAM	4	6	6	2
BLGAR	3	10	5	2
BLGRN	5	10	10	2
BLKVB	4	6	12.5	1
BLLPB	6	10	6	1
BLNOR	10	20	6	2

In the end of the resource estimation process, mineral resource classification takes place using several criteria. Quality of informing data is first validated where new data generally is deemed of a higher quality than historical data. Considering Garpenberg geology, grade continuity and statistical analyses, a drill pattern of 100 x 100 m is used as a guideline for inferred, 50 x 50 m for indicated and 25 x 25 m for measured resource. However, Tyskgården-Finnhyttan is an exception since complex geological conditions demand a denser drilling grid. The final classification depends on drill pattern in combination with below listed criteria and the process is conducted for every estimation where characteristics of the individual mineralized lenses are taken into consideration.

- Geological complexity
- Quality and quantity of informing data
    - Confidence in analytical results
    - Confidence in borehole surveying
    - Analytical data
    - Results of geostatistical analysis, variography, and QKNA
- Metallurgical factors or assumptions
- Confidence in the block estimates

Processing tests are systematically conducted on ore from new mineral resources to confirm that the ore is technically extractable and economically mineable. Valid processing tests are required for classifying mineralization to indicated or measured categories. In 2021 tests were carried out on ore from Lappberget 300-400Z as well as additional test on ore from Finnhyttan.

Traditionally the mineral resources were calculated directly from mineralization wireframes. However, in resource estimations finished in 2020 or later a Reasonable Prospect of Eventual Economic Extraction (RPEEE) has been created in Deswik Stope Optimizer employing a cut off as well as existing geological interpretation and block model (more information on the Deswik Stope Optimizer in chapter 3.13). The latter case stands for more realistic mineable tonnage and grades, which signifies less adjustments when eventually converting mineral resources into mineral reserves. All reserve and resource tonnes and grades are interrogated from the seven active block models in Garpenberg listed in Table 3-9 and reported according to the PERC standard (See Figure 2-1).

3.13 Mineral reserves

When converting mineral resources to mineral reserves, a number of parameters have to be considered, the most important ones being economic feasibility and rock mechanics. The rock mechanic conditions determine the amount and size of pillars and sill pillars as well as the length and width of mined stopes. Weak or unstable rock volumes might be discarded completely from the mineral reserves. The volume and geometry of the mineralization will likely determine which mining method to apply. The choice of mining method should also optimize the NPV (net present value) of the ore volume.

With the sublevel stoping method, the mineral reserves are defined by designed stopes whereas the corresponding mineral resources are defined either by designed stopes or by the mineralized envelope above cut-off. Since designed rooms mostly are formed as cubes with 90 degree corners and the mineralized envelope is irregular some of the ore at the edge of the mineralization might get left out when converting resources to reserves. Likewise, some waste rock might be included at the edges of the mineralization.

Boliden Garpenberg utilizes the mine planning tool Deswik Stope Optimizer (SO) for designing of stopes. SO automates the design process and allows for a number of stope properties including general shape and orientation, cut-off grade, dilution and pillar size. Table 3-11 summarizes the criteria used by SO in different areas in Garpenberg.

Table 3-11. Design properties used by SO to generate stopes in different ore bodies in Garpenberg.

SO criteria	Allow up	min	max
Waste material	20%		
Dilution	25%		
Stope length Lappberget/ Huvudmalmen/Dammsjön	-	7 m	80 m
Stope length Kvarnberget/ Södra malm	-	7 m	40 m
Stope height	-	24-25 m	40 m

The cut-off grade used is based on the cost distribution presented in chapter 3.11. Each stope needs the NSR to be higher than the variable costs, and the average NSR for each time period needs to be higher than the site operational costs. Moreover, the cut-off is adjusted for each ore body and mining method.

For Lappberget the separation into a main and a second pass sequence, as mentioned in chapter 3.10, is done based on different cut-offs for different mining etages. The cut-off is chosen in such a way that both mining sequences are mineable and a favorable NPV is achieved. The different cut-off used for design with SO are presented in Table 3-12.

Table 3-12. Different cut-off values used for design of the stopes with SO in the different areas in Garpenberg.

Orebody	Mining block	Cut-off (SEK/t)	Cut-off for main sequence (SEK/t)
Lappberget	E1100	300	-
	E530/E700/880/1250/1400/1550	270	730
Kvarnberget	all	300	-
Kaspersbo	all	300	-
Dammsjön	all	520	-
Huvudmalmen	all	520	-
Finnhyttan	all	270	-

Table 3-13 shows the Mineral Resources and Mineral Reserves Garpenberg Area as per 2021-12-31.

Table 3-13. Mineral Resources and Mineral Reserves in Garpenberg 2021-12-31

	2021						2020					
	kton	**Au**	**Ag**	**Cu**	**Zn**	**Pb**	kton	Au	Ag	Cu	Zn	Pb
Classification		**(g/t)**	**(g/t)**	**(%)**	**(%)**	**(%)**		(g/t)	(g/t)	(%)	(%)	(%)
Mineral Reserves												
Proved	**7 700**	**0.18**	**135**	**0.03**	**3.3**	**1.2**	23 500	0.23	97	0.03	3.1	1.2
Probable	**86 000**	**0.32**	**90**	**0.05**	**2.8**	**1.3**	66 000	0.35	93	0.05	2.7	1.3
Total	*93 700*	0.31	93	0.04	2.8	1.3	*89 500*	0.32	94	0.04	2.8	1.3
Mineral Resources												
Measured	**100**	**0.24**	**108**	**0.03**	**2.8**	**1.0**	3 900	0.33	94	0.06	3.4	1.7
Indicated	**30 500**	**0.40**	**83**	**0.06**	**2.6**	**1.3**	32 600	0.35	89	0.05	2.7	1.3
Total M&I	*30 600*	0.40	83	0.06	2.6	1.3	*36 600*	0.35	90	0.06	2.8	1.4
Inferred	**48 400**	**0.35**	**50**	**0.06**	**2.3**	**1.1**	25 500	0.42	57	0.07	2.5	1.4

3.14 Comparison with previous year

In 2021 mineral reserves increased by 4.2 Mt to 93.7 Mt. Measured and indicated resources decreased by 5.65 Mt to 30.9 Mt mostly because of an upgrade from resources to reserves. Inferred resource increased by 24.1 Mt to 49.6 Mt. Table 3-14 shows the changes in detail, including changes in metal grades.

Several positions were downgraded from proved to probable mineral reserves because the permit for Ryllshyttan TMF is valid until 2028, which causes some level of uncertainty for the ore that is planned to be mined after 2028. The levels where less than 60% of the ore is planned to be mined before 2028 were downgraded. This was the case for positions LPB 698-822, LPB 840-1038 and DAMM 690-877.

In Finnhyttan, two areas (Finnhyttan 595-845z and Kyrkan 589-779.5z) previously classified as resource were included in the mineral reserve (Figure 3-8). The completion of processing tests on the Finnhyttan ore lenses allowed to include position Finnhyttan 595-845z in the reserve, adding 1.9 Mt with average metal grades of 0.09 g/t Au, 40 ppm Ag, 3.57% Zn and 1.31% Pb. The other position that was upgraded to probable reserve is Kyrkan 589-779.5z, located in the direct continuation of previously mined areas. The lack of processing tests on the Tyskgården ore lenses did not allow to upgrade them to reserve, and therefore they are still classified as mineral resource. A technical and economical assessment was completed for the new reserve positions in Finnhyttan (Derrien, 2021).

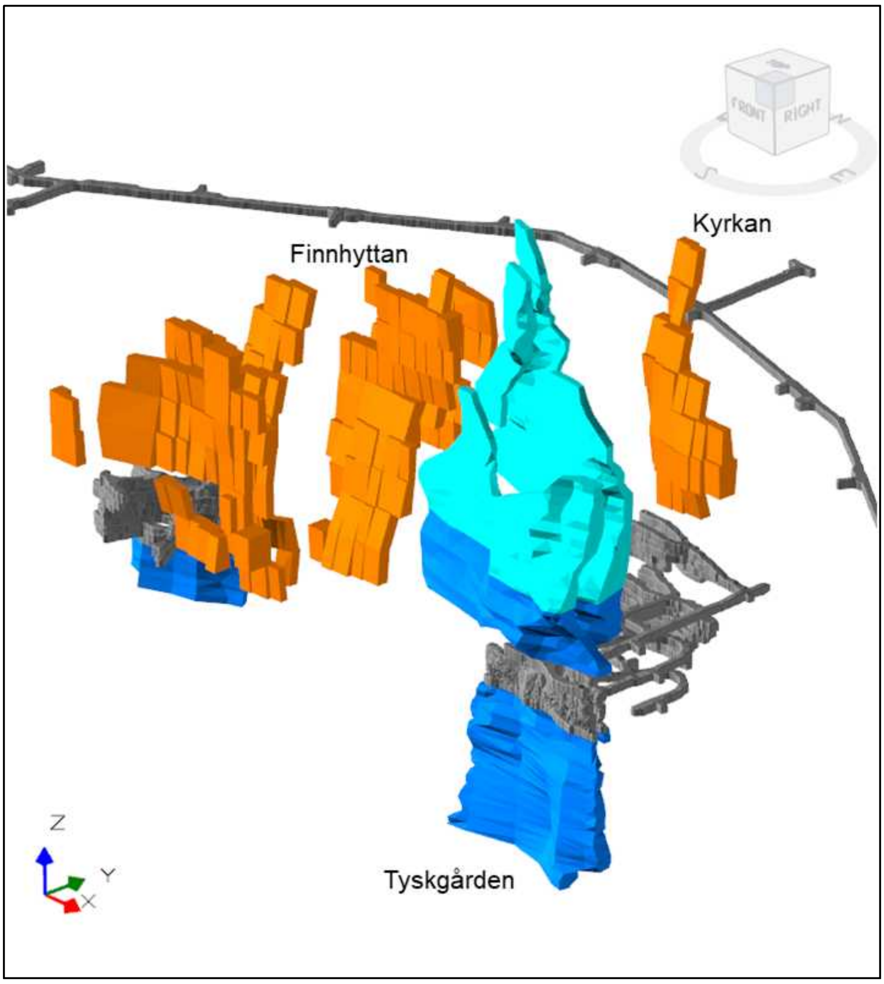

Figure 3-8. Oblique view of Finnhyttan area showing the different areas, including the new reserve positions in Finnhyttan and Kyrkan.

In Dammsjön, a new block model was completed in 2021, but the calculations for the reserve are based on the previous resource calculations because the new design was not implemented in the Life of Mine Plan (LOMP). However, the mining method for Dammsjön was changed from cut and fill to longhole stoping, so some changes were made in the reserve for positions DAMM 595-704z and DAMM 690-877z. The new design includes ore that was previously classified as indicated and measured resource, in particular the ore enveloping the old cut and fill area as well as the uppermost area in Dammsjön (Figure 3-9). Some of the ore from position DAMM 925-1125z located in the low-grade mineralization was downgraded from probable reserve to inferred resource because that area needs additional drilling. The total tonnage of the reserves in Dammsjön increased by 0.6 Mt.

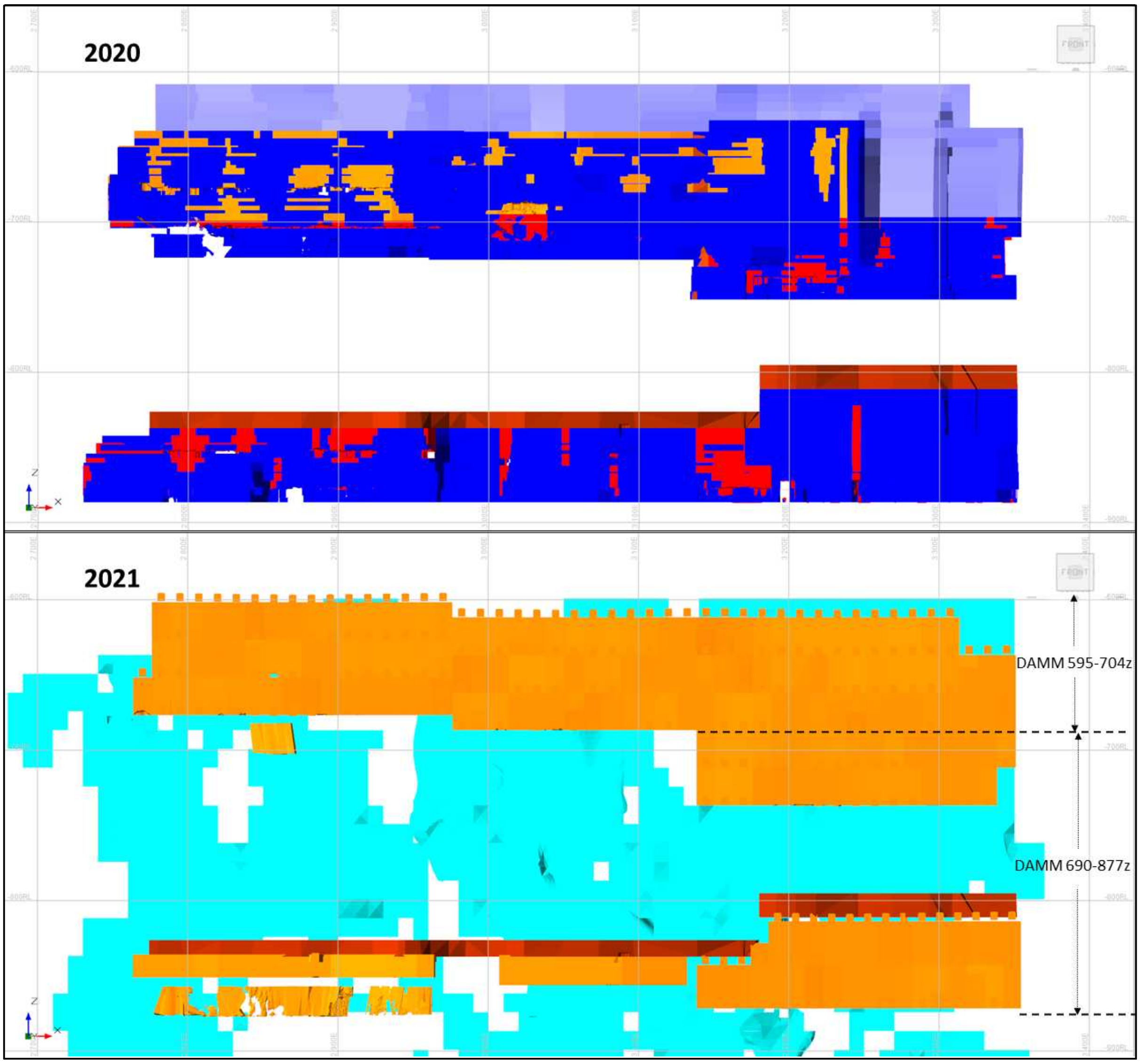

Figure 3-9. Changes in reserves and resources in Dammsjön between approximately -600z and -900z. The image is a front view of Dammsjön ore body, looking north.

In Lappberget, relatively few changes were made in the reserves in comparison with 2020. The main difference concerns the area located between -840z and -891z, which was previously not included in the reserve because of the presence of the old cut-and-fill area in the vicinity. An assessment regarding the rock mechanics near the mined-out area was conducted and it is considered safe for production. Another change that was made is that the indicated resource located between -952z and -1254z was included in the reserves.

In Kvarnberget, some updates and adjustments in the design were made. The main adjustment consisted in including some of the ore in the KVC lens in the design. This update resulted in an increase of 2.2 Mt in the mineral reserves in Kvarnberget.

The block model update in Dammsjön was based on new drilling completed by both exploration and the mine departments, as well as re-assaying of historical drillholes and new geological interpretation that included more low-grade mineralization than previously. This new block model allowed to define three new inferred resource positions with a combined tonnage of 18.5 Mt (Figure 3-10).

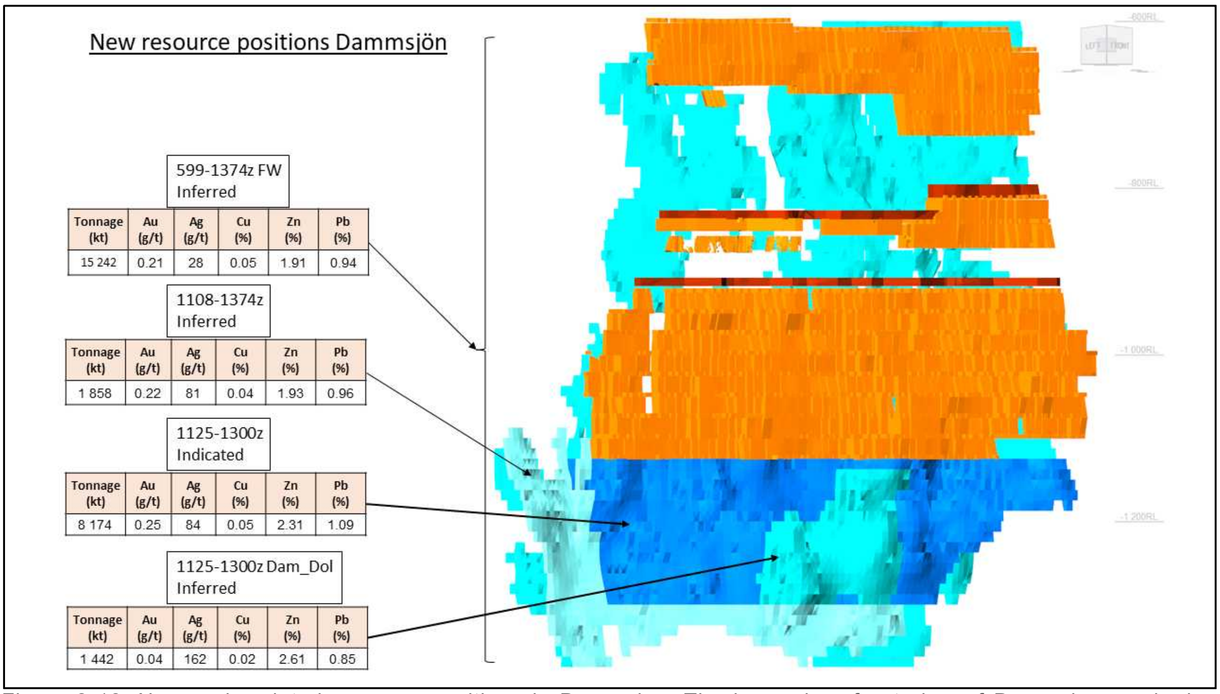

Figure 3-10. New and updated resource positions in Dammsjön. The image is a front view of Dammsjön ore body, looking north.

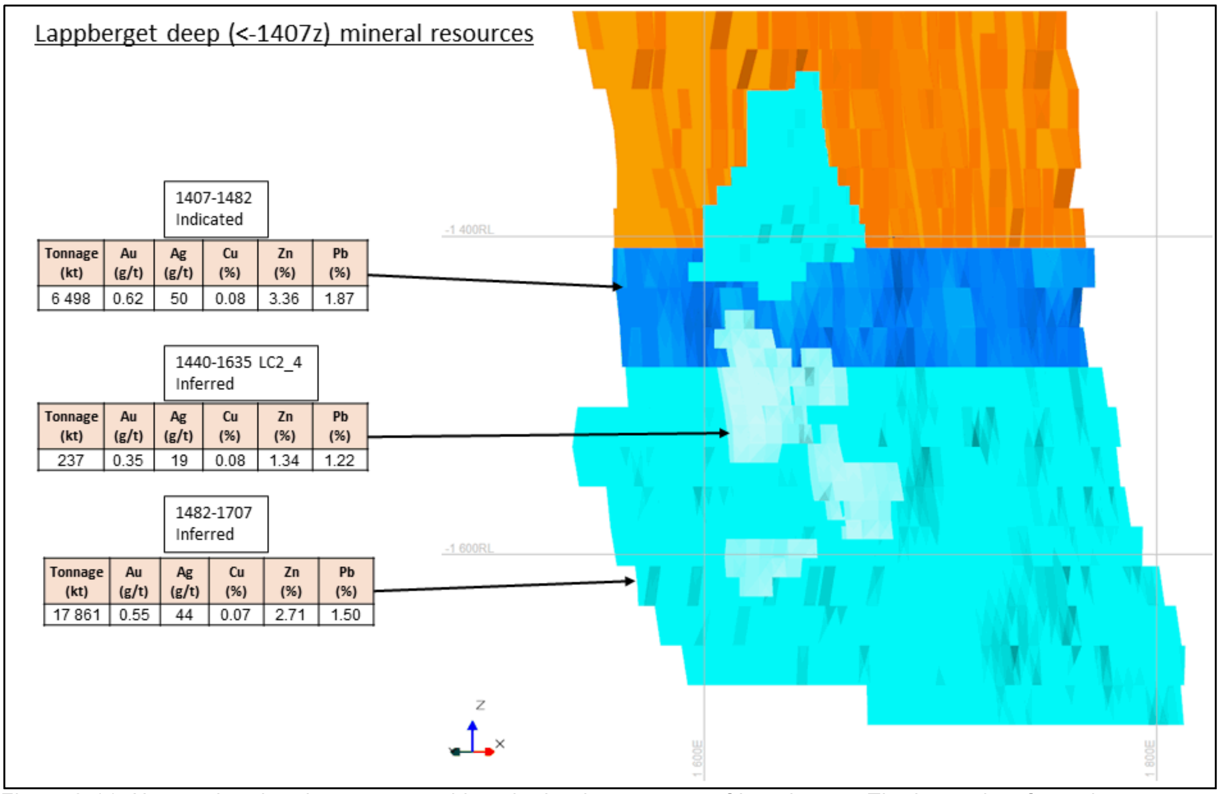

Figure 3-11. New and updated resource positions in the deeper parts of Lappberget. The image is a front view of Lappberget ore body below -1250z, looking north.

Exploration drilling was completed in the lower parts of Lappberget below -1440z. The resource update that followed this drilling resulted in an increase of 0.9 Mt of indicated resource and 8.1 Mt of inferred resource between -1407z and -1707z (Figure 3-11).

Mined out tonnage in 2021 totals 3 052 kton, which is an increase of 51 kton from previous year. Metal grades of the mined-out tonnage is as follows: 3.8% Zn, 1.5% Pb and 119 ppm Ag. Almost 80% of all mined out ore derives from Lappberget.

Table 3-14. Mineral Resources and Mineral Reserves in Garpenberg as per December 31, 2021. Numbers in brackets show changes from last year.

Classification	kton 2021-12-31		Au (g/t)		Ag (g/t)		Cu (%)		Zn (%)		Pb (%)	
Proved Mineral Reserve	7 750	(-15 735)	0.18	(-0.05)	135	(+38)	0.03	(-0.01)	3.3	(+0.1)	1.2	(-0.1)
Probable Mineral Reserve	85 980	(+19 943)	0.32	(-0.03)	90	(-4)	0.05	(-)	2.8	(-)	1.3	(-)
Total Mineral Reserve	*93 730*	*(+4 208)*	*0.31*	*(-0.01)*	93	*(-1)*	*0.04*	*(-)*	*2.8*	*(-)*	*1.3*	*(-)*
Measured Mineral Resource	68	(-3 844)	0.24	(-0.01)	108	(+14)	0.03	(-0.03)	2.8	(-0.6)	1.0	(-0.6)
Indicated Mineral Resource	30 526	(-2 122)	0.40	(+0.05)	83	(-6)	0.06	(-)	2.6	(-0.1)	1.3	(-)
Sum Measured and Indicated	*30 594*	*(-5 967)*	*0.40*	*(+0.05)*	*83*	*(-6)*	*0.06*	*(-)*	*2.6*	*(-0.2)*	*1.3*	*(-)*
Inferred Mineral Resource	48 437	(+22 972)	0.35	(-0.07)	50	(-7)	0.06	(-0.01)	2.3	(-0.2)	1.1	(-0.3)
Total Mineral Resource	*79 031*	*(+17 005)*	*0.37*	*(-0.01)*	*63*	*(-13)*	*0.06*	*(-)*	*2.4*	*(-0.3)*	*1.2*	*(-0.2)*

3.15 Reconciliation

In order to confirm the precision of the geological interpretation, modelling, grade interpolation etc. actual mining volumes times block model grades are checked against the measured results from the processing plant. This procedure called reconciliation is carried out every month and presented quarterly. Monthly estimates vary dramatically depending on the mine's logistics of stocks in the mine and on surface. The turnover of the stocks also varies a lot.

The grades of the mined-out ore are calculated from the block model using the tonnage reported as loaded from the stopes and surveyed tonnage from cut and fill and development ore. The ore can either be transported directly to the plant or put in stockpiles underground. Above ground, there is an ore storage facility which at the beginning of 2021 contained 33 Kton of ore. During the year the tonnage fluctuated between 22 kton and 60 kton. At the end of the year the storage contained 30 kton of ore.

For the annual report of reserves and resources, the reconciliation is compiled from a weighted aggregation of the four quarters (rolling 4 quarters). Table 3-15 shows monthly and quarterly results for 2021 from the mine and the processing plant. The year total is shown on the bottom row. The official grades for Garpenberg are those of the processing plant. The total tonnage reported derives from production reports and differs slightly from the processed tonnage and from tonnage calculated from the block model in Table 3-15.

Table 3-15. Comparing measured results from the processing plant with calculated results from the block model. Note that the numbers from the processing plant for December are preliminary.

	Metal grades of processed ore						Metal grades of mined ore from block model					
Kvartal	kton	Au g/t	Ag g/t	Cu %	Zn %	Pb %	PP kton	Au g/t	Ag g/t	Cu %	Zn %	Pb %
januari	278.2	0.27	122	0.06	3.56	1.32	289.2	0.30	117	0.04	3.19	1.30
februari	250.2	0.35	122	0.07	3.98	1.56	248.2	0.33	122	0.05	3.81	1.43
mars	288.6	0.34	116	0.09	3.78	1.63	290.1	0.40	112	0.10	4.10	1.80
2021 Q 1	**817.1**	**0.32**	**120**	**0.07**	**3.76**	**1.50**	**827.6**	**0.34**	**117**	**0.07**	**3.70**	**1.51**
april	273.8	0.36	105	0.07	4.79	1.84	263.8	0.36	99	0.06	5.07	2.00
maj	244.8	0.27	107	0.05	4.00	1.54	263.0	0.30	107	0.05	3.84	1.58
juni	272.7	0.33	157	0.06	2.79	1.44	248.8	0.33	211	0.04	2.63	1.38
2021 Q 2	**791.3**	**0.32**	**123**	**0.06**	**3.85**	**1.61**	**775.6**	**0.33**	**138**	**0.05**	**3.87**	**1.66**
2021 Q 1+2	**1608.4**	**0.32**	**122**	**0.07**	**3.81**	**1.56**	**1603.2**	**0.34**	**127**	**0.06**	**3.78**	**1.58**
juli	171.7	0.26	155	0.05	2.84	1.13	177.4	0.26	139	0.04	3.09	1.30
augusti	260.0	0.26	125	0.05	4.21	1.58	271.5	0.38	128	0.04	4.69	1.89
september	260.1	0.30	121	0.06	4.19	1.72	254.9	0.32	110	0.04	4.08	1.60
2021 Q 3	**691.8**	**0.28**	**131**	**0.05**	**3.86**	**1.52**	**703.8**	**0.33**	**124**	**0.04**	**4.07**	**1.63**
2021 Q 1-3	**2300.1**	**0.31**	**124**	**0.06**	**3.82**	**1.55**	**2306.9**	**0.34**	**126**	**0.05**	**3.87**	**1.60**
oktober	286.1	0.25	104	0.05	3.58	1.41	267.6	0.24	106	0.03	3.58	1.34
november	186.4	0.30	105	0.06	3.49	1.32	225.3	0.37	96	0.05	3.66	1.44
december	283.5	0.29	98	0.06	4.00	1.51	252.7	0.47	118	0.07	3.35	1.48
2021 Q 4	**756.0**	**0.28**	**102**	**0.06**	**3.72**	**1.43**	**745.5**	**0.36**	**107**	**0.05**	**3.53**	**1.42**
2021 Q 1-4	**3056.1**	**0.30**	**119**	**0.06**	**3.80**	**1.52**	**3052.5**	**0.34**	**121**	**0.05**	**3.78**	**1.55**

The rolling 4-quarter graph for zinc, lead and silver is shown below in Figure 3-12. The graph shows the difference in % in weighted metal grades between processed ore and mined ore and is calculated with the following equation: (Metal Grade Processing Plant/Metal Grade Block Model)-1. Thus, a positive number means that the grade is higher in the processing plant than in the block model. The values for Q 1-4 2021 seen at the rightmost side of the graph are: +0.5% Zn, -2.3% Pb and -2.3% Ag.

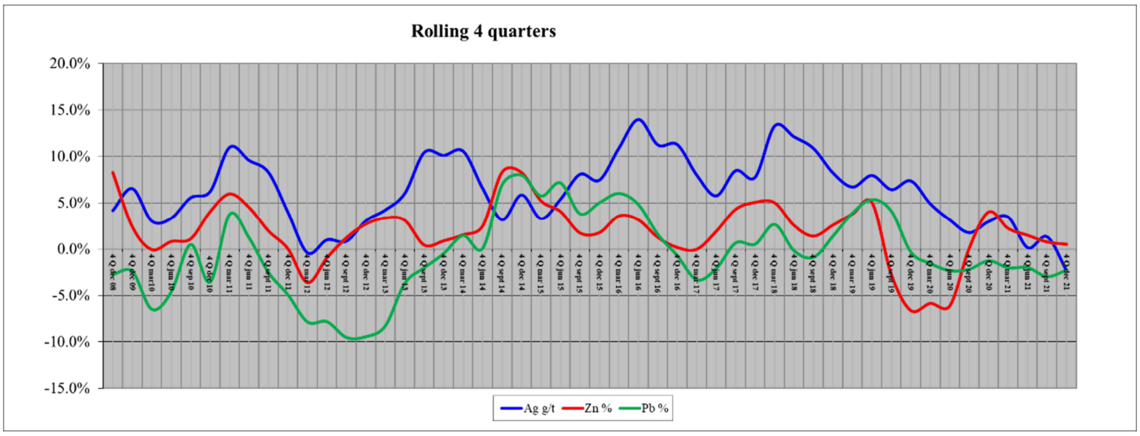

Figure 3-12. Metal grades in processed ore vs metal grades of the mined ore based on the block model, over a ten-year period.

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APPENDIX 1

A historical overview

~1200	Mining operation commences
1544	Gustav Wasa takes over the mining operation
1840	Discontinuation of mining operation
1906	Mining operation resumed
1908	The first concentrator was built
1923	AB Zinkgruvor, Falun takes over the activity from AB Garpenbergs Odalfält
1928	A new concentrator was built
1950-53	New shaft, head frame and a new concentrator were built
1957	Boliden – new owner
1972	The Garpenberg Norra mine in operation
1989	Increased capacity in the concentrator
1994	Shaft extension to 800 m level in Garpenberg Norra
1996	New hoisting shaft, the Gruvsjö shaft, in the Garpenberg mine
1997	A 1000 m long drill hole was sunk towards the south from the ramp in Garpenberg Norra whereupon Kaspersbo and Lappberget were indicated
2000	Connection drift, development starts
2003	Lappberget diamond core drilling to 800 and 1000 meter level
2003	Lappberget in operation. Kvarnberget was indicated in a drill hole drilled from Lappberget. The connection drift between the two mines was completed – one mine.
2007	Paste plant was built and the mining method sublevel stoping commenced
2008	Pre-project study for extension to 2 Mt
2009	Concept study of Water-inflow in Garpenberg
2010	Pre-project study for extension to 2.5 Mt
2011	The expansion to 2.5 Mt commenced during the year
	Drainage drilling in 500 level in Lappberget started
2013	Drainage pumping has started. The expansion project 2.5 is nearing
	completion. Kvarnberget has prepared for mining with the first ore blast in December 2013.
2014	Expansion project to 2.5 Mt completed. New crusher, shafts, ore hoists etc. taken into use. First ore from Kvarnberget delivered to the concentrator. Level 1300 Z passed in Lappberget
2016	Production of 2.6 Mt successfully reached. Ventilation shaft to LAPP 554 ready. Record production of paste, 1005 kTon. First transverse stope mined in KVB.