


Statistics of the Swedish Mining Industry 2021

SGU Geological Survey of Sweden

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Cover image: The collage shows automation in the Kristineberg mine (large image), iron ore pellets (top left), sand reservoirs at the Kringel mine (top center) and mining of dolomite in the Tistbrottet (top right).
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FOREWORD

This report constitutes a statistical summary of the Swedish mining and mineral industry. The content is a translated and shortened version of the publication Bergverksstatistik 2021. The target group comprises stakeholders in the mineral market, such as authorities and exploration or mining companies outside Sweden.

The Geological Survey of Sweden has published Bergverksstatistik since 1985, with statistics dating back to 1978. Statistics on aggregates in Sweden, the production of dimension stone and industrial minerals, have also been included since 1999. In addition, the report includes a presentation of minerals of national importance under the Swedish Environmental Code, data on mining and mineral permits applied for and granted, environmental statistics, exports and imports, and economic statistics on the mining industry.

Among other things, the statistics show that the mining industry's total sales increased significantly in 2021, to approximately SEK 69 billion (not including smelters). Ore production was 88.6 million tonnes, the highest figure ever recorded in Sweden. Exploration also achieved a record high, mostly in the vicinity of existing mining operations.

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Rock reinforcement work. Photo: Fredric Alm/Alm & ME

The Swedish mining industry

Sweden's mineral resources and mineral reserves are mostly located in the three ore districts of Norrbotten and Skelleftefältet in northern Sweden, and Bergslagen in the centre of the country. In addition to these locations, there are deposits in northern Sweden and in the provinces of Småland and Dalsland (Fig. 1).

Swedish ore production reached 88.6 million tonnes in 2021 – the highest figure to date. Output has risen by 22 per cent since 2015 (Table 1). Sweden is a major producer of iron ore in the EU, as well as lead and zinc. In international terms, however, Sweden is a fairly small producer (Fig. 2).

As shown in Figure 3, ore production increased continuously over the past century until the oil crisis in the 1970s. After the financial crisis of 2008–2009 production recovered, almost doubling since then. Boliden's Aitik mine is one explanatory factor, but production has also increased at LKAB's mines and to some extent at others.

There were 12 operational metal ore mines in Sweden in 2021. Statistics on the number of mining facilities include Svartliden and the Boliden enrichment plants, so there are 14 facilities in total (see Table 4 in the Employment section).

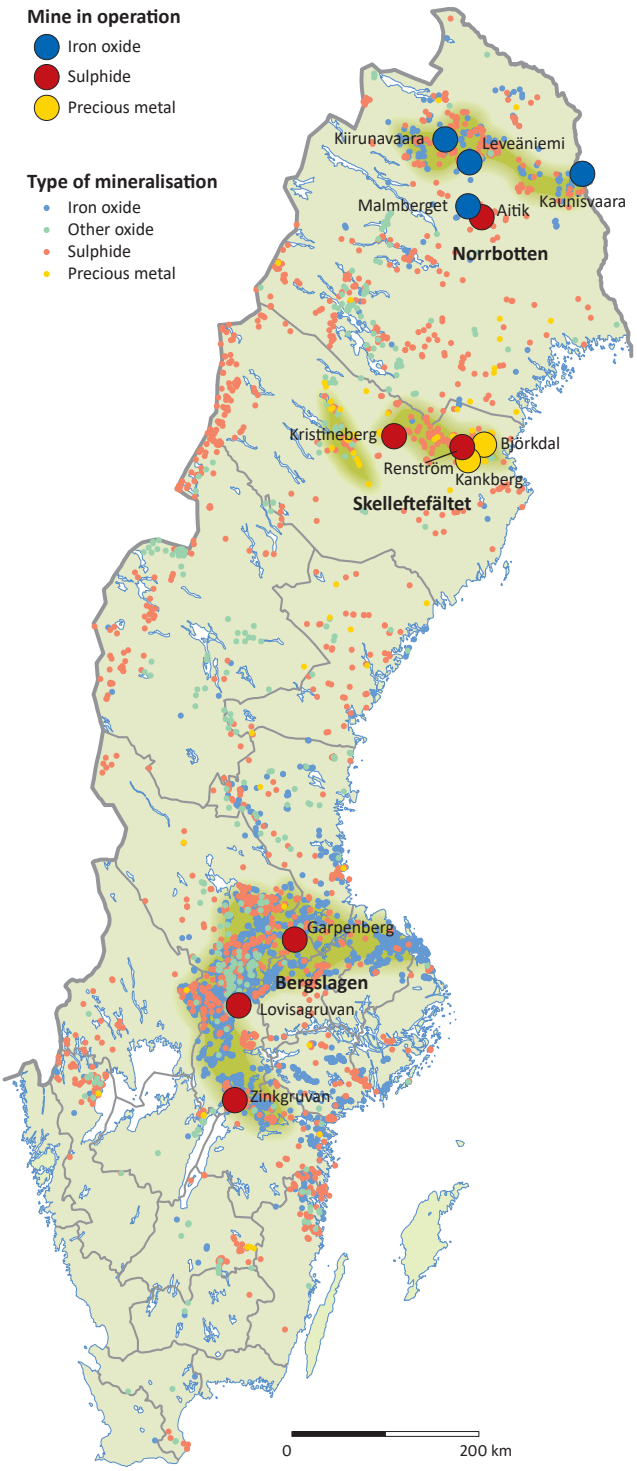

Figure 1. Active mines and known mineralisations in Sweden 2021.

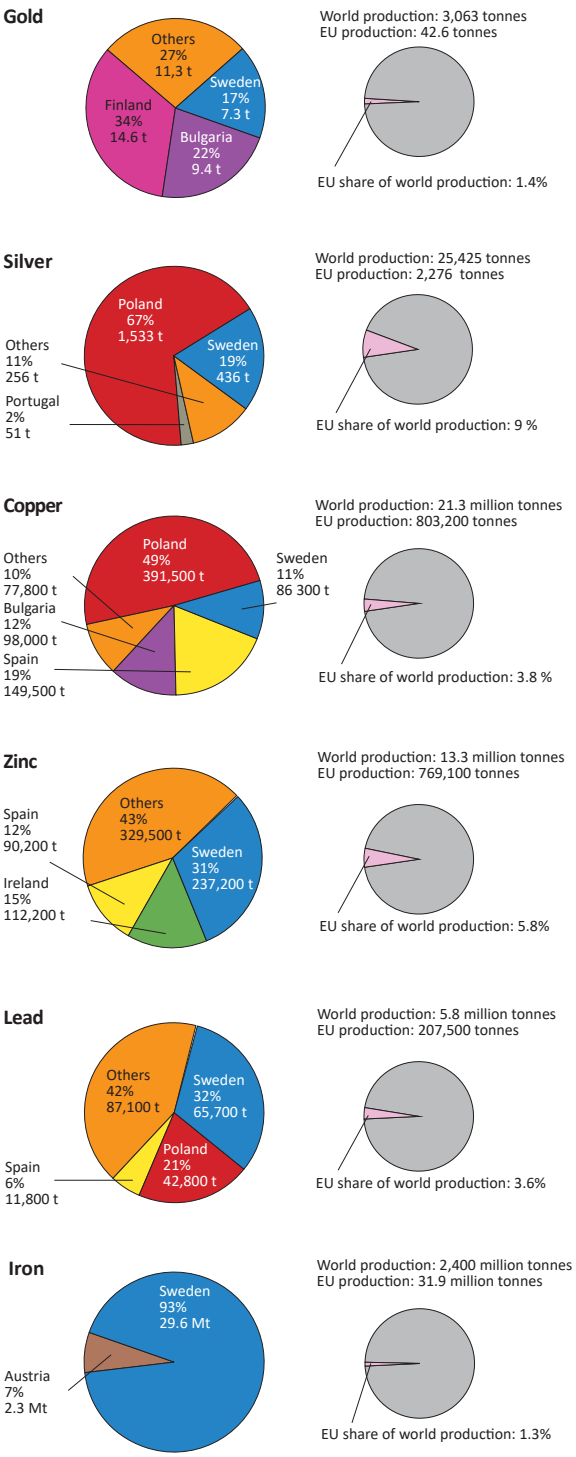

Figure 2. Sweden's mining production 2021 in relation to the EU and the world.

Table 1. Production of iron ore (sorted) and non-ferrous ores in Sweden 1952–2021.

Year	Iron ore (sorted) 1,000 tonnes			Non-ferrous ores 1,000 tonnes			Iron ore and non-ferrous ores in total
	For direct use	For concentrating	Total	For direct use	For concentrating	Total	
1952	15 585	2 686	18 271	29	1 877	1 906	20 177
1953	15 633	2 803	18 436	25	2 036	2 061	20 497
1954	14 038	2 711	16 749	26	2 229	2 255	19 004
1955	15 999	3 093	19 092	12	2 341	2 353	21 445
1956	17 264	3 605	20 869	32	2 504	2 536	23 405
1957	18 092	4 258	22 350	17	2 693	2 710	25 060
1958	16 397	4 654	21 051	6	2 702	2 708	23 759
1959	16 439	4 447	20 886	10	2 920	2 930	23 816
1960	19 100	5 137	24 237	9	3 135	3 144	27 381
1961	20 517	6 049	26 566	17	4 068	4 085	30 651
1962	19 164	6 950	26 114	3	3 377	3 380	29 494
1963	19 922	7 210	27 132	7	3 612	3 619	30 751
1964	22 685	8 036	30 721	6	3 554	3 560	34 281
1965	24 876	9 417	34 293	26	3 533	3 559	37 852
1966	22 243	10 862	33 105	22	3 738	3 760	36 865
1967	22 450	11 170	33 620	19	4 000	4 019	37 639
1968	26 632	10 368	37 000	12	5 009	5 021	42 021
1969	26 883	10 657	37 540	9	6 207	6 216	43 756
1970	24 092	12 410	36 502	0	6 679	6 679	43 181
1971	25 649	14 192	39 841	0	7 236	7 236	47 077
1972	23 917	16 189	40 106	0	7 500	7 500	47 606
1973	22 106	20 234	42 340	0	10 695	10 695	53 035
1974	23 643	20 394	44 037	0	10 910	10 910	54 947
1975	18 847	20 732	39 579	0	11 407	11 407	50 986
1976	17 126	20 685	37 811	0	11 854	11 854	49 665
1977	12 845	18 325	31 170	0	12 159	12 159	43 329
1978	11 886	13 336	25 222	0	13 189	13 189	38 411
1979	15 696	15 431	31 127	0	12 891	12 891	44 018
1980	15 296	15 889	31 185	0	11 819	11 819	43 004
1981	13 061	10 807	23 868	0	14 514	14 514	38 382
1982	7 835	9 878	17 713	0	15 617	15 617	33 330
1983	4 455	11 065	15 520	0	18 236	18 236	33 756
1984	6 267	15 735	22 002	0	18 237	18 237	40 239
1985	6 821	18 872	25 693	0	18 181	18 181	43 874
1986	6 977	18 137	25 114	0	18 899	18 899	44 013
1987	5 706	16 767	22 473	0	18 634	18 634	41 107
1988	6 170	15 872	22 042	0	17 599	17 599	39 641
1989	7 607	16 300	23 907	0	18 259	18 259	42 166
1990	6 879	14 343	21 222	0	18 566	18 566	39 788
1991	6 492	14 469	20 961	0	20 634	20 634	41 595
1992	5 559	15 675	21 234	0	22 164	22 164	43 398
1993	4 998	15 607	20 605	0	22 333	22 333	42 938
1994	5 540	16 609	22 149	0	22 801	22 801	44 950
1995	4 624	19 058	23 682	0	24 226	24 226	47 908
1996	3 493	20 273	23 766	0	24 917	24 917	48 683
1997	3 577	20 441	24 018	0	23 895	23 895	47 913
1998	3 017	21 034	24 052	0	24 182	24 182	48 234
1999	2 755	18 832	21 587	0	23 526	23 526	45 112

Table 1. Continued.

Year	Iron ore (sorted) 1,000 tonnes			Non-ferrous ores 1,000 tonnes			Iron ore and non-ferrous ores in total
	For direct use	For concentrating	Total	For direct use	For concentrating	Total	
2000	2 687	21 437	24 124	0	23 608	23 608	47 732
2001	2 592	19 575	22 167	0	22 695	22 695	44 862
2002	2 527	20 530	23 057	0	22 099	22 099	45 156
2003	2 730	22 116	24 846	0	22 043	22 043	46 889
2004	2 833	23 290	26 123	0	21 707	21 707	47 830
2005	2 576	24 502	27 078	0	20 609	20 609	47 687
2006	2 907	23 622	26 529	0	24 162	24 162	50 691
2007	2 864	24 988	27 852	0	22 614	22 614	50 466
2008	1 234	27 713	28 947	0	21 897	21 897	50 844
2009	257	20 389	20 646	0	23 576	23 576	44 222
2010	880	27 917	28 797	0	32 721	32 719	61 516
2011	991	29 849	30 840	0	36 707	36 877	67 717
2012	822	31 376	32 198	0	40 176	40 176	72 374
2013	843	36 568	37 411	0	41 675	41 675	79 086
2014	570	35 189	35 759	0	45 077	45 077	80 836
2015	470	29 391	29 861	0	42 873	42 873	72 734
2016	500	31 343	31 843	0	42 890	42 890	74 733
2017	687	31 076	31 763	0	46 501	46 501	78 264
2018	898	34 876	35 774	0	45 650	45 650	81 424
2019	678	38 235	38 913	0	47 641	47 641	86 554
2020	609	38 619	39 228	0	48 721	48 721	87 949
2021	**595**	**40 718**	**41 313**	**0**	**47 303**	**47 303**	**88 616**

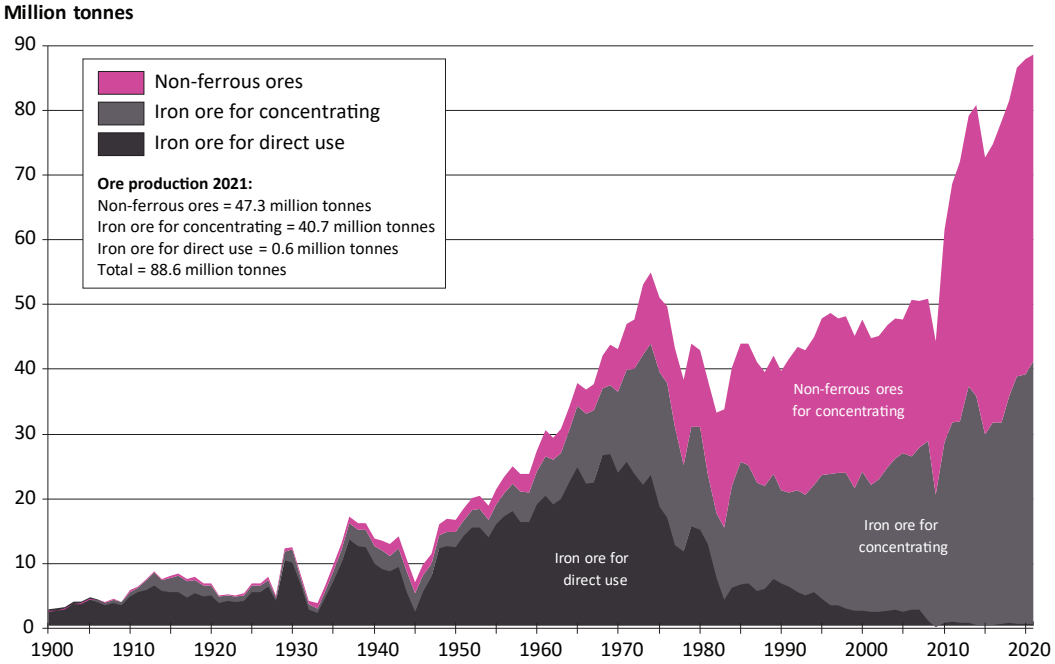

Figure 3. Production of ore in Sweden 1900–2021.

NUMBER OF MINES 1900–2021

National statistics on mining production in Sweden were first published in 1833. Figure 4 shows there were between 100 and 300 active mines and ore fields in Sweden in the early 1900s. Mines usually involve long-term investments. Of the 12 mines currently operational (Fig. 5), eight are more than 50 years old (Fig. 6).

There is a discrepancy in the statistics, however. Pre-1930 statistics included all individual mines within a single ore field. After that date the figures relate to an entire ore field. For example, statistics from Dannemora field were previously divided between 12 mines. Since 1940 the statistics have been aggregated as "Dannemora".

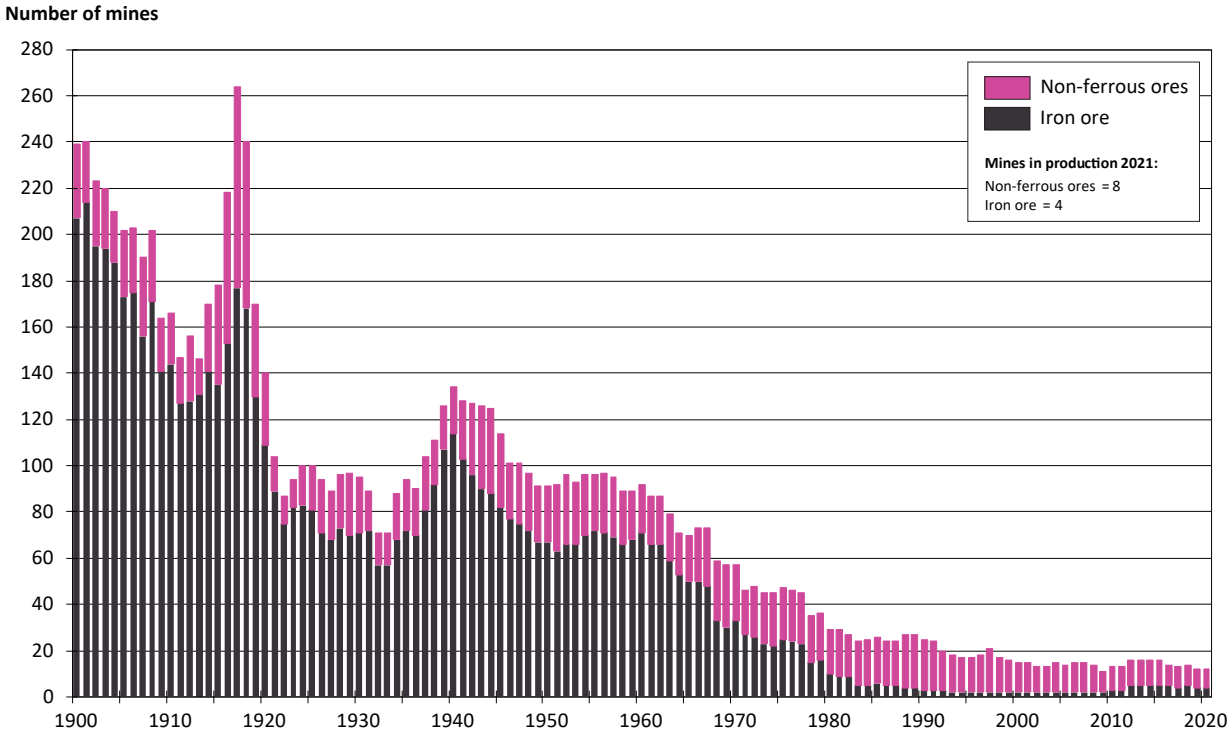

Figure 4. Number of mines in production in Sweden 1900–2021.

Figure 5. In December 2021 there were 12 mines in Sweden, all of them metal ore mines. The term "current mining concessions" means concessions mentioned in the companies' annual reports, newsletters or where there are other indications that the company is working to open a mine. There are 165 current mining concessions in total.

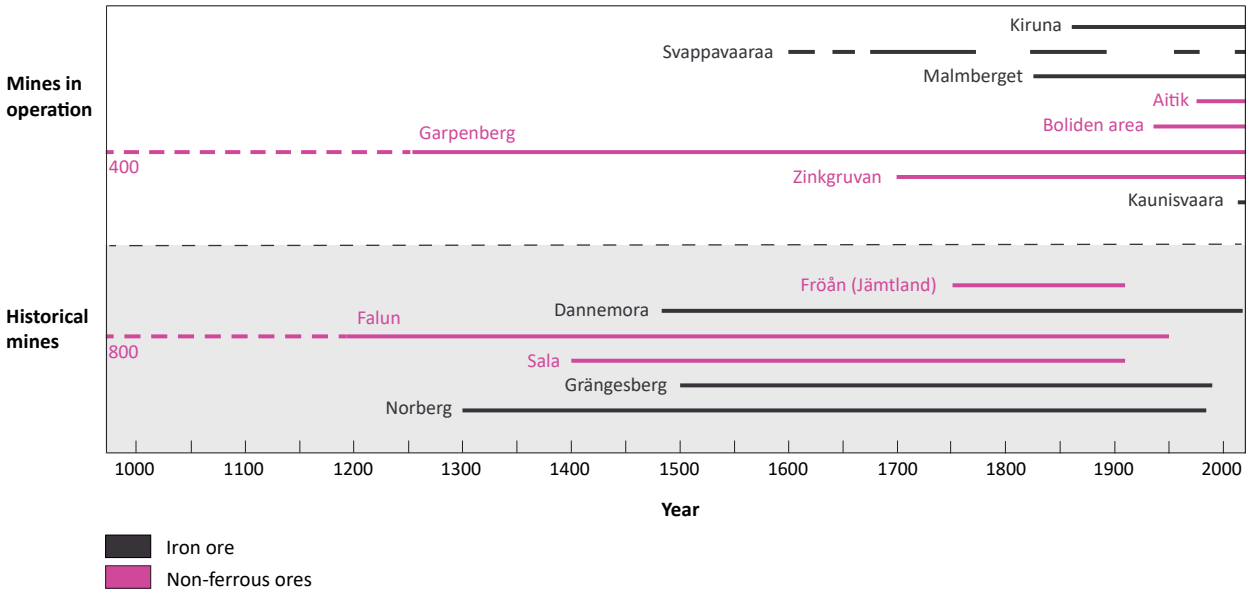

Figure 6. Swedish mines have a long history. The upper part of the diagram shows mines in operation; the lower part shows some major historical mines. Most of these date back to the Middle Ages. Dark grey/black shows iron ore mines; pink represents non-iron ore mines.

The Stora Stöten open-pit at Falu mine was created by a collapse at the end of the 17th century. During the same period, the mine was the world's largest copper producer. Photo: Arild Vågen/CC BY-SA 4.0

EMPLOYMENT IN THE MINING INDUSTRY

Some 7,387 people were employed in the Swedish mining industry in 2021. Non-ferrous ore mines employ more people than do iron ore mines, and there are also more mining facilities of this kind (Table 2). Most mining industry workers are employed in the provinces of Norrbotten and Västerbotten. This is also where most of the facilities are located (Table 3).

Overall employment at all 12 mines in Sweden showed a slight increase on the previous year. Employment including subcontractors also rose slightly (Fig. 7). Official statistics are always reported with a one-year delay. The entire Swedish minerals industry employed 9,189 people in 2020.

The proportion of women among manual and white-collar workers in the industry continues to increase. Female workers employed by mining companies totalled 1,852 in 2021 (Table 4). The proportion of women employed in the mining industry is slightly lower than for manufacturing industry as a whole (Fig. 8).

Work-related accidents and sick leave rates

Statistics from the Swedish Work Environment Authority show that, in absolute terms, the number of accidents at work leading to absenteeism and work-related illnesses remained relatively stable from 2014 to 2021 (Fig. 9). The frequency of accidents at work per 1,000 employees varied between 12 and 20 for men and between 9 and 26 for women.

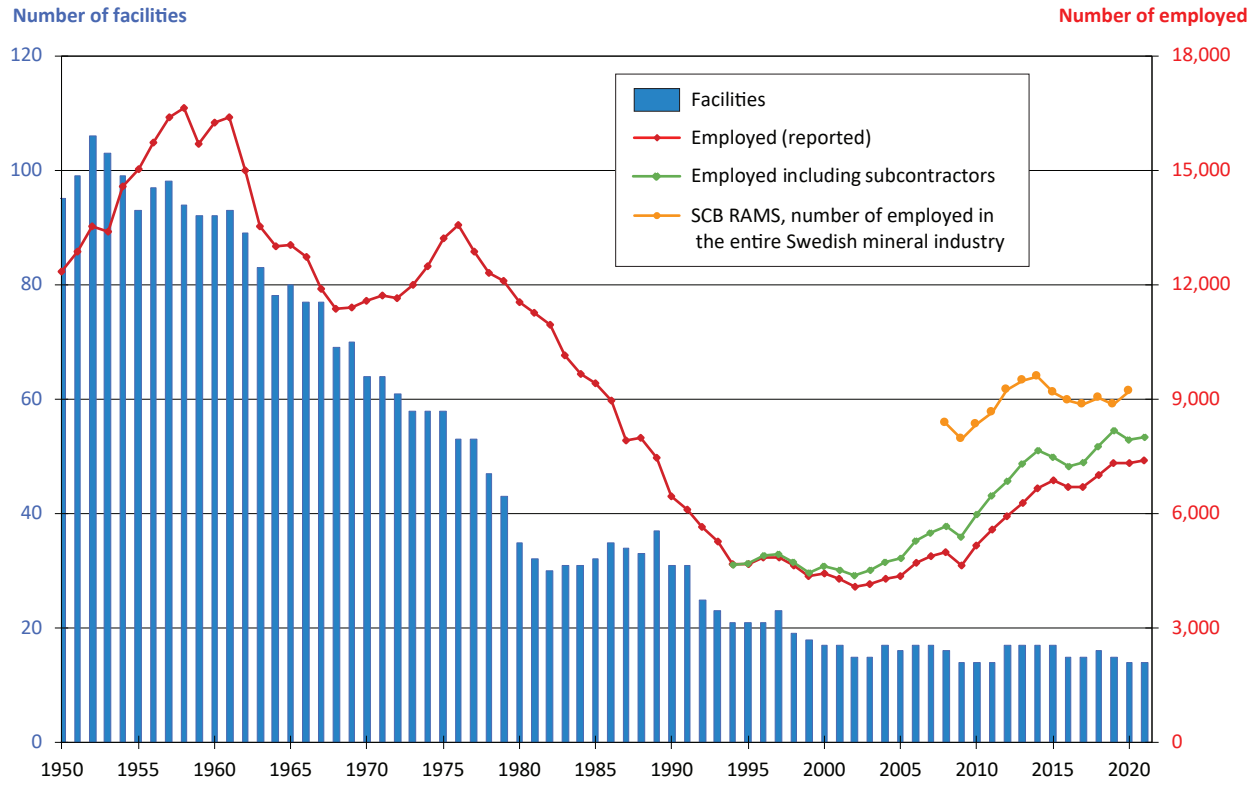

Figure 7. Number of facilities and people working in the mining industry 1950–2021.

Table 2. Number of facilities and people working in the mining industry 1950–2021*. Source: SGU survey.

	Iron ore mines				Non-ferrous ore mines				Total	
Year	Facilities	White-collar workers	Workers	Total employed	Facilities	White-collar workers	Workers	Total employed	Facilities	Employed
1950	68	927	8 375	9 302	27	421	2 630	3 051	95	12 353
1951	68	1 012	8 876	9 888	31	462	2 521	2 983	99	12 871
1952	72	1 125	9 310	10 435	34	503	2 593	3 096	106	13 531
1953	72	1 186	9 008	10 194	31	518	2 688	3 206	103	13 400
1954	69	1 279	9 612	10 891	30	585	3 087	3 672	99	14 563
1955	66	1 378	9 979	11 357	27	594	3 092	3 686	93	15 043
1956	68	1 556	10 437	11 993	29	627	3 113	3 740	97	15 733
1957	69	1 799	10 983	12 782	29	625	2 981	3 606	98	16 388
1958	68	2 002	11 244	13 246	26	652	2 723	3 375	94	16 621
1959	68	2 074	10 404	12 478	24	719	2 479	3 198	92	15 676
1960	68	2 164	10 742	12 906	24	742	2 604	3 346	92	16 252
1961	69	2 318	10 685	13 003	24	793	2 572	3 365	93	16 368
1962	65	2 282	9 488	11 770	24	799	2 416	3 215	89	14 985
1963	59	2 173	8 542	10 715	24	733	2 080	2 813	83	13 528
1964	57	2 146	8 160	10 306	21	725	1 979	2 704	78	13 010
1965	57	2 093	8 155	10 248	23	781	2 006	2 787	80	13 035
1966	53	2 084	7 819	9 903	24	734	2 105	2 839	77	12 742
1967	50	1 975	7 109	9 084	27	734	2 085	2 819	77	11 903
1968	39	1 804	6 606	8 410	30	795	2 171	2 966	69	11 376
1969	40	1 718	6 636	8 354	30	800	2 238	3 038	70	11 392
1970	36	1 685	6 697	8 382	28	873	2 310	3 183	64	11 565
1971	36	1 723	6 881	8 604	28	881	2 247	3 128	64	11 732
1972	35	1 753	6 633	8 386	26	890	2 366	3 256	61	11 642
1973	33	1 755	6 833	8 588	25	884	2 528	3 412	58	12 000
1974	32	1 746	7 208	8 954	26	933	2 605	3 538	58	12 492
1975	32	1 831	7 547	9 378	26	990	2 859	3 849	58	13 227
1976	30	1 892	7 672	9 564	23	1 051	2 948	3 999	53	13 563
1977	30	1 917	7 079	8 996	23	1 006	2 878	3 884	53	12 880
1978	24	1 754	6 871	8 625	23	996	2 677	3 673	47	12 298
1979	21	1 675	6 560	8 235	22	951	2 901	3 852	43	12 087
1980	15	1 570	6 024	7 594	20	902	3 048	3 950	35	11 544
1981	12	1 537	5 557	7 094	20	929	3 242	4 171	32	11 265
1982	10	1 402	5 110	6 512	20	980	3 451	4 431	30	10 943
1983	8	1 134	4 358	5 492	23	913	3 729	4 642	31	10 134
1984	7	867	3 816	4 683	24	1 095	3 893	4 988	31	9 671
1985	8	967	3 607	4 574	24	1 079	3 778	4 857	32	9 431
1986	7	939	3 429	4 368	28	1 026	3 552	4 578	35	8 946
1987	7	862	3 089	3 951	27	871	3 083	3 954	34	7 905
1988	7	838	3 291	4 129	26	840	3 017	3 857	33	7 986
1989	7	772	3 083	3 855	30	674	2 931	3 605	37	7 460
1990	5	631	2 512	3 143	26	590	2 704	3 294	31	6 437
1991	5	635	2 308	2 943	26	615	2 540	3 155	31	6 098
1992	5	653	2 296	2 949	20	588	2 107	2 695	25	5 644
1993	4	611	2 150	2 761	19	556	1 940	2 496	23	5 257
1994	4	527	2 077	2 604	17	311	1 757	2 068	21	4 672

Table 2. Continued.

Year	Iron ore mines				Non-ferrous ore mines				Total	
	Facilities	White-collar workers	Workers	Total employed	Facilities	White-collar workers	Workers	Total employed	Facilities	Employed
1995	4	416	2 130	2 546	17	315	1 817	2 132	21	4 678
1996	3	603	2 141	2 744	18	325	1 784	2 109	21	4 853
1997	3	612	2 036	2 648	20	329	1 886	2 215	23	4 863
1998	3	573	1 956	2 529	16	316	1 792	2 108	19	4 637
1999	3	520	1 816	2 336	15	304	1 708	2 012	18	4 348
2000	3	641	1 933	2 574	14	279	1 593	1 872	17	4 446
2001	3	667	1 893	2 560	14	264	1 461	1 725	17	4 285
2002	3	642	1 847	2 489	12	260	1 339	1 599	15	4 088
2003	3	640	1 862	2 502	12	263	1 401	1 664	15	4 166
2004	3	618	1 897	2 515	14	294	1 493	1 787	17	4 302
2005	3	665	1 950	2 615	13	286	1 453	1 739	16	4 354
2006	3	706	2 046	2 752	14	324	1 651	1 975	17	4 727
2007	3	742	2 123	2 865	14	342	1 684	2 026	17	4 891
2008	3	779	2 279	3 058	13	328	1 599	1 927	16	4 985
2009	3	756	2 044	2 800	11	239	1 617	1 856	14	4 656
2010	3	763	2 235	2 998	11	361	1 821	2 182	14	5 180
2011	3	815	2 351	3 166	11	408	2 019	2 427	14	5 593
2012	5	1 004	2 518	3 522	12	430	1 970	2 400	17	5 922
2013	5	1 035	2 839	3 874	12	462	1 959	2 421	17	6 295
2014	5	1 016	2 814	3 830	12	489	2 339	2 828	17	6 658
2015	5	1 030	2 344	3 374	12	528	2 974	3 502	17	6 876
2016	4	929	2 277	3 206	11	532	2 946	3 478	15	6 684
2017	4	904	2 255	3 159	11	546	2 991	3 537	15	6 696
2018	5	962	2 412	3 374	11	569	3 053	3 622	16	6 996
2019	4	1 021	2 473	3 494	10	656	3 174	3 830	15	7 324
2020	4	1 152	2 468	3 620	10	681	3 033	3 714	14	7 334
2021	**4**	**1 193**	**2 353**	**3 546**	**10**	**719**	**3 122**	**3841**	**14**	**7387**

* All employees of subcontractors are not included. From 2017, employees of non-ferrous ore subcontractors are included.

Table 3. Number of workers by county in the mining industry (2021). Source: SGU survey.

County	Number of facilities 2021	Employed		Iron ore mines	Non-ferrous ore mines
		2020	2021		
Örebro	2	414	381		381
Dalarna	1	559	557		557
Västerbotten	6	984	841		841
Norrbotten	5	3 544	3 696	2 353	1 343
Whole Sweden 2021	**14**		**5 475**	**2 353**	**3 122**
Whole Sweden 2020	14	5 501		2 468	3 174

Table 4. Number of female workers in the mining industry 2000–2021. Source: SGU survey.

	Workers, all mines			White-collar workers, all mines		
Year	Women	Total	%	Women	Total	%
2001	198	3 354	6			
2002	182	3 186	6			
2003	199	3 263	6			
2004	171	3 690	5			
2005	197	3 403	6			
2006	229	3 447	7			
2007	284	3 807	7			
2008	387	3 878	10	270	1 071	25
2009	329	3 661	9	270	1 075	25
2010	481	4 056	12	281	1 111	25
2011	590	4 370	14	328	1 212	27
2012	648	4 462	15	372	1 399	27
2013	703	4 721	15	403	1 497	27
2014	731	5 153	14	424	1 505	28
2015	814	5 318	15	448	1 558	29
2016	832	5 223	16	418	1 461	29
2017	865	5 246	16	426	1 450	29
2018	911	5 465	17	466	1 533	30
2019	980	5 647	17	526	1 677	31
2020	1 017	5 501	18	590	1 833	32
2021	**1 209**	**5 475**	**22**	**643**	**1912**	**34**

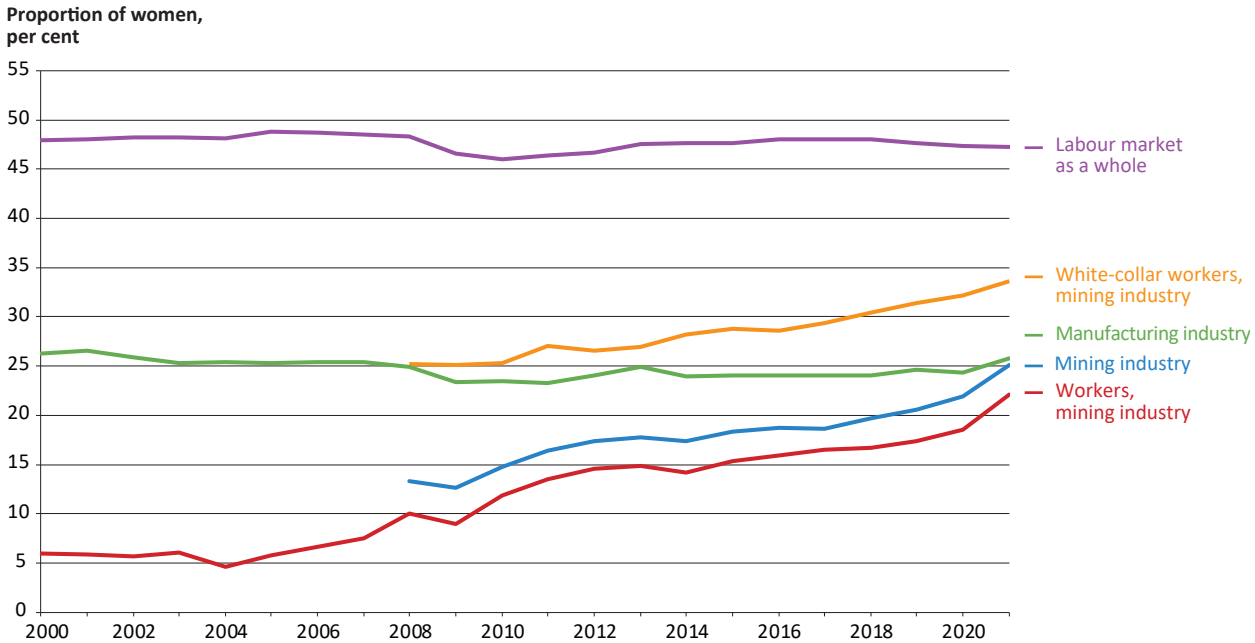

Figure 8. Proportion of women in the mining industry, manufacturing industry and labour market as a whole 2000–2021.

Automated mining in Boliden's mine in Garpenberg.
Photo: Tomas Westermark

Figure 9. Frequency and total number of work-related illnesses and accidents with resulting lost working hours in the metal mining sector 2014–2020. Number per 1,000 employees by gender and total. Source: Swedish Work Environment Authority

Fines from LKAB's iron ore mines. Foto: Fredric Alm/LKAB

Iron ore

The Geological Survey of Sweden (SGU) sends a questionnaire to companies operating in the Swedish mining industry once a year. The survey includes questions about production volumes, sales and employment. The following section presents LKAB's and Kaunis Iron AB's iron ore mines as well as results from SGU's survey for production year 2021 and iron ore mines. The results are also summarised in Tables 5–10.

LKAB

LKAB's iron ore mines are located in the environs of Malmberget, Kiruna and Svappavaara in Norrbotten County in northern Sweden. According to LKAB's annual report, delivery volumes from the iron ore mines in the form of pellets and fines totalled 27 million tonnes in 2021 (28.5 million tonnes in 2020), of which 83 per cent consisted of pellets (84 per cent in 2020). Volumes during the year were relatively low compared to the previous year. This was mainly due to Covid-19 infection control measures. Ore production was also still impacted by an seismic event in the Kiruna mine in spring 2020.

LKAB started up the Mertainen open pit mine near Svappavaara in autumn 2021. The mine had been mothballed, but market trends have created a growing need for raw materials (iron ore). According to LKAB, the start-up of Mertainen is a way of achieving a steadier supply of ore, thereby avoiding production bottlenecks.

LKAB's annual report for 2021 states that the company is participating in the work on Hybrit, a fossil fuel-free steel production process. In 2022 LKAB expects to

Table 5. Extraction from iron ore mines in 2021.

County *Municipality* Mining company	Name of the mine	Waste rock and ore Underground (tonnes)	Open-pit (tonnes)	Total (tonnes)	Average content of Iron (%)	Phosphorus (%)	Enrichment ore obtained after sorting, total (tonnes)	Lump ore and limonite ore for direct sale, total (tonnes)
Norrbotten county								
Gällivare								
LKAB	Malmberget	18 928 000		18 928 000	39.4	0.29	9 877 313	
Kiruna								
LKAB	Kiirunavaara	25 911 400		25 911 400	40.7	0.33	17 505 441	595 076
Svappavaara								
LKAB	Leveäniemi		8 917 712	8 917 712	42.7	0.57	6 076 462	
LKAB	Gruvberget				26.5	0.34	179 053	
Pajala								
Kaunis Iron	Kaunisvaara		23 957 525		24.3*		6 577 831	
Whole Sweden 2021		**44 839 400**	**32 875 237**	**53 757 112**			**40 216 100**	**595 076**
Whole Sweden 2020		44 469 066	26 692 577	51 258 308			38 619 480	608 757

* After sorting

start preparatory work on ancillary industrial facilities at Malmberget. During the year the company introduced raise caving, which will allow mining below current levels. The method offers the potential for greater automation and efficiency than current methods allow. LKAB also has plans to extract an apatite concentrate from mining residues. Following exploration and testing in 2021, a mineral resource totalling approximately 2.3 billion tonnes of phosphorus has been confirmed. Other critical minerals and rare earth elements such as vanadium, fluorine and gypsum can also be extracted from the apatite concentrate. According to LKAB, the company can supply up to 30 per cent of Europe's current rare earth element needs when in full production, which is expected to start in 2027.

Kiirunavaara Mine

When industrial ore mining at Kiirunavaara in Kiruna Municipality started in the early 1900s the ore was mined in open-pit mines, but since the early 1960s the ore has been mined underground. The ore is currently mined at the main level 1,365 metres (from the top of the former mountain), which is the fifth main level in the mine. The iron ore is refined after sorting above ground in three tailings and three pelletising plants.

According to data from SGU's annual survey, just under 26 million tonnes of ore were mined. After sorting, 0.6 million tonnes of direct ship ore and almost 17 million tonnes of refined ore was obtained in 2021. Unrefined ore had an average concentration of 63.6 per cent iron and 0.45 per cent phosphorus. The output concentrate of the refiners had in average 71.3 per cent of iron and 0.03 per cent of phosphorus. Kiirunavaara mainly produces blast furnace and direct reduction pellets (DR pellets).

Leveäniemi Mine

Mining takes place in the Leveäniemi open pit, which is located south of the town of Svappavaara and adjacent to the concentrator on the site. According to SGU's survey, 8.9 million tonnes of ore were mined in 2021 and after sorting, 6.1 million tonnes of tailings were generated. Unrefined ore entering the concentrator had in average 60.5 per cent iron content and a 0.39 per cent phosphorus content. The concentrator's output had in average a content of 71.0 per cent iron and 0.02 per cent phosphorus. Leveäniemi mainly produces blast furnace pellets and direct reduction pellets (DR pellets).

Malmberget Mine

In Malmberget Mine, located near the towns of Gällivare and Malmberget, iron ore is mined underground in more than a dozen different ore bodies at the main level of 1,250 metres. It is the fourth main level at the mine. After sorting, the iron ore is processed

Table 6. Extraction of ore and waste rock at iron ore mines 1985–2021. Source: SGU survey.

Year	Total quantity of mined ore and waste rock	Waste rock		Enrichment ore		Lump ore and fines for direct use	
	1 000 tonnes	1 000 tonnes	% of total quantity	1 000 tonnes	% of total quantity	1 000 tonnes	% of total quantity
1985	32 247	6 555	20	18 871	59	6 821	21,0
1986	32 795	9 250	28	16 568	51	6 977	21,0
1987	30 335	7 861	26	16 768	55	5 706	19,0
1988	30 363	8 321	28	15 872	52	6 170	20,0
1989	31 958	8 051	25	16 300	51	7 607	24,0
1990	28 375	7 153	25	14 343	51	6 879	24,0
1991	28 693	7 731	27	14 469	50	6 493	23,0
1992	29 430	8 196	28	15 675	53	5 559	19,0
1993	29 129	8 524	29	15 607	54	4 998	17,0
1994	32 352	10 203	31	16 609	51	5 540	17,0
1995	33 460	9 778	29	19 058	57	4 624	14,0
1996	33 605	9 839	29	20 273	60	3 493	10,0
1997	33 488	9 470	28	20 441	61	3 577	10,7
1998	34 894	10 842	31	21 034	60	3 017	8,7
1999	32 512	10 925	34	18 832	58	2 755	8,5
2000	34 629	10 505	30	21 437	62	2 687	7,8
2001	34 020	11 853	35	19 575	58	2 592	7,6
2002	32 136	9 079	28	20 530	64	2 527	7,9
2003	34 906	10 060	29	22 116	63	2 730	7,8
2004	35 988	9 841	29	23 314	65	2 833	7,9
2005	37 465	10 387	28	24 502	65	2 576	6,9
2006	40 692	14 163	35	23 622	58	2 907	7,1
2007	41 420	13 568	33	24 988	60	2 864	6,9
2008	43 487	14 540	33	27 713	64	1 234	2,8
2009	30 420	9 774	32	20 389	67	257	0,8
2010	43 846	14 170	32	28 797	66	880	2,0
2011	45 325	14 485	32	29 849	66	991	2,2
2012	46 894	16 622	33	30 272	65	822	1,8
2013	53 044	15 633	29	36 568	69	843	1,6
2014	54 417	17 518	32	34 002	62	570	1,0
2015	49 506	19 645	40	29 391	59	470	0,9
2016	52 587	20 744	39	31 343	60	500	1,0
2017	52 405	20 641	39	31 077	59	687	1,3
2018	57 574	21 800	38	34 876	61	898	1,6
2019	58 418	19 505	33	38 235	65	678	1,2
2020	58 726	19 498	33	38 619	66	609	1,0
2021	**62 066**	**20 753**	**33**	**40 718**	**66**	**595**	**1,0**

Table 7. Production of direct saleable products (lump ore, fines, concentrates and pellets) 2008–2021. Source: SGU survey.

	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Whole Sweden, 1 000 tonnes	23 888	17 677	25 292	26 113	26 540	27 285	28 181	24 823	26 900	27 200	27 526	28 980	30 584	29 603

Table 8. Processing of iron ore in 2021. Source: SGU survey.

County *Municipality* Mining company Enrichment plant	Enrich-ment method*	Incoming raw material						Received concentrates						Tailings		
		From	Total (tonnes)	Average content				Quality	Total (tonnes)	Average content				Average content		
				Fe (%)	P (%)	S (%)	Mn (%)			Fe (%)	P (%)	S (%)	Mn (%)	Fe (%)	P (%)	Mn (%)
Norrbotten																
Gällivare																
LKAB																
Malmberget	mv	FAR	3 138 224	64.30	0.250	0.040	0.05	MPC	7 331 235	71.4	0.006	0.020	0.05	9.1	1.6	0.10
	mv	PAR	6 174 209	59.70	0.400	0.060	0.05	MAF	1 997 022	70.7	0.030		0.05			
	mv	AMD						Spec. prod.	404 099							
	mv	AMGB						MHF	14 015	66.6	0.216					
	mv	AMLB	2 093 803	56.40	0.470		0.07	**Total:**	**9 746 371**							
	mv	HPAR	564 880	56.21	0.610	0.010	0.04									
		Total:	**11 971 116**													
Kiruna																
LKAB																
Kirunavaara	mv, f	Kiirunavaara	17 068 496	63.6	0.45			KA1+KA2+KA3	13 427 286	71.3	0.03			9.3	2.3	
Svappavaara	mv, f		3 698 560	60.5	0.39			Svappavara	2 931 894	71.0	0.02					
		Total:	**20 767 056**					**Total:**	**16 359 180**							
Pajala																
Kaunis Iron AB																
Kaunisvaara		Kaunisvaara	**6 338 559**	24.3		0.052		Kaunisvaara	2 012 990	67.1		0.07		4.13		
Whole Sweden 2021			**39 076 731**						**28 118 541**							
Whole Sweden 2020			41 092 503						28 327 021							

* Enrichment method: mv = combined magnetic and wet enrichment, f = flotation

above ground in a concentrator and two pelletising plants. According to SGU's survey, 18.9 million tonnes of ore was mined in 2021. After sorting, 10 million tonnes of tailings were were separated from the ore. Unrefined ore entering the refining plant contained in average between 56.2 and 64.3 per cent iron and had a phosphorus average content of between 0.25 and 0.61 per cent. Refines ore contained in average 70.7–71.4 per cent iron and 0.006–0.03 per cent phosphorus. In addition to blast furnace pellets, fines are produced at Malmberget.

KAUNIS IRON AB

Kaunisvaara Mine

Kaunis Iron AB produced just over 2 million tonnes of refined iron ore products in 2021 (1.9 million tonnes in 2020) at the Kaunisvaara Mine near the town of Pajala in Norrbotten County. According to SGU's survey, almost 24 million tonnes of ore was extracted from the mine producing almost 6.6 million tonnes of fines. The unrefined ore contained 24.3 per cent iron and 0.05 per cent sulphur. The refined ore or concentrate (fines) had in average 67.1 per cent iron and 0.07 per cent sulphur, and is transported about 150 km to a transshipment station at Pitkäjärvi (near Svappavaara) for onward shipment by railway to the port of Narvik in Norway.

In 2019 Kaunis Iron AB applied to the Land and Environment Court for expanded mining operations in Kaunisvaara, where mining is also planned on the nearby Sahavaara and Palotieva deposits. The permitting process was ongoing at the time of writing. In another case related to the revocation of permits by the Border River Commission, a judgment was delivered in early 2022 under which Kaunis Iron can continue its operations subject to an annual maximum of 7 million tonnes of ore mined.

Table 9. Sintering of iron ore concentrates (2021).

County *Municipality* Mining company	Sinter plant	Incoming raw material Total (tonnes)	Average content (%) Iron	Phosphorus	Sulphur	Received product Total (tonnes)*
Norrbotten county						
Gällivare						
LKAB	Malmberget	7 331 235	71.4	0.006	0.02	7 537 123
Kiruna						
LKAB	Kiruna	17 068 496	63.6	0.450	-	13 427 286
	Svappavaara	3 698 560	60.5	0.390	-	2 931 894
	Total:	**20 767 056**				**16 359 180**
Whole Sweden 2021		**28 098 291**				**23 896 303**
Whole Sweden 2020		24 034 437				24 116 092

* Note: LKAB's production consists of pellets.

Table 10. Production of iron ore concentrates 1976–2021 broken down into phosphorus and sulphur content (1,000 tonnes). Source: SGU survey.

Year	Production of concentrates (tonnes)	Percentage average content of Phosphorus <0,006	0,006 –0,03	0,04 –0,09	0,1– 0,6	>0,6	not analysed	Sulphur <0,01	0,01 –0,04	>0,04	not analysed	Manganese >1,0
1976	12 735	1 197	8 496	2 397	296	53	296	1 208	167	572	10 788	
1977	11 994	1 426	8 042	1 804	469	50	203	1 469	346	589	9 590	
1978	9 180	462	3 906	3 885	233	95	599	1 313	338	230	7 299	

Table 10. Continued.

Year	Production of concentrates (tonnes)	Percentage average content of Phosphorus <0,006	0,006 –0,03	0,04 –0,09	0,1– 0,6	>0,6	not analysed	Sulphur <0,01	0,01 –0,04	>0,04	not analysed	Manganese >1,0
1979	10 487	757	6 046	3 174	251	58	201	378	672	344	9 093	
1980	11 597	727	6 187	4 600	-	83	-	59	372	292	10 874	
1981	10 087	472	5 135	4 216	-	113	151	67	-	177	9 843	
1982	8 074	372	4 810	2 784	-	87	21	1 042	417	371	6 244	
1983	9 336	380	6 558	2 202	-	96	-	578	-	1 320	7 438	
1984	11 647	253	5 451	-	-	111	5 832	736	1 039	253	9 619	
1985	13 897	242	10 353	3 108	-	194	-	752	7 154	242	5 749	
1986	13 738	441	13 110	-	-	187	-	966	6 445	298	6 029	
1987	14 051	328	13 495	-	-	228	-	966	6 645	328	6 112	
1988	13 547	308	13 088	-	-	142	9	183	5 803	308	7 253	
1989	13 799	338	13 318	-	-	71	72	135	5 517	331	7 816	
1990	12 626	320	12 306	-	-	-	-	5 711	-	320	6 595	
1991	12 599	342	12 257	-	-	-	-	5 530	-	342	6 727	
1992	13 593	210	13 383	-	-	-	-	6 553	-	110	6 929	
1993	13 597	84	13 513	-	-	-	-	6 258	-	-	7 339	
1994	14 123	103	14 020	-	-	-	-	6 715	-	-	7 408	
1995	16 686	148	16 538	-	-	-	-	6 686	-	-	10 000	
1996	17 527	180	17 347	-	-	-	-	6 794	-	-	10 733	
1997	18 031	215	17 516	-	-	-	-	6 767	-	-	11 264	
1998	17 922	217	17 705	-	-	-	-	6 584	-	-	11 338	
1999	15 525	210	11 637	-	-	-	3 678	6 748	-	-	8 777	
2000	16 688	167	16 487	-	34	-	-	167	-	-	16 521	
2001	16 467	232	16 235	-	-	-	-	-	-	-	16 467	
2002	17 266	86	17 180	-	-	-	-	-	-	-	17 266	
2003	18 575	245	18 330	-	-	-	-	-	-	-	18 575	
2004	19 002	282	18 720	-	-	-	-	7 172	282	-	11 548	
2005	20 329	-	20 329	-	-	-	-	7 814	-	-	12 515	
2006	20 943	-	20 943	-	-	-	-	7 612	-	-	13 331	
2007	22 372	-	22 372	-	-	-	-	9 199	-	-	13 173	
2008	23 620	348	23 620	-	-	-	-	3 029	5 560	-	15 031	
2009	17 863	179	17 863	-	-	-	-	2 630	3 936	-	11 297	
2010	24 438	-	24 438	-	-	-	-	6 129	2 279	-	16 030	
2011	25 400	286	25 400	-	-	-	-	6 797	2 167	-	16 437	
2012	26 038	254	26 038	-	-	-	-	7 073	1 547	273	17 146	273
2013	26 692	297	26 692	-	-	-	-	7 158	2 424	948	16 162	948
2014	27 391	247	24 910	-	-	-	-	8 081	1 577	1 187	16 546	1 187
2015	24 300	273	24 080	-	-	-	-	1 927	6 308	-	16 065	-
2016	25 643	267	25 376	-	-	-	-	1 846	6 082	-	17 715	-
2017	26 396	485	25 911	-	-	-	-	485	8 448	-	17 463	-
2018	25 296	379	17 945	6 803	169	-	-	1 981	6 803	626	16 512	-
2019	27 278	-	22 517	-	2 558	47	2 156		6 049	1 770	19 459	-
2020	28 327	399	25 987	-	-	-	1 940	2 352	6 779	1 940	17 256	-
2021	**28 119**	**-**	**26 106**	**-**	**-**	**-**	**2 013**	**-**	**7 331**	**2 013**	**18 775**	**-**

Truck being loaded at the Aitik mine. Copper, silver and gold are mined here. Photo: Lars deWall/Boliden

Non-ferrous ores

The information in this section is largely based on SGU's annual survey of companies operating in the Swedish mining industry. Some of the information comes from the companies' annual reports or websites. The results for non-iron ore mines for the production year 2021 are presented below. The results are also summarised in Tables 11–14 and in Figures 10 and 11.

A total of 883,401 tonnes of concentrates were produced from non-iron ore mines in Sweden in 2021 (Table 11), down roughly 6 per cent on the previous year. The decrease was largely due to a lower metal content in the mined ore. Tables 15 and 16 show that the largest percentage reduction for concentrate and metal content was recorded for copper. As shown in Figure 10, the metal content of lead and zinc was approximately the same as the previous year. The metal content of gold rose by 7 per cent (Fig. 11), largely due to increased amounts of concentrate (Table 13). Silver metal content also increased (Fig. 11).

MANDALAY RESOURCES

Björkdal Mine

Björkdal Mine, 40 km northwest of the town of Skellefteå in Västerbotten County, is a gold mine in which the ore consists of gold-bearing quartz veins. The mine and concentrator were acquired in 2014 by Canadian mining company Mandalay Resources, which also owns and operates a gold-antimony mine in Australia, has a dormant mine in Chile as well as development projects

Table 11. Processing in non-ferrous ore mines in 2021 (tonnes). Source: SGU survey

County *Municipality* Mining company Enrichment plant	Enrich-ment met-hod*	Incoming raw material						Recieved concentrates						
			Average content							Average content				
		Total (tonnes)	Cu (%)	Pb (%)	Zn (%)	Ag (g/ tonnes)	Au (g/ tonnes)	Type	Total (tonnes)	Cu (%)	Pb (%)	Zn (%)	Ag (g/tonnes)	Au (g/tonnes)
Örebro County														
Örebro														
Zinkgruvan Mining														
Zinkgruvan	f	1 359 153	1.78	2.40	7.41			Copper	10 730	25.97		5.24	358	
								Lead	31 759		69.85	5.64	1 456	
								Zinc	147 485		2.22	51.78	86	
Dalarna County														
Hedemora														
Boliden AB														
Garpenberg	f	3 056 159	0.06	1.52	3.79	118.49	0.30	Copper 1	6 046	16.30	18.92	6.95	25 632	71.67
								Lead 1	53 018	0.54	72.52	5.11	2 222	2.29
								Zinc 1	204 102	0.12	1.01	53.36	116	0.25
								Lead 2	405	0.16	11.58	3.35	6 800	315.44
Västerbotten County														
Skellefteå														
Boliden AB														
Boliden	f	1 636 326	0.33	0.39	3.19	53.56	1.94	Copper 1	421	0.84	3.23	3.64	2 120.07	1151.63
								Lead 1	7 528	3.80	41.52	11.01	2 240.62	5.51
								Zinc 1	45 214	0.48	0.67	57.99	88.47	0.88
								Copper 2	17 463	24.03	5.85	4.80	2 141.53	30.03
								Zinc 2	37 617	0.44	2.19	53.87	171.29	2.24
								Zinc 3	1 741	0.86	1.66	38.85	309.33	5.92
								Gold 1	5.9	0.00	0.00	0.00	383556.23	242113.89
Björkdalsgruvan AB														
Björkdal	fv	1 259 947					1.31	Gold 1	1.3					567 923
								Gold 2	261					1 339
								Gold 3	118					276
								Gold 4	5 719					56.9
Norrbotten County														
Gällivare														
Boliden AB														
Aitik	f	40 100 000	0.22			0.89	0.11	Copper 1	313 767	25.54			83.70	8.35
Whole Sweden 2021		**47 411 586**							**883 401**					

* Enrichment method: fv = flotation and wet concentration. f = flotation. c = cyanide leaching.

in Canada. Björkdal Mine has been in production under several owners since 1988, with a lengthy production stoppage between 2000 and 2001.

The ore was initially mined only in open-pit mines, but open-pit and underground ore mining took place from 2005 to 2018. Since 2019 all mining has taken place underground. Mining waste containing gold is also processed from time to time. The gold ore is enriched using shaking tables and spirals, which exploit the high density of gold, as well as flotation.

In 2021, 1.07 million tonnes of ore was mined, but the refiner processed 1.26 million tonnes of ore (see Tables 11 and 12). Gold mineralised waste rock accounted for the difference. Production was thus slightly lower than in 2020, but since the gold content in the ore was higher, gold production was almost on a par with 2020. About 1,400 kg of gold was produced each year in 2021 and 2020.

Exploration work focused on the eastern part of the ore body in 2021, and gold has been detected in two zones. Additional potential has been found between zones and the company has carried out drilling programmes that have detected high gold levels.

Table 12. Production in non-ferrous ore mines in 2021 (tonnes). Source: SGU survey

County *Municipality* Mining company	Name of the mining field (mine)	Type of ore	Production method*	Waste rock and ore		Enrichment ore	Waste rock
				Under-ground	Open-pit		
Örebro County							
Askersunds kommun							
Zinkgruvan Mining AB	Zinkgruvan	zinc, lead, copper	1	1 819 735		1 400 727	419 008
Lindesbergs kommun							
Lovisagruvan AB	Lovisagruvan	zinc, lead, silver	3	73 639		37 019	36 620
Dalarnas County							
Hedemora kommun							
Boliden Mineral AB	Garpenberg	zinc, lead, copper	1, 2, 3, 4	3 488 487		3 052 464	436 023
Västerbottens County							
Lycksele kommun							
Boliden Mineral AB	Kristineberg**	copper, lead, zinc	3	960 407		605 254	355 153
Skellefteå kommun							
Boliden Mineral AB	Renström	copper, lead, zinc	3	717 272		498 217	219 055
Boliden Mineral AB	Kankberg	gold, tellurium	3	645 287		474 082	171 205
Björkdalsgruvan AB	Björkdalsgruvan	gold	1, 2	1 504 049		1 071 212	432 837
Norrbottens County							
Gällivare kommun							
Boliden Mineral AB	Aitik	copper, gold	1		71 602 000	40 164 000	31 438 000
Whole Sweden 2021				**9 208 876**	**71 602 000**	**47 302 975**	**33 507 901**
Whole Sweden 2020				9 249 992	67 587 000	48 720 699	28 187 739

* 1 = open-pit mining, 2 = sublevel caving, 3 = cut-and-fill mining, 4 = rill-mining
** Including trial mining in Rävliden

BOLIDEN MINERAL AB

The Boliden mining company hold its name from the Boliden mine in the Västerbotten County in northern Sweden, where an ore deposit was found in 1924 and which came into production two years later. Boliden mine was closed in 1967, but the enrichment plant built next to the mine is still in operation and it ow processes ore from several mines in the Skellefte field in Västerbotten. In addition to the Skellefte field, Boliden operates two other mines in Sweden, Garpenberg in Dalarna and Aitik in Norrbotten, as well as in Ireland and Finland.

Aitik Mine

Aitik Mine is situated near the town of Gällivare. When the mine started in 1968 it had an estimated lifespan of fifteen years. Initial annual production was 2 million tonnes of ore, which was enriched at the mine. In 2021, 53 years later, ore production was 40.2 million tonnes (Table 12). The reserves and assets present in the mine and nearby deposits are likely to suffice for many decades of ore production.

Aitik is a porphyry copper deposit, an ore type characterised by low metal levels but present in very large amounts. Most copper produced in the world comes from such copper ores in America and Southeast Asia. Silver and gold are also mined at Aitik.

The ore deposit in Aitik is mined in two open-pit mines (Salmijärvi and Aitik) and processed by flotation near the mine. There are plans to launch a third open-pit satellite mine at Liikavaara. Ore production at Aitik totalled just over 40 million tonnes in 2021, a drop of almost 4 per cent on the previous year. Concentrate production totalled 313,767 tonnes (Table 11), a decrease of nearly 15 per cent on the previous year. The decrease was due to lower metal concentrations in the ore during the year. Mineral reserves fell by 3.4 per cent, representing approximately one year's production. However, mineral resources in the Aitik area increased by 0.8 per cent in 2021 due to contributions from the nearby Liikavara deposit.

Table 13. Production of non-ferrous ores 1976–2021 (tonnes of concentrates). Source: SGU survey

Year	Pyrite	Copper	Lead	Zinc	Tungsten	Gold	Graphite	Total
1976	404 434	187 833	114 234	225 793	349	-	-	932 643
1977	402 049	177 653	123 742	252 259	378	-	-	956 081
1978	484 202	196 572	119 842	299 963	683	-	-	1 101 262
1979	447 681	191 960	115 073	302 866	687	-	-	1 058 267
1980	395 878	180 910	102 267	304 600	606	-	-	984 261
1981	419 028	221 384	123 872	340 507	676	-	-	1 105 467
1982	426 222	234 644	118 664	344 335	646	-	-	1 124 511
1983	430 393	303 597	115 949	374 985	774	-	-	1 225 698
1984	417 781	361 138	118 540	382 725	819	3 528	-	1 284 531
1985	407 122	368 213	112 372	387 546	804	7 003	-	1 283 060
1986	448 253	352 232	129 265	394 374	645	5 804	-	1 330 573
1987	428 555	352 983	133 074	392 494	574	-	-	1 307 680
1988	355 103	306 939	122 148	344 346	584	-	-	1 129 120
1989	301 286	277 257	120 103	303 146	310	1 210	-	1 003 312
1990	251 822	296 331	120 076	285 980	-	1 849	-	956 058
1991	89 145	332 825	123 145	285 365	-	2 350	-	832 830
1992	37 140	339 330	144 371	313 333	-	2 444	-	836 618
1993	-	334 384	150 988	303 116	-	2 468	-	790 956
1994	-	293 147	152 692	287 052	-	3 285	-	736 176
1995	-	311 495	137 151	303 831	-	4 736	-	757 213
1996	-	269 031	136 243	291 509	-	5 841	500	703 124
1997	30	315 044	146 004	284 379	-	4 784	1 581	751 792
1998	-	270 358	155 140	297 394	-	4 412	3 277	730 581
1999	-	261 947	157 088	316 189	-	1 674	4 504	741 402
2000	-	282 202	147 353	319 586	-	186	5 602	754 929
2001	-	267 848	123 200	284 816	-	1 281	1 035	678 180
2002	-	263 151	68 425	270 925	-	3 800	-	606 301
2003	-	304 617	77 855	341 198	-	3 641	-	727 311
2004	-	297 139	82 456	362 622	-	3 052	-	745 269
2005	-	315 667	88 462	383 949	-	2 405	-	790 483
2006	-	315 001	79 807	381 720	-	2 228	-	778 755
2007	-	230 653	92 641	397 910	-	1 944	-	723 148
2008	-	209 208	118 213	322 490	-	2 230	-	652 141
2009	-	202 385	96 733	359 879	-	2 607	-	661 604
2010	-	299 584	94 054	371 312	-	4 928	-	769 878
2011	-	336 928	85 661	358 919	-	3 500	-	785 008
2012	-	331 520	88 255	345 713	-	2 500	-	767 988
2013	-	339 802	83 846	322 180	-	3 977	-	749 805
2014	-	325 358	107 198	409 062	-	3 109	-	844 727
2015	-	339 357	115 698	456 609	-	3 208	295	915 167
2016	-	354 967	110 884	477 892	-	3 708	-	947 451
2017	-	422 872	108 341	477 664	-	4 924	-	1 013 801
2018	-	434 276	93 700	441 502	-	4 421	-	973 899
2019	-	411 089	99 948	462 944	-	4 406	-	978 387
2020	-	404 545	93 079	438 906	-	5 520	-	942 050
2021	**-**	**348 426**	**92 710**	**436 160**	**-**	**6 105**	**-**	**883 401**

Table 14. Metal content in non-ferrous ores (concentrates, tonnes or kg) 1976–2021.

Year	Copper (tonnes)	Lead (tonnes)	Zinc (tonnes)	Sulphur (tonnes)	Tungsten (tonnes)	Gold (kg)	Silver (kg)	Tellurium (kg)	Graphite (tonnes)
1976	44 860	81 625	128 326	205 283	194	1 934	143 617	-	-
1977	44 764	88 132	140 233	204 357	199	2 113	169 153	-	-
1978	47 229	84 224	167 319	225 931	381	2 377	168 892	-	-
1979	45 811	81 627	169 854	282 209	402	2 135	168 736	-	-
1980	42 790	72 393	179 772	276 996	364	2 037	183 429	-	-
1981	51 979	91 103	177 404	273 451	394	2 041	183 493	-	-
1982	56 293	83 012	192 727	307 542	338	2 446	187 499	-	-
1983	76 540	85 762	216 605	338 998	386	3 369	206 978	-	-
1984	89 381	82 845	215 589	288 974	388	4 405	238 771	-	-
1985	91 867	80 604	221 298	287 468	402	4 631	231 483	-	-
1986	87 871	91 729	227 648	310 519	360	4 514	262 708	-	-
1987	86 113	95 141	229 353	215 678	336	4 108	254 107	-	-
1988	75 032	91 579	200 393	286 387	352	3 590	207 804	-	-
1989	71 238	88 967	173 515	232 812	80	5 120	227 715	-	-
1990	74 283	98 259	164 128	230 833	-	6 326	242 685	-	-
1991	81 650	91 127	161 170	83 373	-	6 247	239 321	-	-
1992	89 145	105 295	171 539	18 199	-	6 164	311 059	-	-
1993	88 909	111 709	168 617	-	-	6 548	298 772	-	-
1994	79 384	112 787	159 858	-	-	6 364	275 224	-	-
1995	83 603	100 070	167 962	-	-	6 528	268 200	-	-
1996	71 659	98 812	160 133	-	-	6 145	271 866	-	463
1997	86 610	108 624	155 385	-	-	6 777	304 048	-	1 470
1998	73 685	114 430	164 711	-	-	5 944	299 051	-	3 011
1999	71 160	116 393	174 448	-	-	4 202	341 584	-	4 144
2000	77 765	106 584	176 788	-	-	3 570	328 737	-	5 108
2001	74 269	85 975	156 334	-	-	4 986	306 029	-	963
2002	71 991	42 954	148 620	-	-	5 757	320 823	-	-
2003	83 143	50 962	185 884	-	-	5 900	340 701	-	-
2004	82 415	54 347	197 034	-	-	6 564	319 563	-	-
2005	87 068	60 445	215 691	-	-	6 564	309 933	-	-
2006	86 746	55 644	210 029	-	-	6 848	292 255	-	-
2007	62 905	63 224	214 576	-	-	5 159	323 171	-	-
2008	57 688	63 489	187 987	-	-	4 943	293 068	-	-
2009	55 414	69 293	192 502	-	-	5 542	288 590	-	-
2010	76 514	67 697	198 687	-	-	6 285	302 145	-	-
2011	82 967	62 028	194 021	-	-	5 994	301 959	-	-
2012	82 422	63 551	188 325	-	-	6 015	309 337	6 791	-
2013	82 904	59 556	176 582	-	-	6 530	341 346	24 457	-
2014	79 681	70 848	221 841	-	-	6 849	382 611	30 917	-
2015	75 113	79 354	246 983	-	-	6 028	479 686	33 000	254*
2016	79 247	75 830	258 264	-	-	6 463	498 686	38 680	-
2017	104 594	71 112	251 244	-	-	7 858	467 500	34 979	-
2018	106 140	64 751	237 715	-	-	7 866	443 624	44 641	-
2019	99 332	68 635	247 657	-	-	7 972	419 926	40 953	-
2020	100 065	65 402	234 811	-	-	8 249	400 929	41 742	-
2021	**88 108**	**65 404**	**236 416**	-	-	**8 805**	**428 585**	**41 367**	**-**

* Estimated quantity

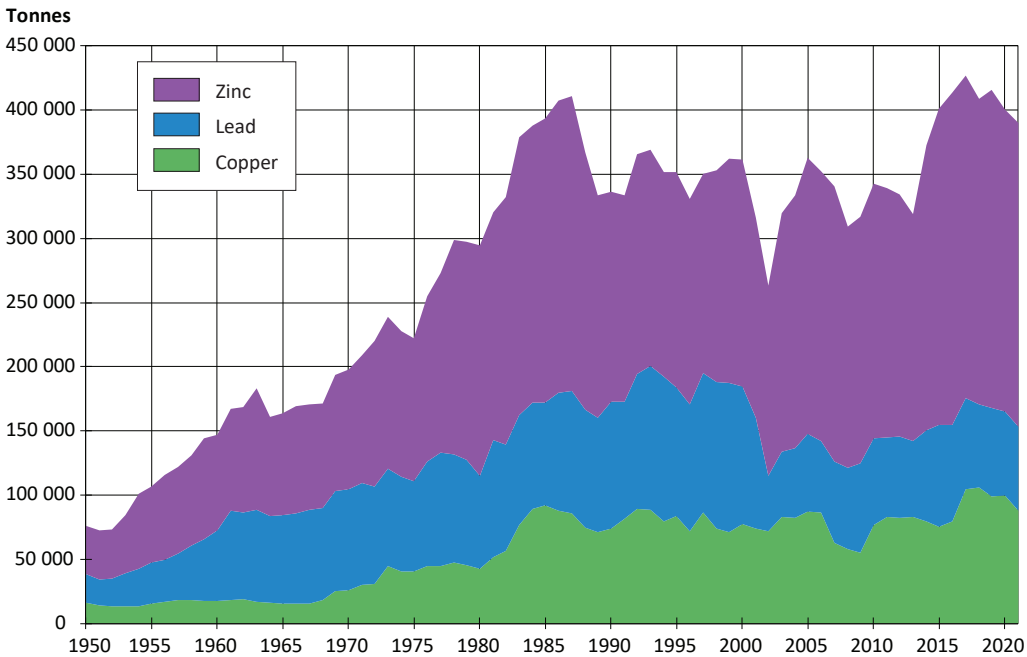

Figure 10. Metal content in copper, lead and zinc ores mined in Sweden 1950–2021.

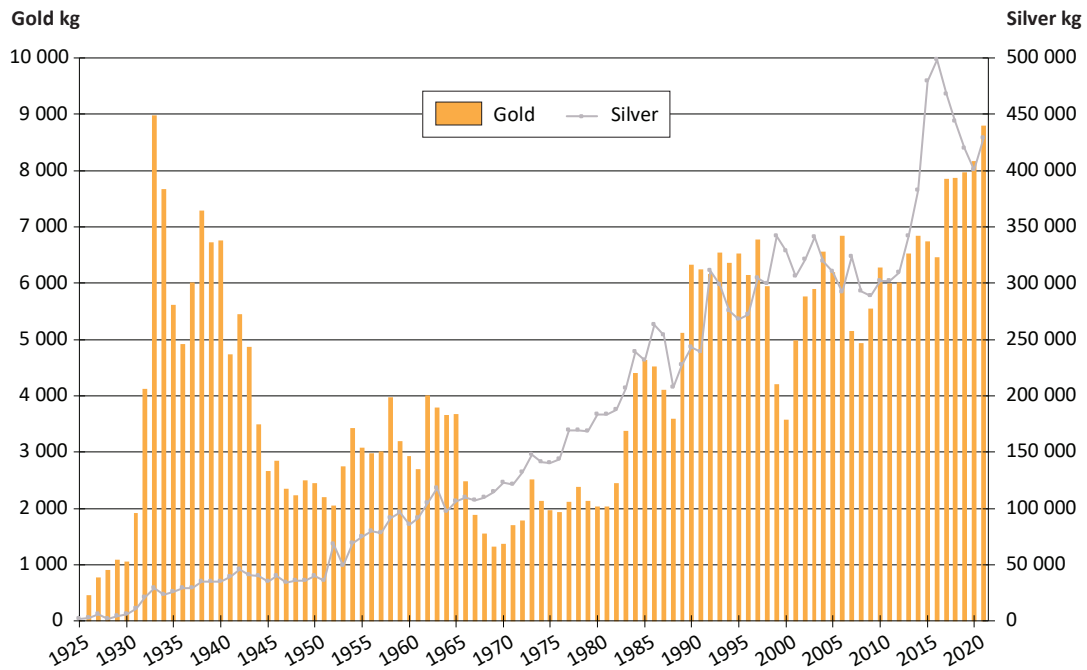

Figure 11. Production of gold and silver (metal content) in Swedish mines (1925–2021).

Boliden area

In the Boliden area within the Skellefte field in Västerbotten, Boliden had production at three mines in 2021: Kristineberg, Renström and Kankberg. The ores in Renström and Kristineberg are massive sulphide ores with copper, zinc and lead as well as considerable levels of gold and silver. The ore in Kankberg Mine is of a different type, and the economically viable elements are gold and tellurium (Table 12).

Ore from the mines in the Skellefte field is transported to the concentrator in Boliden for enrichment. As shown in Table 11, 1.64 million tonnes were enriched in 2021 (including older waste rock deposits), which was slightly more than in 2020. However, the amount of metal in concentrates (with the exception of lead) fell due to lower metal concentration in the ore. Tellurium production, which started at the Boliden enrichment plant in 2012 using ore from Kankberg Mine, was 41.4 tonnes, about the same as the previous year.

Boliden has reported a new mineral resource at Strömfors (4 km northwest of Boliden). Additionally, parts of the deposit at Rävliden have been converted into mineral resources, i.e. they have a proven economic value. For the entire Boliden area, this means that in 2021 mineral resources increased by 9 per cent and mineral reserves rose by 4 per cent.

Garpenberg Mine

Garpenberg Mine is situated in Hedemora Municipality, Dalarna County. The ore in Garpenberg consists of several ore bodies in a altered, folded and faulted limestone horizon. The ore bodies are thought to have been formed by impregnation of the limestone by mineralising fluids. The ore bodies in Garpenberg are zinc- and lead-rich and also contain a little copper. Silver concentration is relatively high and silver production accounted for approximately 35 per cent of revenue from Garpenberg Mine in 2021.

Investments in recent years have increased production capacity at Garpenberg. Table 11 shows that 3.05 million tonnes of ore was produced in 2021, up 1.8 per cent on the previous year. Since metal content was roughly at the same level as in 2020, the total production of concentrate also rose. Just over 204,000 tonnes of zinc, 53,000 tonnes of lead and 6,000 tonnes of copper were produced in 2021 (Table 11). On average, output grew by 1.8 per cent relative to the previous year. Almost 80 per cent of production comes from Lappberget, which is the largest ore body.

Aerial view of the Kankberg mine within the Boliden area. Photo: Tomas Westermark/Boliden

Mineral reserves increased by 4.7 per cent to 93.7 million tonnes and mineral resources rose by as much as 27.2 per cent to 79 million tonnes.

DRAGON MINING SWEDEN AB

Svartliden Mine

Dragon Mining's gold mine in Svartliden is located about 70 km west of Lycksele in Västerbotten County. Dragon Mining is an Australian mining and exploration company. The shares are listed on the Hong Kong Stock Exchange. In addition to Svartliden, the Fäboliden mining project and the Svartliden enrichment plant, the company owns three mines and one enrichment plant in Finland. Mining at Svartliden ceased a few years ago, but the Svartliden concentrator has continued to process gold concentrates from the company's mines in Finland.

Test mining at Fäboliden, about 22 km southeast of Svartliden, was completed in September 2020. Approximately 100,000 tonnes of ore with an average concen-

tration of 2.6 grams/tonne of gold was mined, bulk sampled and tested at the Svartliden enrichment plant. The company is now waiting for permission to continue with regular mining, which is planned for 2022. Fäboliden has mineral resources of 10 million tonnes with an average concentration of 3.1 grams/tonne of gold. Mineral reserves consists of 2.1 million tonnes with an average concentration of 2.9 grams/tonne of gold.

LOVISAGRUVAN AB

Lovisa Mine

Lovisa Mine is a small, metal-rich lead and zinc mine located just over 15 kilometres north of Lindesberg in Örebro County in Bergslagen ore district. The mine is operated by Lovisagruvan AB. A similar ore is also mined at Zinkgruvan (see next section), but Lovisa Mine is much smaller.

When production started in 2005, the ore deposit was estimated to contain 0.4 million tonnes at an average concentration of 22 per cent of Zn, 14 per cent of Pb and some silver. At the end of 2021 total production to date, proven mineral resources and probable mineral resources were together estimated to contain 1.178 million tonnes at an average concentration of 9.2 per cent of Zn and 5.4 per cent of Pb. Mineral resources are estimated at 0.576 million tonnes at an average concentration of 9.4 per cent of Zn and 3.5 per cent of Pb.

Ore mining takes place at different levels in the mine. The deepest level is currently 235 metres below the surface. Just over 37,000 tonnes of ore were mined in 2021 (Table 11), 8 per cent less than in 2020. The company transports the ore to an enrichment plant in Poland (ZGH Boleslaw). Shipping ore is expensive, so the company has invested in advanced sorting of ore to avoid shipping waste rock. The company has discussed building its own enrichment plant for many years, and those discussions continued in 2021.

LUNDIN MINING

Zinkgruvan Mine

Zinkgruvan Mine is located about 18 km southeast of Askersund in Örebro County. The mine has had several owners during more than a hundred years of operation. It is currently owned by Lundin Mining, a Canadian mining company that also owns or co-owns other mines in Brazil, Portugal, Chile and the US.

The zinc and lead ore at Zinkgruvan consists of bands of massive sphalerite and galena with volcanic and sedimentary rocks as host rock. Recent research has shown that the mineralised fluids that formed the ore deposit were first oxidised, as they upwelled onto the seabed, and metals precipitated in the form of sulphides only in areas where oxidised fluids were reduced due to prevailing reduced conditions. This makes the ore-forming process at Zinkgruvan different from most other Swedish sulphide ores (except for the Lovisa ore), but similar to the large Sedex ores in Australia (the McArthur River deposit). The research results also provide evidence of the connections between the zinc-lead ore in Zinkgruvan and the copper-cobalt ore mined at the same location. The copper-cobalt ore is located where the oxidizing solutions were upwelling out, on or just below the seabed level at the time of ore formation.

Mining of zinc, lead and copper ores at Zinkgruvan takes place underground. The ore is transported to the concentrator located next to the mine. The ore is enriched in two parts; one part that processes zinc-lead ore and in another that processes both copper ore and zinc-lead ore in 'campaigns' (production for limited periods). The concentrates produced are sold to smelters in Europe.

A total of about 1.4 million tonnes of ore was mined at Zinkgruvan in 2021, consisting of 1.2 million tonnes of zinc-lead ore and 0.2 million tonnes of copper ore, both figures slightly down from 2020. Table 11 shows that metal concentrate production was 10.7 tonnes (copper), 31.8 tonnes (lead) and for almost 147,500 tonnes (zinc). The first two figures represent a fall in production of almost 16 per cent and 6 per cent respectively, compared with the previous year, due to lower metal content. In contrast, production from zinc concentrate rose by almost 4 per cent.

Mineral reserves of 10.3 million tonnes (zinc) and 2.2 million tonnes (copper), and mineral resources of 34.5 million tonnes (zinc) and 4.2 million tonnes (copper) ensure several years of future production.

Electric power lines at Aitik Mine. In 2021, the degree of electrification was 61 percent in the Swedish mines. Foto: Mats Hillblom/Boliden.

Environmental Statistics

MINING WASTE

Mining usually generates two solid waste fractions: waste rock and tailings. Waste rock is the material that is removed to reach to the ore. Waste rock is a heterogeneous material that can have a very variable grain size. It may consist of both fine and coarse material, such as stones and blocks. Piles of waste rocks are usually located close to open pits, primarily to reduce transport costs. Figure 12 shows the location and size of open-pit storage in Sweden. Waste rock is also returned to open-pit or underground mining sites when all ore has been mined.

Tailings are a residue from the enrichment processes. After enrichment, the tailings are transported as slurry (sand and process water) with a high water content via pipelines to ponds (sand reservoirs), where the solid material is allowed to settle. Sand reservoirs are usually located a little further away from the open pits. Figure 13 shows the location and size of open-pit storage in Sweden. Tailings can also be deposited as infill in disused mining sites or be converted into a thickened deposit, where the process water is pressed out and then reused in the enrichment processes.

SGU's survey shows that the amount of tailings has remained relatively constant over the past three years, whereas waste rock quantities have increased. As shown in Table 15, approximately 130 million tonnes of mining waste was generated in 2021, of which 72 million tonnes was waste rock and about 58 million tonnes was tailings. Theoretically, higher metal prices cause

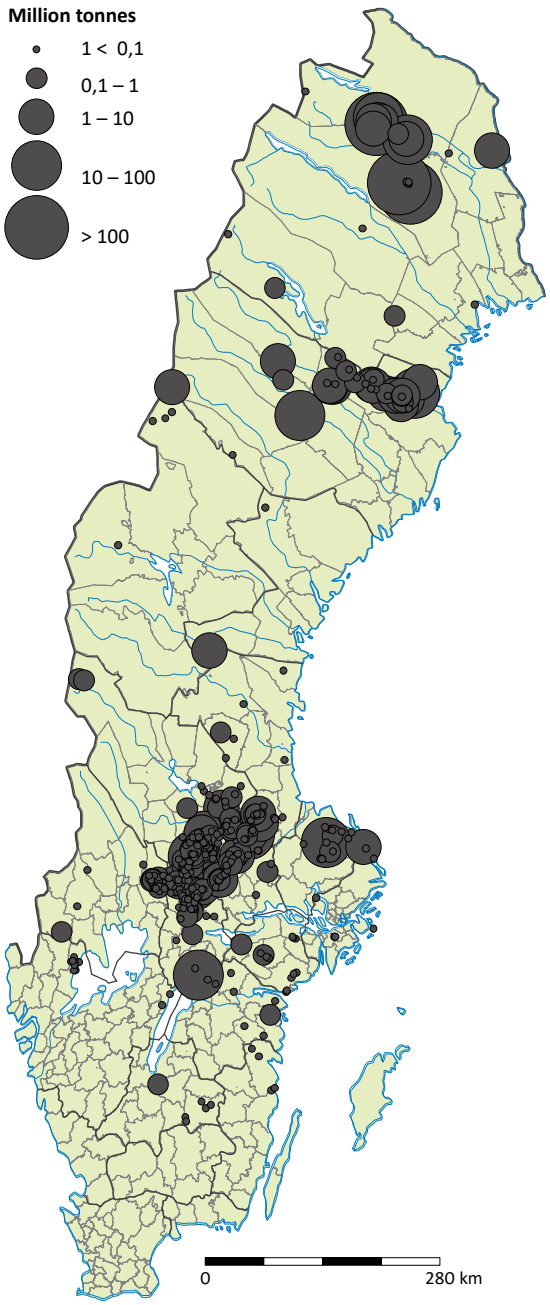

Figure 12. Waste rock, million tonnes. Data from SGU database: Ores and Minerals, see MapViewer, www.sgu.se.

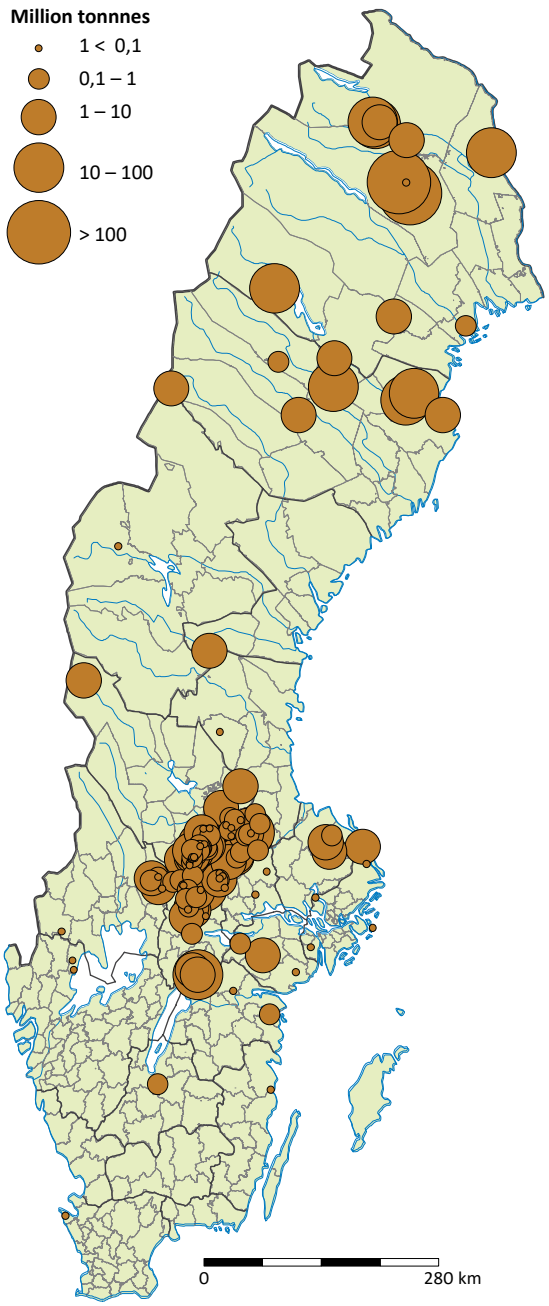

Figure 13. Tailings, million tonnes. Data from SGU database: Ores and Minerals, see MapViewer, www.sgu.se.

waste rock quantities to fall and tailings to increase, as the economic break-even point rises. However, local measures greatly impact the amount of mining waste, for example when a mine chooses to expand mining at a new level. Hence, the economic theory does not always hold good in practice, as was evidenced in 2021, a year that saw generally higher metal prices.

As mentioned above, mining residues are used for backfilling. They can also be used as rock material in roads or sold as aggregates if they do not pose an environmental hazard. However, the vast majority of waste is landfilled. Based on reported data for 2021, 67 per cent was used as landfill and 28 per cent as backfill. One per cent of mining waste was sent to market (Table 16).

The totals in Tables 15 and 16 differ by nearly 0.1 million tonnes. This is because the former refers to estimated quantities based on production statistics and the latter figure represents reported quantities. The difference can mainly be attributed to differences in the calculated quantities of waste rock.

USE OF FRESH WATER IN PROCESSING PLANTS

Processing plants use fresh water from surrounding lakes or streams. The tailings are pumped out as slurry with a high water content to sedimentation and clearing ponds where the sand can settle. Mining companies reuse process water from sedimentation and clarification ponds, enabling use of less fresh water in the processes.

Data from the Swedish Environmental Reporting Portal (SMP) show that fresh water use in processes at Swedish mines in 2021 varied between about 0.07 and 3.5 million cubic metres. LKAB's iron ore mines do not report how much fresh water has been used in the processes (Fig. 14). However, the mines use far more fresh water than reported; a large proportion of process water is recycled or taken from precipitation. In addition to fresh water, Boliden's Rönnskär smelter uses seawater, albeit mainly for cooling purposes.

The volumes of fresh water used in processes at Swe-

Table 15. Estimated amount of waste rock and tailings 2020 and 2021, and in total between 1833 and 2021.* Source: SGU survey

	Estimated amount (million tonnes)		
	2021	2020	1833–2021
Iron ore mines			
Waste rock	38.1	32.9	1062
Tailings	11.0	12.8	339
Non-ferrous ore mines			
Waste rock	34.0	28.1	957
Tailings	46.6	47.9	1 119
All mines			
Waste rock	72.1	61.0	2 019
Tailings	57.6	60.7	1 458
Total	129.63	121.7	3 477

* Information only indicates how much ore and waste rock has been produced and how much material has been processed in the enrichment plant. A large part of the material may have gone back to the mine as construction of infrastructure, filling, etc.

Table 16. Residues from iron ore and non-ferrous ore 2021. Source: SGU survey

	Reported amount (million tonnes)
Iron ore mines	
Waste rock for selling	1.5
Waste rock for backfilling	0.0
Waste rock for landfill	34
Waste rock for mine infrastructure	4.5
Tailings for backfilling	0.1
Tailings for landfill	9.0
Non-ferrous ore mines	
Waste rock selling	0.3
Waste rock for backfilling	33.2
Waste rock for landfill	0.2
Waste rock for mine infrastructure	0.2
Tailings for backfilling	2.6
Tailings for landfill	43.9
All mines	
Waste rock	74.0
Tailings	55.5
Total	129.5
Share for landfill	67 %
Share for backfilling	28 %
Share for selling	1 %

dish mines vary between about 1 and 60 million cubic metres. Consumption at most mines remained fairly constant between 2013 and 2021. Aitik is an exception and has increased water use. A total of 60 million cubic metres was used at Aitik in 2021. However, the mine has maintained a high recycling rate and collection from precipitation. The recycling rate at Aitik is nearly 100 per cent. Boliden's processing plant showed an increased recycling rate in 2021, from 3 to nearly 30 per cent.

DISCHARGE OF METALS TO RECIPIENTS

Operations at Swedish mines are subject to target levels for metal discharges to surrounding water. Metal discharges have generally fallen over time. This is due to stricter regulation of water management and water treatment processes. Data on metal discharges from Swedish mines are presented in Table 19. The main decreases in 2021 can be attributed to lead, nickel and zinc.

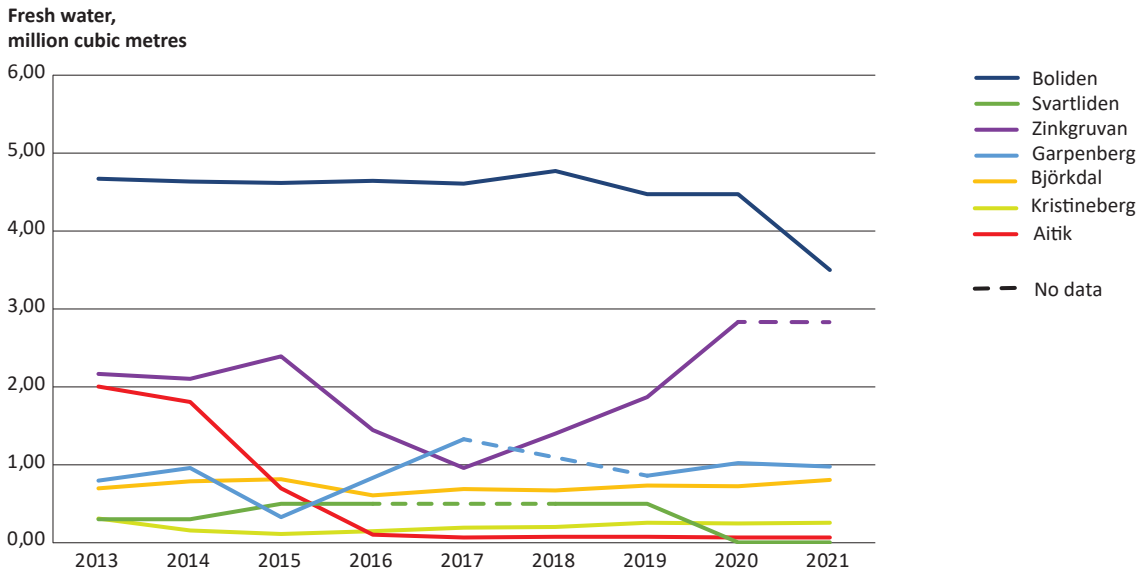

Figure 14. Fresh water use (not including sea water) at Swedish mines and smelters during 2013–2021, million cubic metres. Source: own processing of data from the Swedish Environmental Reporting Portal (SMP)

Table 17. Metal discharges to water from Swedish mine sites 2013–2021 (kg/year). Source: own processing of data from the Swedish Environmental Reporting Portal (SMP)

	2013	2014	2015	2016	2017	2018	2019	2020	2021
Cadmium	9.26	8.91	8.00	8.09	4.60	5.13	5.29	7.23	6.56
Copper	239.40	1495.83	211.52	203.04	151.97	112.20	80.76	91.24	85.52
Nickel	156.62	206.75	244.89	227.34	175.82	153.14	128.31	196.53	175.39
Lead	167.14	121.12	70.29	61.84	43.29	148.57	119.75	109.46	79.29
Zinc	3055.38	3406.74	2693.80	2470.53	1303.61	2071.50	1851.20	2564.98	1791.96

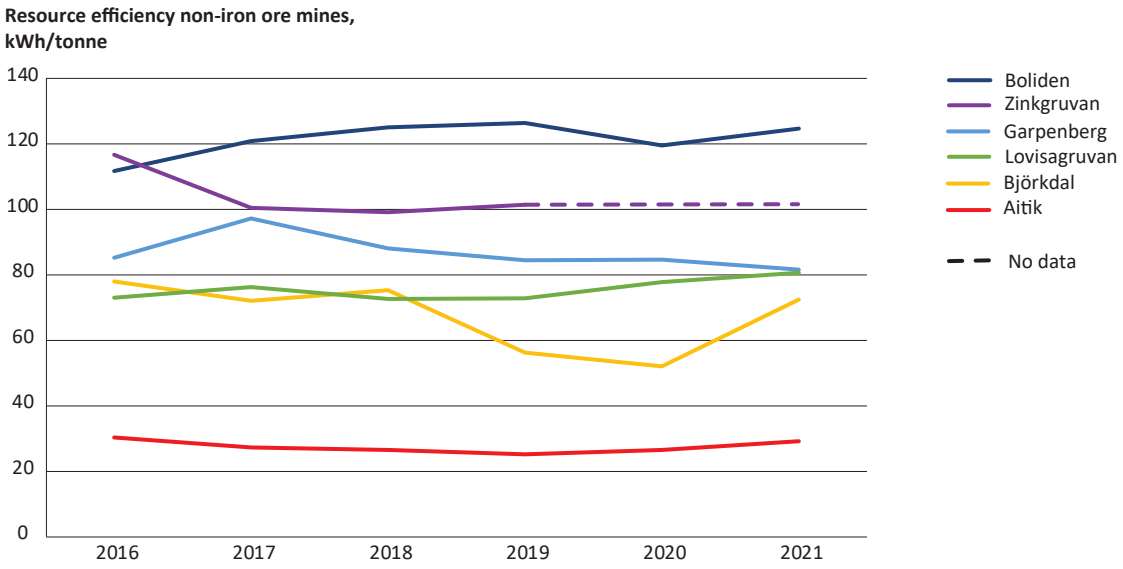

Figure 15. Resource efficiency non-iron ore mines 2016–2021. Source: own processing of data from the Swedish Environmental Reporting Portal (SMP)

RESOURCE EFFICIENCY

Resource efficiency is calculated by dividing the total amount of energy (electricity + fossil fuels) in kilowatt hours (KWh) consumed at the mine, by the amount of ore enriched (tonnes). The unit of resource efficiency is kWh/tonne. The calculations in this section are based on data from the Swedish Environmental Reporting Portal (SMP).

The resource efficiency of base metal mines remained fairly constant between 2016 and 2021 (Fig. 15). Resource efficiency is highest at the Aitik mine. Energy consumption per unit of ore produced here reached nearly 29 kWh/tonne. The lowest resource efficiency for base metals is in the Boliden area. Energy consumption per tonne of ore produced was just over 119 kWh/tonne. Boliden's concentrator enriches ore from the mines in Kankberg, Kristineberg and Renström, which are located between 10 and 90 km from the enrichment plant. Transport is probably a factor contributing to the low resource efficiency at Boliden. The resource efficiency of Björkdal mine varied between 2018 and 2021. One reason is the operational variation between open-pit and underground mining.

The resource efficiency of the iron ore mines is not directly comparable, since they produce different products. LKAB mainly produces pellets; Kaunis Iron produces so-called fines (finely crushed iron ore which is melted into cake shape form). Pellet production consumes more energy. In 2021, however, Kaunis Iron had lower resource efficiency than LKAB because the company had increased its waste rock production. Resource efficiency at iron ore mines is presented in Figure 16.

ENERGY CONSUMPTION

Energy consumption at Swedish mines increased between 2018 and 2021, probably due to higher processing quantities. Energy consumption may also be affected by the degree of electrification, which is calculated by dividing total consumption of electricity by total energy consumption. Total energy consumption includes the use of electricity and fossil fuels (e.g., oil, diesel, coal and petrol).

Data from SMP show that the rate of electrification in Swedish mines is between 45 and 84 per cent and that the average level of electrification remained fairly

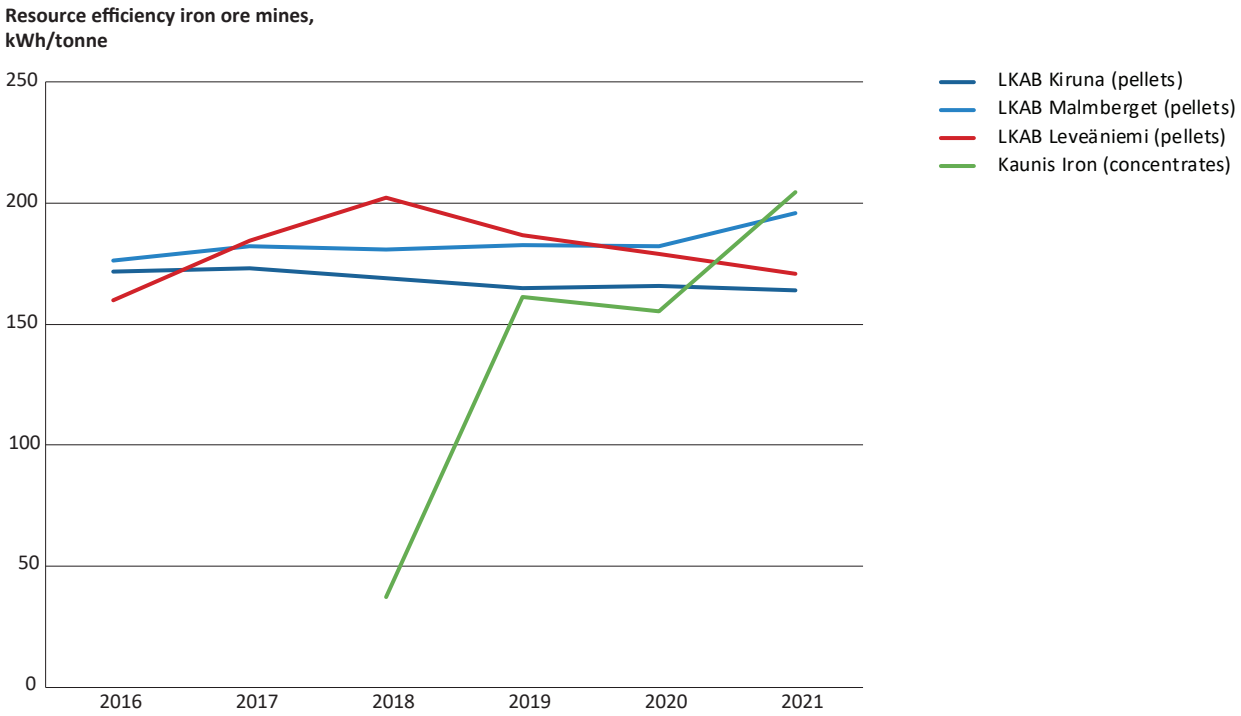

Figure 16. Resource efficiency iron ore mines 2016–2021. Source: own processing of data from the Swedish Environmental Reporting Portal (SMP)

constant at around 60 per cent between 2016 and 2021 (61 per cent in 2021, Fig. 17). However, the degree of electrification at the Björkdal mine and the Tapuli mine has fallen significantly. This may be due to higher volumes of waste rock, which has resulted in higher diesel consumption. In the Boliden area, mining at Maurliden has now been discontinued, which has reduced the long-distance transport of ore. This is also reflected in the degree of electrification at Boliden's enrichment plant. The electrification rate for all mines supplying ore to the concentrator averaged 77 per cent in 2021. The electrification rate for the concentrator alone was much higher – over 90 per cent.

SECONDARY RAW MATERIALS

Sweden has a high recycling rate for most common metals such as iron (steel scrap), base metals and precious metals. Steel scrap containing alloy metals is sorted by alloy metal to produce new alloy steel. Use of rare earth elements has increased in recent years, for example in battery manufacture. Recycling of rare earth elements is significantly lower. This is because there is less metal in circulation and recycling methods are not fully developed.

In the smelters, metals are produced directly from ore extracted in the mines ("primary smelting material") or from recycled materials (secondary smelting materials such as scrap, e-scrap, metal ash or steel mill dust). The amount of metals produced in Sweden from recycled materials during 2016–2021 is presented in Table 18.

It is not possible to report the proportion of metals produced from secondary materials of Swedish origin, however. The introduced or imported proportion of the total amount of melting material is unknown and may vary from year to year.

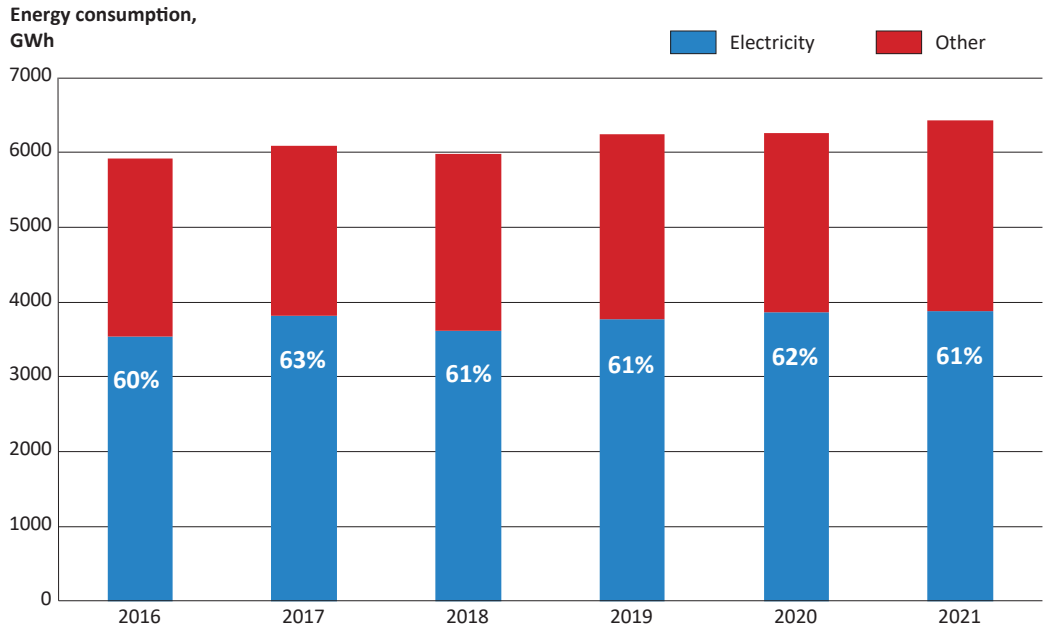

Figure 17. Energy consumption and electrification of Swedish mines 2016–2021. Source: own processing of data from the Swedish Environmental Reporting Portal (SMP).

Table 18. Metal content in tonnes of secondary raw materials (recycled raw materials) 2016–2021. The metal content has been refined in Sweden, whereas the origin is both domestic and imported.

	2016	2017	2018	2019	2020	2021
Iron (steel scrap)	2 185 000	2 317 000				
Copper	58 352	61 488	56 125	54 378	58 757	60220
Lead (Boliden Bergsöe)*	46 000	50 000	47 000	49 000	46 000	46 000
Zinc	16 200	24 696	0	19 007	27 071	17935
Aluminium	75 235	72 589	74 176	68 500	58 100	67 000
Gold	5.9	5.6	4.7	4.1	4.5	3.19
Silver	102	97	109	100	131	111

* Refers to lead alloys.

Exploration and exploration permits

Exploration activities in Sweden reached a record high in 2021. Figure 18 shows that total investments in Sweden increased by 27 per cent. Investments were just over SEK 970 million in 2020 and SEK 1,230 million in 2021. The main exploration companies are the mining companies LKAB, Boliden and Zinkgruvan Mining AB, which together account for 80 per cent of exploration in the country. Most exploration in 2021 was in the form of near-mine explorations, i.e. exploration in or near an existing mine. Strategic efforts to extend the life of mining around existing mining operations are costly. About half of the exploration took place in Norrbotten County. Investments in exploration for base metals and gold were the largest. Iron exploration accounted for 46 per cent in 2021. Only a small proportion of investments involved exploration for battery metals and graphite.

There were 585 current exploration permits at the end of 2021 (Table 19, Fig. 19). This figure was up on the previous year, when 550 permits had been issued. Permit numbers are currently fairly low compared with historical levels. In 2013 there were 853 exploration permits.

Eighty-five new exploration permits were granted in 2021 (Fig. 20, Table 20). Figures 20 and 21 show that exploration permits granted are decreasing over time, both in number and in area covered. 111 permits were granted in 2020 and 97 in 2019. In the preceding years

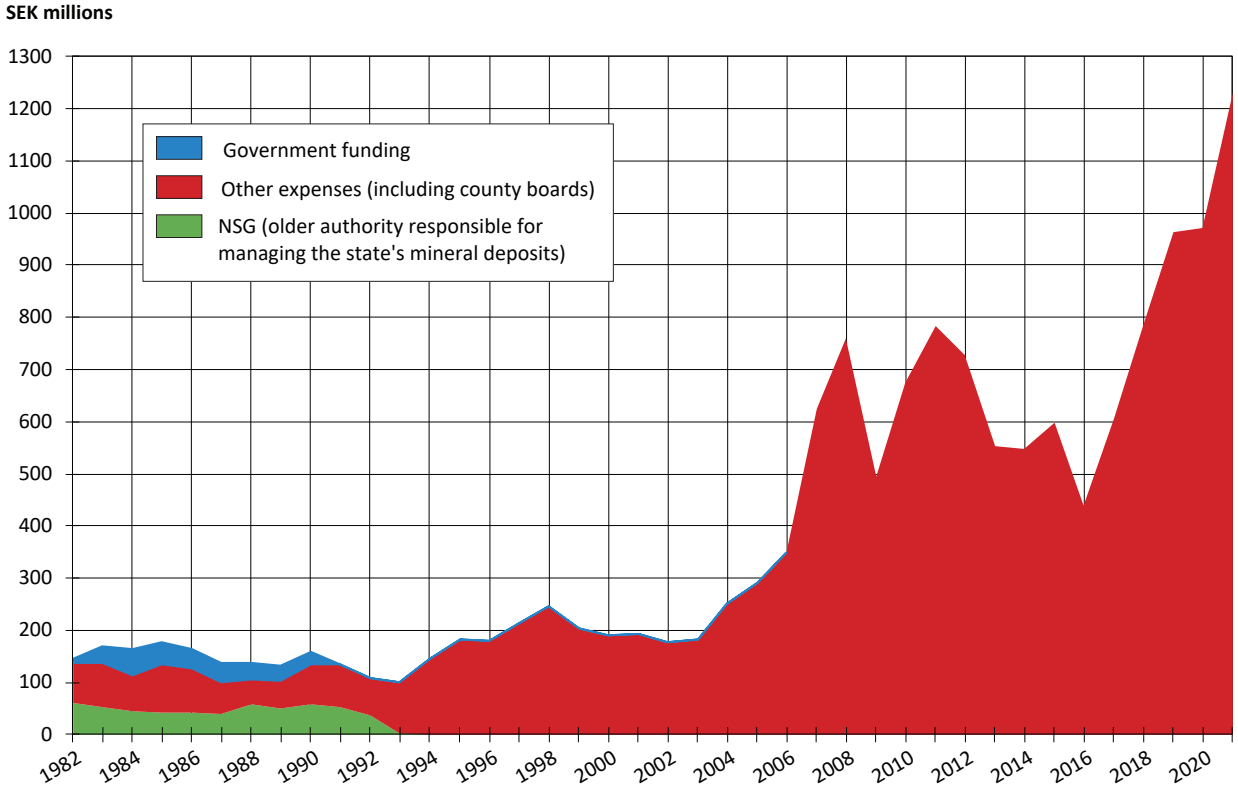

Figure 18. Value of exploration in Sweden 1982–2021 (SEK millions, current prices)

between 100 and 200 permits were granted each year. The number of renewals has also decreased. Sixty-one permits were renewed in 2021, down from 72 in 2020. The renewal figure in 2019 was 45 (Table 21). The permits granted in 2021 were mainly for Västerbotten County, Norrbotten County and Dalarna County.

Valid permits covered 38 metals and minerals (Table 22). Copper and gold dominated with 63 and 60 per cent respectively. Next were silver (40%), zinc (39%), lead (30%), iron (15%), cobalt (11%), nickel (9%) tungsten and molybdenum (7% each.) The metals that saw the largest increase in the number of exploration permits granted in comparison with 2020 were gold (+19), lead (+12) as well as zinc and silver (+10 and +10 respectively). The largest decrease was for tungsten (-4).

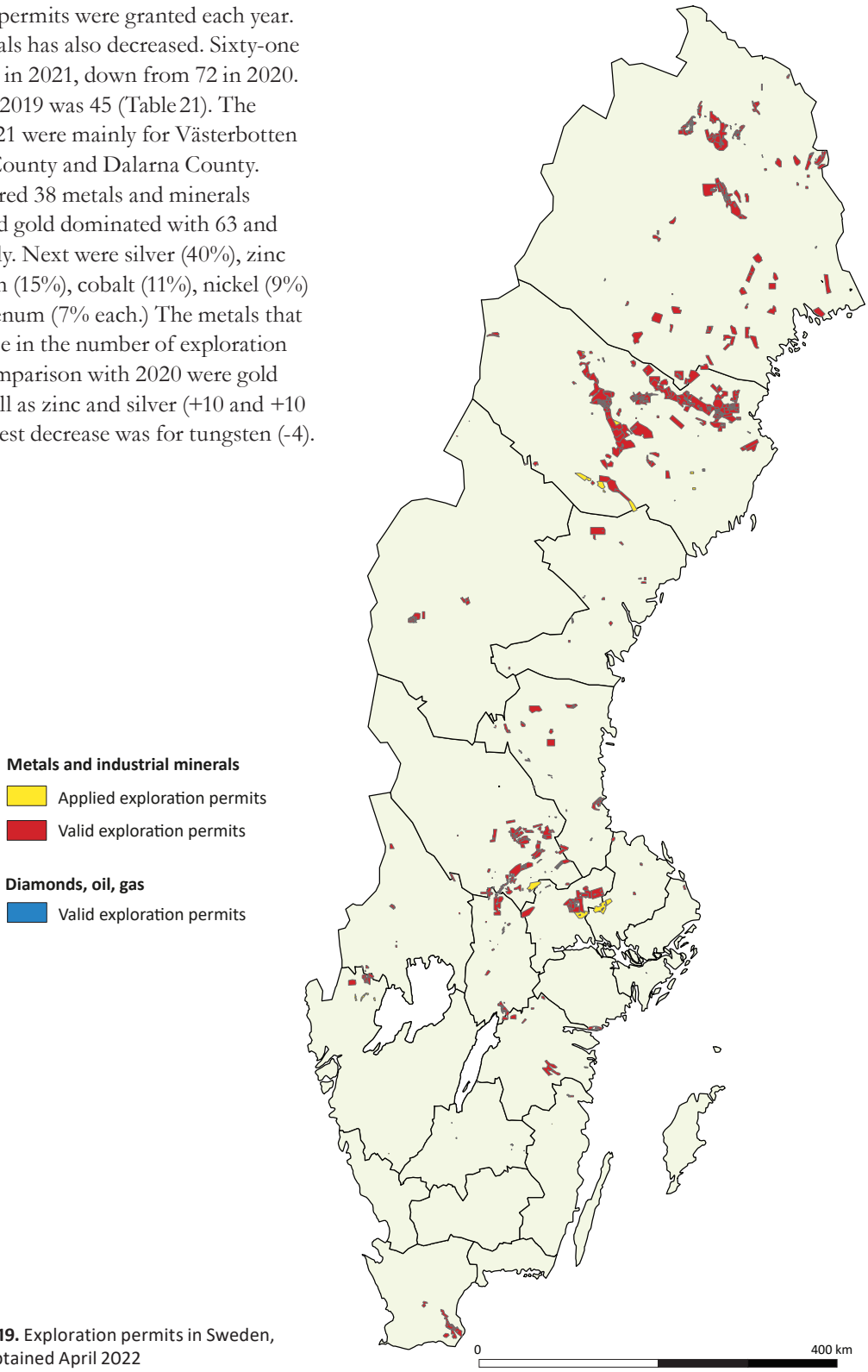

Figure 19. Exploration permits in Sweden, data obtained April 2022

Table 19. Valid exploration permits at the end of 2021. Source: Bergsstaten

County	Mineral Act 1 kap. 1 § 1 och 2 st. [1]		Mineral Act 1 kap. 1 § 3 st. [2]		Total	
	Number	Area (ha)	Number	Area (ha)	Number	Area (ha)
Dalarna	87	104 249			87	104 249
Gävleborg	40	38 215			40	38 215
Jämtland	12	16 517			12	16 517
Jönköping	5	245			5	245
Kalmar	2	1 371			2	1 371
Norrbotten	136	300 966	2	429.49	138	301 395
Skåne	15	21 968			15	21 968
Stockholms	2	1 089			2	1 089
Södermanland	3	4 261			3	4 261
Uppsala	9	29 553			9	29 553
Värmland	11	5 318			11	5 318
Västerbotten	186	481 203			186	481 203
Västernorrland	14	20 896			14	20 896
Västmanland	20	26 105			20	26 105
Västra Götaland	9	8 388			9	8 388
Örebro	26	38 497			26	38 497
Östergötland	8	21 321			8	21 321
Total	**585**	**1 120 163**	**2**	**429**	**587**	**1 120 593**

[1] The Minerals Act 1 kap. 1 § 1&2 st. includes all mineral substances listed in the Act except oil, gaseous hydrocarbons and diamond.
[2] The Minerals Act 1 kap. 1 § 3 st. includes oil, gaseous hydrocarbons and diamond

Table 20. Number of exploration permits granted in 2021. Source: Bergsstaten.

County	Mineral Act 1 kap. 1 § 1 och 2 st. [1])	
	Number	Areal (ha)
Dalarna	11	7 277
Gävleborg	7	6 153
Jämtland	2	6 107
Jönköping	0	0
Kalmar	0	0
Norrbotten	21	71 540
Skåne	0	0
Stockholms	0	0
Södermanland	1	244
Uppsala	1	32
Värmland	2	1 441
Västerbotten	24	119 147
Västernorrland	7	17 716
Västmanland	6	9 958
Västra Götaland	0	0
Örebro	3	1 848
Östergötland	0	0
Total	**85**	**241 464**

[1] The Minerals Act 1 kap. 1 § 1&2 st. includes all mineral substances listed in the Act except oil, gaseous hydrocarbons and diamond.

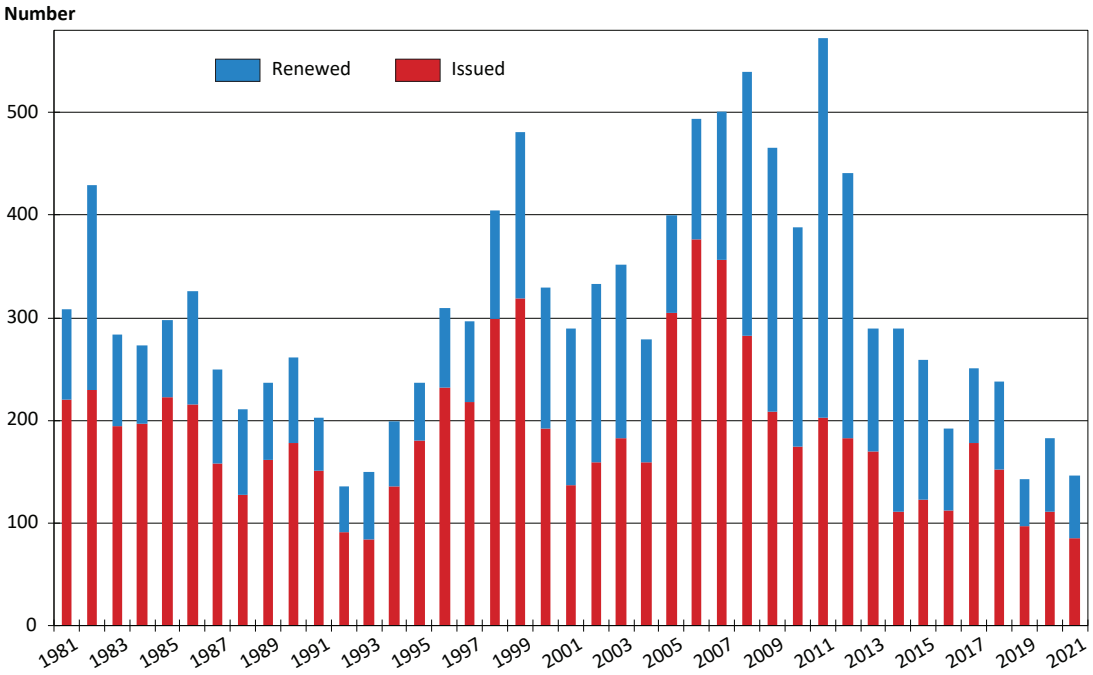

Figure 20. Number of claim certificates and exploration permits issued or renewed 1981–2021.

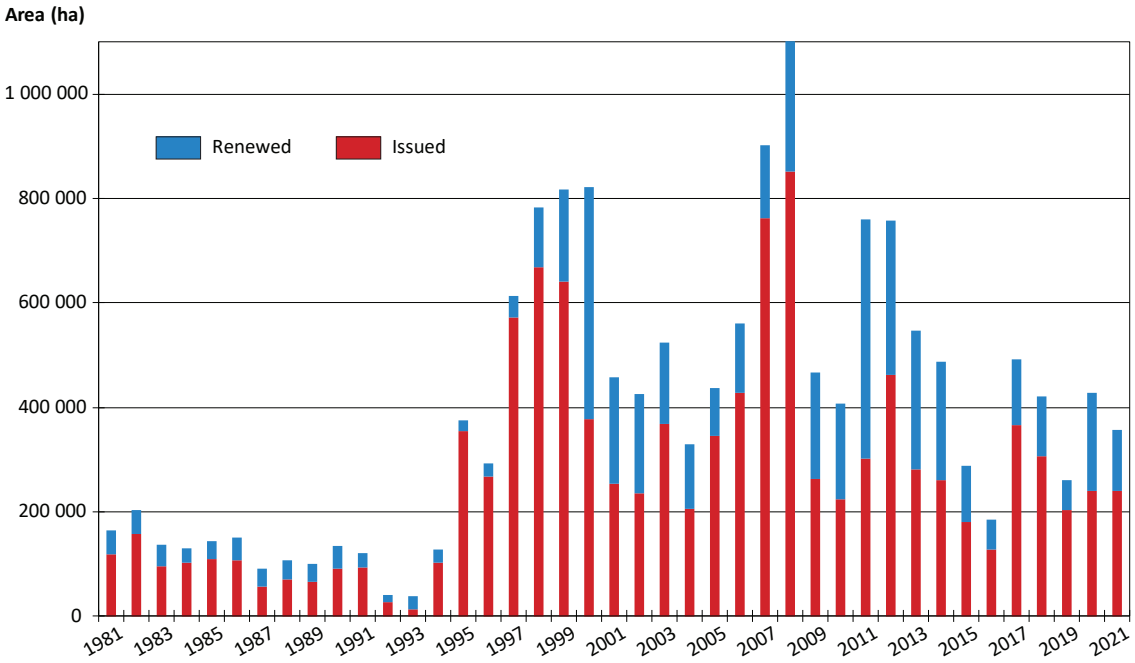

Figure 21. Area of claim certificates and exploration permits issued or renewed (not including diamonds) 1981–2021.

Table 21. Exploration permits renewed in 2021. Source: Bergsstaten.

County	Mineral Act 1 kap. 1 § 1 och 2 st. [1])	
	Number	Area (ha)
Dalarna	6	5 577
Gävleborg	2	2 415
Jämtland	1	1 598
Jönköping	1	64
Kalmar	0	0
Norrbotten	6	9 469
Skåne	0	0
Stockholms	0	0
Södermanland	0	0
Uppsala	3	5 081
Värmland	1	708
Västerbotten	28	72 058
Västernorrland	0	0
Västmanland	3	5 062
Västra Götaland	0	0
Örebro	8	11 081
Östergötland	2	1 827
Total	**61**	**114 940**

[1]) The Minerals Act 1 kap. 1 § 1&2 st. includes all mineral elements listed in the Act except oil, gaseous hydrocarbons and diamond.

Table 22. Number of concession minerals applied for in valid exploration permits in 2021, compared with 2020. The percentage shows the proportion of each element in the total number of exploration permits. Difference in number. Source: Bergsstaten.

Mineral	Number applied for 2021		Number applied for 2020		Difference 2020–2021
Copper	367	63 %	364	66 %	3
Gold	354	60 %	341	62 %	13
Zinc	231	39 %	220	40 %	11
Silver	236	40 %	225	41 %	11
Lead	176	30 %	164	30 %	12
Iron	87	15 %	82	15 %	5
Cobalt	66	11 %	67	12 %	-1
Tungsten	41	7 %	45	8 %	-4
Molybdenum	39	7 %	37	7 %	2
Nickel	53	9 %	49	9 %	4
Vanadium	27	5 %	28	5 %	-1
Graphite	17	3 %	16	3 %	1
Lithium	18	3 %	11	2 %	7
Tin	12	2 %	12	2 %	0
Platinum	31	5 %	25	5 %	6
Palladium	34	6 %	28	5 %	6
Tantalum	11	2 %	4	1 %	7
Titanium	14	2 %	15	3 %	-1
Scandium	13	2 %	12	2 %	1

Mineral	Number applied for 2021		Number applied for 2020		Difference 2020–2021
Iridium	16	3 %	14	3 %	2
Lanthanum	13	2 %	12	2 %	1
Osmium	16	3 %	14	3 %	2
Rhodium	16	3 %	14	3 %	2
Ruthenium	16	3 %	14	3 %	2
Yttrium	12	2 %	11	2 %	1
Apatite	7	1 %	7	1 %	0
Cesium	3	1 %	2	< 1 %	1
Bismuth	1	< 1 %	1	< 1 %	0
Rubidium	2	< 1 %	2	< 1 %	0
Zirconium	3	1 %	4	1 %	-1
Beryllium	1	< 1 %	1	< 1 %	0
Fluorspar	0	0	0	0	0
Magnesite	0	0	0	0	0
Manganese	0	0	0	0	0
Ephelin syenite	1	< 1 %	1	< 1 %	0
Niobium	1	< 1 %	0	0	1
Antimony	1	< 1 %	0	0	1
Wollastonite	1	< 1 %	0	0	1

Björkdal Mine with lake Mörttjärnen in the foreground. Photo: Henrik Sendelbach/CC BY-SA 4.0

Mining concessions and mineral fees in Sweden

There were three new mining concessions in 2021. Six concessions were pending at the end of the year. One concession has been revoked. Two mining concessions were rejected and one application was dismissed. One application for a processing concession was granted (Table 23).

The approved mining concession concerned Kvarnforsliden K nr 1 in Skellefteå municipality. The applicant was Björkdalsgruvan AB. The concession included gold and an indicated mineral resource of 25,200 tonnes of ore with a content of 2.4 g/tonne and an assumed mineral resource of 172,000 tonnes with a content of 2.0 g/tonne.

There were 165 valid mining concessions at the end of 2021. Table 24 presents the distribution of concessions in 2021. Most of the sites are located within the three ore regions in Sweden: Malmfälten in Norrbotten County, Skelleftefältet with gold line in Västerbotten County and Bergslagen (most in Dalarna County). At the end of the year, there were 12 active mines with concessions, all metal mines.

Table 25 presents mineral fees (SEK) for the years 2006 to 2021. In 2021 there were 21 mining concessions. Total mineral fees were SEK 20,650,662, up approximately SEK 2.7 million on the previous year. The mineral fees were apportioned between the state (approximately SEK 5.2 million) and landowners (approximately SEK 15.5 million).

Table 26 presents mineral fees paid to the state under the Minerals Act for the years 2006 to 2021. Note that application fees for mining concessions are not specified, since these are included in the fee for mining concessions. The total sum paid to the state in 2021 was just over SEK 12.4 million.

Table 23. Approved and rejected mining concession applications 2001–2021. Source: Bergsstaten.

Year	Applied	Of wich utmål*	Approved	Of wich utmål*	Rejected	Errends prepared for decision by the government**
2001	5	1	14	11	1	0
2002	9	8	23	20	0	0
2003	4	4	17	15	0	0
2004	4	2	5	3	0	0
2005	3	1	2	1	0	0
2006	4	0	2	0	0	0
2007	3	1	7	0	0	0
2008	8	0	5	0	0	0
2009	4	1	4	0	0	0
2010	8	1	4	1	0	0
2011	7	1	2	0	0	0
2012	6	0	7	1	0	0
2013	6	1	5	0	1	0
2014	6	0	5	2	2	1 (Eva K nr 1)
2015	9	1	2	0	0	1 (Kallak K nr 1)
2016	4	0	6	1	1	0
2017	4	0	6	0	0	1 (Kallak K nr 1)
2018	2	0	4	0	1	0
2019	4	0	2	0	1	0
2020	3	0	0	0	0	0
2021	**3**	**0**	**1**	**0**	**2**	**0**

* Conversion to mining concessions of old, expiring permissions (utmål).
** Cases where Bergsstaten has referred the decision to the government.

Table 24. Valid mining concessions at the end of 2021. Source: Bergsstaten.

County	Number of mining concessions		
	Expired	New	Valid att the end of 2021
Uppsala			2
Östergötland			2
Kalmar			1
Skåne	2		1
Värmland	1		0
Örebro			5
Dalarna			30
Gävleborg			8
Västernorrland			1
Jämtland			3
Västerbotten		1	74
Norrbotten	1		38
Summa	**4**	**1**	**165**

Table 25. Mineral fees (SEK) under the Minerals Act. The fee was introduced in 2005 and applies only to concessions granted after that. Source: Bergsstaten.

Year	Contributing concessions	Mineral fees, total	Mineral fees, to the state	Mineral fees, to landowners
2006	1	30 241	7 560	22 681
2007	1	21 392	5 348	16 044
2008	3	234 475	58 221	175 856
2009	4	682 217	170 952	511 663
2010	5	2 280 263	570 095	1 710 197
2011	7	4 559 742	1 139 936	3 419 807
2012	11	5 150 918	1 287 730	3 863 180
2013	13	6 886 013	1 721 503	5 164 511
2014	13	7 372 452	1 843 113	5 529 339
2015	11	6 381 449	1 585 085	4 796 364
2016	11	6 375 762	1 583 127	4 792 635
2017	13	12 104 285	3 026 070	9 078 216
2018	18	13 468 117	3 367 029	10 101 088
2019	18	16 545 231	4 136 308	12 408 924
2020	21	19 264 020	4 816 005	14 448 014
2021	**21**	**20 650 662**	**5 162 666**	**15 487 996**

Table 26. Fees paid to the state (SEK) under the Minerals Act 2006–2021. Source: Bergsstaten.

Year	Application fee*	Exploration fee	Renewal fees	Defense fees	Land designation fee	Withdrawal, refund	Total
2006	773 500	8 639 612	4 967 148	49 100	40 000	−181 059	14 288 301
2007	1 317 060	14 096 778	6 712 326	31 900	0	−760 881	21 397 183
2008	1 342 993	12 373 854	13 114 100	30 000	120 000	−1 396 926	25 584 021
2009	787 500	4 319 513	8 505 679	30 000	40 000	−2 015 602	11 667 090
2010	1 050 500	4 735 136	9 032 238	27 200	80 000	−205 018	14 720 056
2011	1 153 000	6 018 463	26 756 238	24 700	0	−251 021	33 701 380
2012	833 500	8 602 966	17 441 850	15 900	40 000	−1 164 523	25 769 693
2013	769 015	4 550 790	16 574 107	7 300	40 000	−4 052 077	17 889 135
2014	771 500	3 392 570	19 689 995	2 800	0	−2 609 790	21 247 075
2015	906 500	3 582 934	11 079 681	12 100	160 000	−1 331 454	14 409 761
2016	513 500	2 583 098	6 048 248	2 800	40 000	-816 025	8 371 621
2017	585 000	6 991 905	11 752 762	0	40 000	-235 700	19 133 967
2018	412 000	5 814 840	12 912 928	0	80 000	-1 481 824	17 737 944
2019	478 000	4 101 860	5 613 261	0	40 000	-4 476 567	5 756 554
2020	456 500	4 797 763	13 917 387	0	40 000	-639 452	18 572 198
2021	**395000**	**4829440**	**7140025**	**0**	**80000**	**-37335**	**12 407 130**

* This also includes application fees for exploration concession.

Tistbrottet is an industrial mineral pit, west of the Sala silver mine, where dolomite is mined. Foto: Torbjörn Bergman/SGU.

Industrial minerals and dimension stone

INDUSTRIAL MINERALS

An industrial mineral is defined by physical properties such as fibrosity, insulating ability, density, hardness and its chemical properties such as concentrations, type of composition and proportion of impurities. One example is limestone used for cement production or as a filler in paint. Another is clay baked to form bricks. At present there are more than 60 types of minerals, rocks and raw materials included in the definition of industrial minerals. Industrial minerals permeate every aspect of society and life, but are usually little seen. There are only few products and materials that do not contain industrial minerals or whose processing has not involved their use. Industrial mineral pits are fairly evenly distributed throughout Sweden (Table 27, Fig. 22).

Deliveries of industrial minerals increased by about 8 per cent in 2021. This was a reversal of the declining trend seen in recent years. About 7.6 million tonnes of industrial minerals were delivered in 2021 (Table 28). Limestone accounted for just under 6.4 million tonnes, up 12 per cent on 2020. Last year's declining trend for limestone was due to a general decline in steel production in the country, which reduced the need for limestone deliveries to steel mills. Over time, significant quantities of high-quality limestone on the

Table 27. Licensed pits for industrial minerals with reported production in 2021. Source: the Swedish Environmental Reporting Portal (SMP)

Nr	Pit namne	N	E	Municipality	Mineral	Company
1	Masugnsbyn	7 497 023	801 190	Kiruna	Dolomite	LKAB
2	Kallholn 9:16	6 781 458	484 587	Orsa	Limestone (crushed)	Nordkalk AB
3	Jutjärns kalkbrott	6 760 920	513 380	Rättvik	Limestone (crushed)	SMA Mineral AB
4	Styggberget	6 672 976	526 924	Smedjebacken	Other (Garnet)	Swegar AB
5	Silvergruvan 1:353 m. fl. (Tistbrottet)	6 642 215	587 611	Sala	Dolomite	Björka Mineral AB
6	Gillberga 3:8 m. fl.	6 643 746	618 885	Heby	Clay	Monier Roofing AB
7	N. Allmänningbo 1:41	6 624 098	528 269	Lindesberg	Feldspar	Sibelco Nordic AB
8	Fanthyttan 5:39	6 614 324	505 425	Lindesberg	Dolomite	Björka Mineral AB / Larsbo Kalk
9	Grythyttan 6:332	6 618 082	473 342	Nora	Slate (crushed)	Icopal AB
10	Gåsgruvan (Yngshyttan 1:337)	6 621 876	456 602	Filipstad	Limestone (crushed)	SMA Mineral AB
11	Björka 1:35	6 576 138	526 132	Örebro	Dolomite	Björka Mineral AB
12	Forsby 2:8	6 557 436	554 399	Vingåker	Limestone (crushed)	Nordkalk AB
13	Kilane Valön 4:42	6 524 378	353 830	Åmål	Quartz/Quartzite	Calderys Nordic AB
14	Ulerud 1:20	6 526 163	352 610	Åmål	Quartz/Quartzite	Dalbo Kvartsit AB
15	Flåtungebyn 1:3, 1:11 m. fl.	6 540 893	353 828	Åmål	Quartz/Quartzite	Vargön Alloys AB
16	Livarebo 1:2, 1:3, 1:4	6 525 300	352 060	Mellerud	Quartz/Quartzite	Dalbo Kvartsit AB
17	Råda	6 485 917	388 676	Lidköping	Quartz sand	Rådasand AB
18	Arnemossen 2:1	6 490 311	406 654	Götene	Other (Burned alum shale)	Brattex Mineral
19	Våmb 30:10, 3:99	6 472 747	430 634	Skövde	Limestone (crushed)	Cementa AB/Skövdefabriken
20	Berga	6 451 438	419 974	Falköping	Limestone (crushed)	SMA Mineral AB
21	Uddagården (Karleby 9:13)	6 450 390	418 388	Falköping	Limestone (crushed)	Nordkalk AB
22	Baskarp	6 430 885	450 707	Habo	Quartz sand	Sibelco Nordic AB
23	Dykärr (Brogården)	6 420 511	443 294	Habo	Quartz sand	Brogårdssand AB
24	Stora Vikers 1:94	6 414 085	726 936	Gotland	Limestone (crushed)	Nordkalk AB
25	Västra brottet, Filehajdar	6 404 068	721 255	Gotland	Limestone (crushed)	Cementa AB
26	Snögrinde	6 363 645	695 764	Gotland	Limestone (crushed)	SMA Mineral AB
27	Ignaberga 3:27 mfl	6 219 220	428 868	Hässleholm	Limestone (crushed)	Nordkalk AB
28	Lindholmen 1:2, 1:5, 1:6, m. fl.	6 153 372	393 110	Svedala	Clay	Bara Mineraler AB

Swedish island of Gotland have also been replaced by imports, as several quarries have had problems obtaining permits. However, increased limestone production in 2021 was largely attributable to quarries on Gotland. This was due to increased mining of raw materials for cement production, an effect of the company Cementa's doubts about the future situation. Imported limestone mainly goes to other industries such as steel and paper, and were therefore not affected by the increase in domestic production in 2021.

Some products continue to see a fairly sharp decline. One explanation may be the Covid-19 pandemic impacting national and global industry. Data collection also changed in 2020. Previously, data were based on questionnaires sent by SGU, but as from 2020 data are collected from the Swedish Environmental Reporting Portal (SMP). This may have affected the statistics.

Quartz sand production has been growing steadily for several years, whereas quartzite production has fluctuated. For clay and other industrial minerals, the downward trend continues, following a few years of upturn.

The economic value of industrial minerals has previously been assessed from survey responses and estimated values. Estimates are no longer provided.

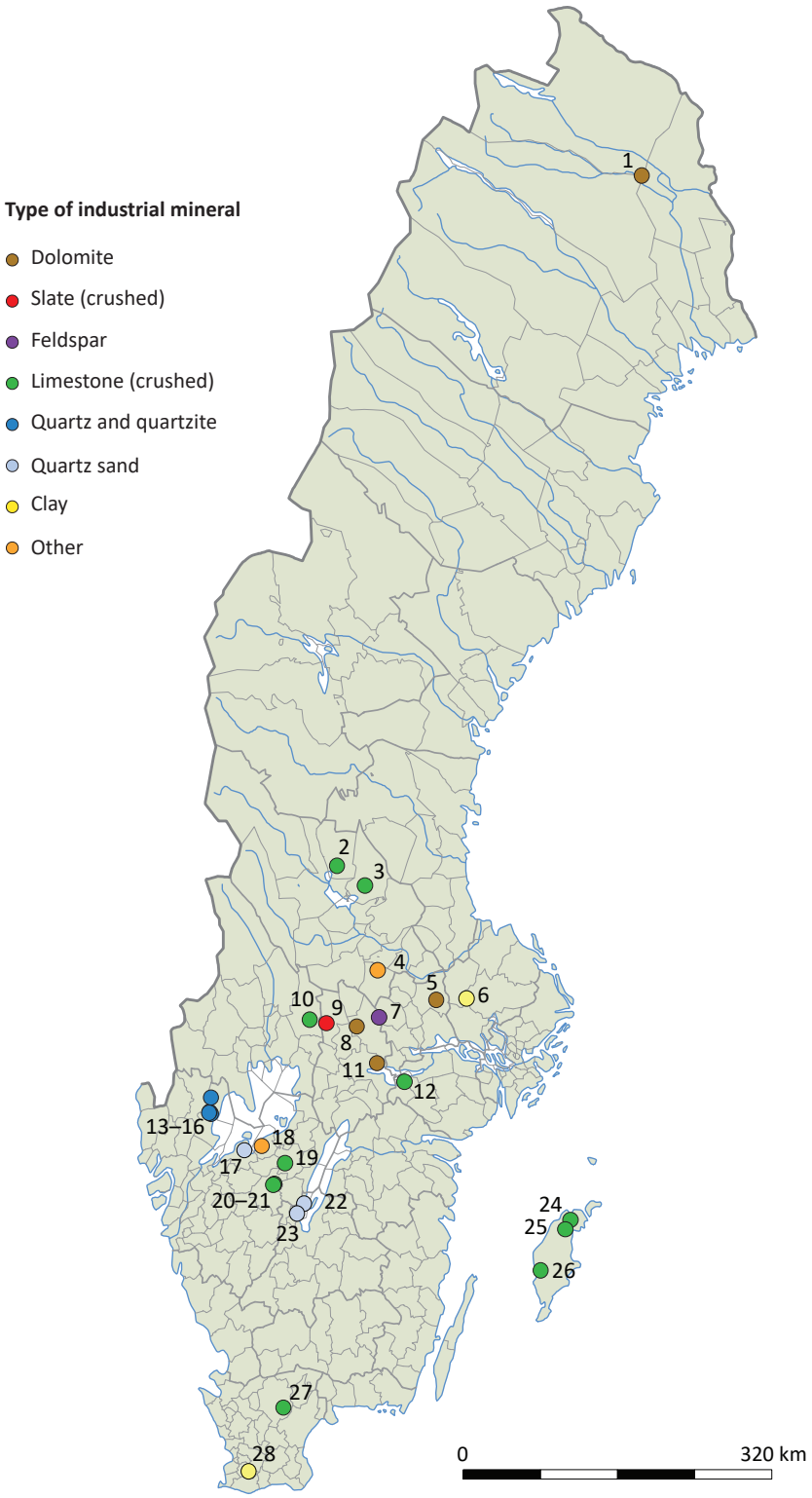

Figure 22. Industrial minerals in Sweden 2021. Numbers refer to table 26.

Table 28. Deliveries of extracted industrial minerals in Sweden 2011–2021. Source: the Swedish Environmental Reporting Portal (SMP)

Rock type or mineral	2011 ktonne	2012 ktonne	2013 ktonne	2014 ktonne	2015 ktonne	2016* ktonne	2017 ktonne	2018 ktonne	2019 ktonne	2020 ktonne	2021 ktonne	2021 Difference
Slate (crushed)	8	10	9	10	8							
Feldspar (kv/fsp)	30	27	30	27	29							
Dolomite	483	429	445	379	393	344	473	385	461	336	306	-9 %
Limestone (crushed)	7 317	7 385	7 448	6 791	6 715	6 949	6 757	6 649	6 326	5 718	6 388	12 %
Quartz/Quartzite	163	101	102	73	72	48	56	104	80	72	86	20 %
Quartz sand	629	629	595	683	638	656	716	735	730	754	775	3 %
Talc/soapstone	3											
Diabase	261	215	206	134	265							
Clay	230	231	199	134	157	180	174	200	77	54	31	-44 %
Graphite					9							
Other industrial minerals	4	3	2	2	3	248	189	162	137	119	39	-67 %
Total	**9 703**	**9 030**	**8 889**	**8 233**	**8 289**	**8 425**	**8 365**	**8 235**	**7 811**	**7 053**	**7 625**	**8 %**

Note: The information is based on survey responses from the companies for 2011–2020, but is also to some extent estimated by SGU. From 2020, data has been collected from the Swedish Environmental Reporting Portal (SMP). Other industrial minerals consist of: shale (crushed), feldspar, diabase, burned alum shale and iron ocher.
* The division has changed from 2016.

DIMENSION STONE

Dimension stone quarries are evenly distributed throughout the country (Table 29). Granite, gneiss, diabase and gabbro are mainly mined in basement rocks. Limestone and shale are mined in younger sedimentary bedrock in southern Sweden, mainly Ordovician limestone.

Production in the dimension stone industry increased significantly in 2021 compared with 2020. Table 30 shows that 216,000 tonnes of finished products were delivered in 2021, in the form of trading blocks, semi-finished products and finished stone products from 57 dimension stone quarries operated by a total of 24 companies. The corresponding figures for 2020 were 178,000 tonnes, divided between 47 sites. Most dimension stone quarries produced granite (21 quarries) or limestone/marble (19 quarries). Of the 19 active limestone/marble quarries, 18 produced dimension stone, while one was dormant and supplied only a small quantity of residual products. The quantity of mined rock was about 997,000 tonnes, which means that just over 20 per cent of the mined rock could be used for finished dimension stone products.

As shown in Table 30, the total delivery of rock materials from quarries in 2021 was 1.25 million tonnes, the same level as 2020. The stone material produced exceeds the amount of loose rocks (0.25 million tonnes). At many smaller quarries, quarrying campaigns are conducted, and some years natural stone is produced from the previous year's quarrying. Many dimension stone quarries also crush residual material from earlier mining and stockpiles to make different types of ballast. Aggregate production at dimension stone quarries is usually carried out in the form of campaign crushing by setting up crushing mills for a limited period.

Table 29. Licensed dimension stone quarries with reported production and/or delivery 2021.

Id-no	Namne of the quarry	N	E	Municipality	Type of rock	Company
1	Korpkullen	7 208 781	545 372	Vilhelmina	Mylonite	Lapplands Natursten AB
2	Nya Finnsäter	7 063 359	444 798	Krokom	Slate	Minera Skiffer AB
3	Grytan	6 997 619	491 447	Östersund	Limestone	Dala Sten AB
4	Grytan	6 997 176	490 689	Östersund	Limestone	Ölands Stenförädling AB
5	Vamsta 7:2	6 996 801	491 560	Östersund	Limestone	Ölands Stenförädling AB
6	Brunflo Berge 2:7, 2:22	6 995 966	493 782	Östersund	Limestone	Ölands Stenförädlling AB
7	Brunflo-Gärde	6 995 545	493 769	Östersund	Limestone	Dala Sten AB
8	Mångsbodarna	6 773 724	424 806	Älvdalen	Älvdalen quartzite	Wasasten of Sweden AB
9	Glava Skifferbrott	6 601 175	363 051	Arvika	Slate	AB Glava Skifferbrott
10	Ekeberg 1:1	6 576 137	526 131	Örebro	Limestone	Borghamnsten AB
11	Näsinge-Vässby 1:12, Mällegården 1:25	6 548 846	288 886	Strömstad	Granite	Bohusgranit ekonomiska förening
12	Björneröd	6 545 147	294 115	Strömstad	Granite	Stefan Gustafsson
13	Nedre Knalla marmortäkt	6 515 982	503 266	Askersund	Limestone	Borghamnsten AB
14	Oxåker 2:1	6 504 425	582 974	Norrköping	Limestone	Borghamns Stenförädling AB
15	Alnäs 2:2, 2:6	6 501 709	297 235	Tanum	Granite	Hallindens Granit AB
16	Österplana 3:23	6 494 310	408 718	Götene	Limestone	Thorsbergs Stenhuggeri AB
17	Fålbengsröd 1:6 (Ävja)	6 489 037	292 049	Sotenäs	Granite	Bohusgranit ekonomiska förening
18	Bjälkebräcka, Gröv, Skarstad	6 487 008	296 412	Lysekil	Granite	Hallindens Granit AB
19	Valla 4:7, 3:4	6 485 714	288 532	Sotenäs	Granite	Hallindens Granit AB
20	Broberg 2:2, 3:1	6 480 158	295 245	Lysekil	Granite	Hallindens Granit AB
21	Vese 1:3	6 479 363	292 880	Lysekil	Granite	Leif Nicklasson
22	Håle Stenbrott	6 476 698	286 112	Sotenäs	Granite	Håle Stenbrott AB
23	Nolby 1:24	6 475 010	294 874	Lysekil	Granite	Nolby stenbrott AB
24	Bårstad 6:32	6 472 317	482 526	Vadstena	Limestone	Borghamns Stenförädling AB
25	Västerlösa 1:51	6 471 214	481 616	Vadstena	Limestone	Borghamnsten AB
26	Kungshult 6:1, Bänarp 1:2	6 438 005	494 524	Tranås	Granite	Hallindens Granit AB
27	Tjuvkil 2:157	6 422 416	305 341	Kungälv	Gneiss	Johan Backman
28	Snäckers 1:58, 1:63	6 418 190	722 804	Gotland	Limestone	Slite Stenhuggeri AB
29	Norrvange 1:99	6 412 458	724 753	Gotland	Limestone	Slite Stenhuggeri AB
30	Flivik 1:2	6 378 707	593 830	Oskarshamn	Granite	Scandinavian Stone Naturstens-kompaniet AB
31	Horn 1:38	6 340 718	615 048	Borgholm	Limestone	Naturstenkompaniet Sverige AB
32	Gillberga 4:10	6 330 843	614 559	Borgholm	Limestone	Naturstenskompaniet Sverige AB
33	Stenninge 1:15 mfl	6 328 608	613 188	Borgholm	Limestone	Sjöström Stenförädling AB
34	Hössjö 8:1	6 316 444	471 048	Alvesta	Granite	Hallindens Granit AB
35	Täkt Sundre Hallbjäns	6 314 926	692 040	Gotland	Limestone	Gotlands Kalkstensfabrik AB
36	Alböke 3:5 & 1:2	6 313 662	607 298	Borgholm	Limestone	Mysinge Stenhuggeri AB
37	Hjortsjö 3:8	6 311 842	459 716	Värnamo	Diabase	Scandinavianstone Naturstens-kompaniet AB
38	Eftra Svenstorp 1:19	6 299 727	356 308	Falkenberg	Gnejs	Hallindens Granit AB
39	Åketorp 5:7, Tomteby 1:4	6 298 470	598 247	Borgholm	Limestone	Sjöström Stenförädling AB
40	Bårarp-Nygård	6 298 150	359 038	Halmstad	Gneiss	Scandinavianstone Naturstens-kompaniet AB
41	Toften 1:1	6 296 395	359 296	Halmstad	Gneiss	FO-Sten AB
42	Plönninge 1:4	6 289 571	363 824	Halmstad	Gneiss	Halmstad Gnejs AB

Table 29. Continued.

Id-no	Namne of the quarry	N	E	Municipality	Type of rock	Company
43	Sutareboda 2:1	6 274 467	452 916	Älmhult	Diabase	Scandinavianstone Naturstens-kompaniet AB
44	Såganäs 1:4	6 272 866	451 978	Älmhult	Diabase	Mixment AB
45	Brännhult	6 271 380	451 346	Älmhult	Diabase	Scandinavianstone Naturstens-kompaniet AB
46	Biskopsgården	6 255 887	453 344	Östra Göinge	Diabase	Scandinavianstone Naturstens-kompaniet AB
47	Duvhult	6 255 418	460 053	Osby	Diabase	Scandinavianstone Naturstens-kompaniet AB
48	Hägghult	6 250 948	453 885	Osby	Diabase	Scandinavianstone Naturstens-kompaniet AB
49	Gylsboda 1:36	6 246 468	459 569	Osby	Diabase	Scandinavianstone Naturstens-kompaniet AB
50	Ekeröd 1:3	6 243 828	446 896	Östra Göinge	Granite	Scandinavianstone Naturstens-kompaniet AB
51	Sporrakulla 1:1	6 238 164	453 811	Östra Göinge	Granite	Scandinavianstone Naturstens-kompaniet AB
52	Boa 1:2, 2:2 (Blekinge Natursten)	6 232 210	479 455	Olofström	Granite	Johan Albertsson
53	Vånga 89:3, Vånga Väst	6 225 359	459 620	Kristianstad	Granite	Scandinavianstone Naturstens-kompaniet AB
54	Vånga 2:2 Ivö mfl	6 225 004	460 191	Kristianstad	Granite	Scandinavianstone Naturstens-kompaniet AB
55	Vånga Söder 23:1, 24:2, 24:4, 24:11	6 224 548	460 295	Kristianstad	Granite	Scandinavianstone Naturstens-kompaniet AB
56	Hanaskog 1:1-12:1 (Bokalyckan)	6 221 278	444 477	Kristianstad	Granite	Naturstenskompaniet Sverige AB
57	Bjärlöv 39:1	6 220 731	444 435	Kristianstad	Granite	Scandinavianstone Naturstens-kompaniet AB

Table 30. Quarrying, deliveries and export of dimension stone in 2021.

	Number of quarries		Number of companies		Quarrying, total		Delivered dimension stone		Exchange*		Export	
Type of rock	2021	2020	2021	2020	2021 ktonne	2020 ktonne	2021 ktonne	2020 ktonne	2021 %	2020 %	2021 ktonne	2020 ktonne
Diabase and gabbro	8	7	2	2	169	191	27	28	16	15		18
Gneiss	5	5	5	3	217	191	14	10	6	5		12
Granite	21	18	8	7	439	360	128	98	29	27		42
Limestone (marble)	19	19	10	11	96	94	43	34	45	36		
Other dimension stone	4	2	4	2	75	35	5	5	6	14		
Total	**57**	**51**	**29**	**25**	**997**	**871**	**216**	**175**	**22**	**20**		
Total incl. residual product							**1249**	**1010**				

* Exchange refers to share of total quarrying during the year.

The national interest Brunflo in Jämtland was demarcated in detail during 2021. Gusta stone museum in Vamsta depicts the long tradition of quarrying limestone in Brunflo. Foto: Andreaze/CC BY-SA 4.0

National interests

The Environmental Code contains specific provisions governing the management of land and water areas. These provisions are designed to promote reasonable long- and short-term use of natural resources from a comprehensive societal perspective. Both preservation interests and mining opportunities are accommodated. Large virgin areas of land and water, ecologically sensitive areas, and agriculture and forestry of national importance must always be protected to the maximum possible extent. The same applies to areas of importance, e.g., for reindeer husbandry, natural beauty, cultural heritage, outdoor recreation, valuable substances they contain or for purposes of national defence. These areas may also constitute national interests, and so must always be protected. These land and water areas have different protection needs, for example because they are particularly important for reindeer husbandry, contain valuable substances or materials, are particularly suitable for communications or industrial production, or are particularly important because of their natural or cultural value.

When an area is of national importance for several incompatible purposes, priority must be given to the purpose best conducive to long-term management of the land, except where defence interests of overriding importance are involved. Various national sectoral authorities are required to provide particulars of areas judged to be of national importance. The Geological Survey, for example, is responsible for assessing national interests in areas containing valuable substances such as minerals. In addition, the Environmental Code specifies certain geographical areas that come under direct protection and are regarded as national interests for the purposes of tourism and outdoor recreation. These areas are found along the coasts, rivers and in certain mountain regions. The area protection described above, national interests included, is safeguarded to prevent palpable damage. Measures, e.g. mineral extraction, that palpably harm a national interest are an absolute impediment to mining operations, unless the deposit is also of major national importance. In summary, the management provisions can be seen as a planning instrument before decisions are taken on changed land use.

There were 149 national mineral interests at the end of 2021. Of these, 94 had been demarcated and delimited. The rest have been given a centre coordinate (Fig. 23). Table 31 shows that these interests are located in 19 of Sweden's 21 counties. There are no national mineral interests in Stockholm County and Kronoberg County.

SGU uses three criteria for a particular deposit to be identified as a national interest. These are (i) that the substance or material is of great importance for society's needs; (ii) that the substance or material has particularly valuable properties; and (iii) that the area of the deposit of the substance or material is well delimited, investigated and documented (in accordance with Chapter 3, section 7 of the Environmental Code). For deposits assessed to be of national importance, detailed delimitations are provided on an ongoing basis. Decisions were made for the following sites of national importance in 2021:

- Brunflo, limestone: demarcated in detail; decided 20 December 2021 (journal no. 31-2114/2015)
- Barsele, gold: designated and demarcated in detail; decided 30 September 2021 (journal no. 31-1734/2020)

Figure 24 shows the Brunflo national interest in Jämtland, central Sweden, demarcated in detail. The demarcation is based on geological information from SGU's databases and publications. Sites are usually visited and, if possible, an operator on site is contacted. The above three criteria are also considered in this procedure. After demarcation with coordinates and shape area calculation, a proposal for detailed delimitation is referred to the relevant county administrative board and municipality, the National Board of Housing, Building and Planning and other authorities. Depending on the comments of the consultation bodies, the proposal may be further amended. SGU then makes a decision and submits the information to the relevant county administrative board.

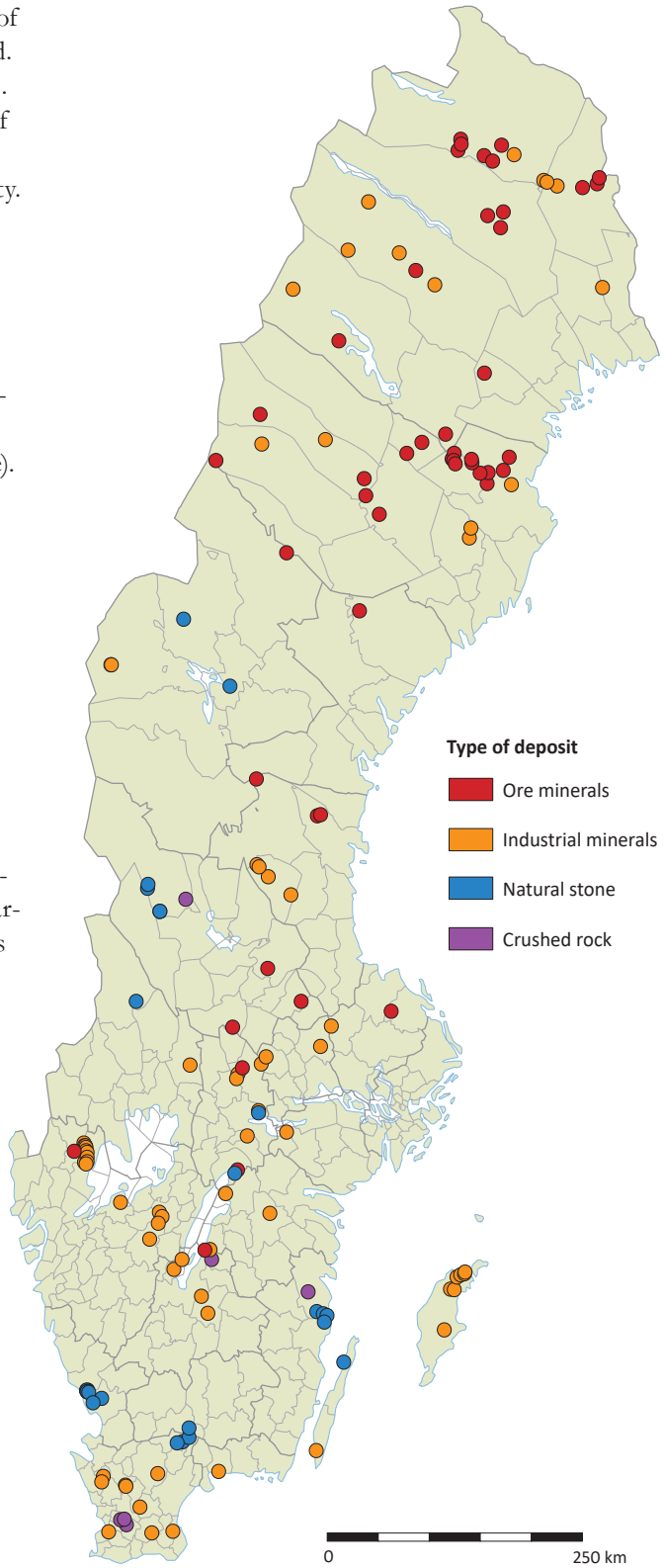

Figure 23. Mineral deposits of national interest under the Environmental Code

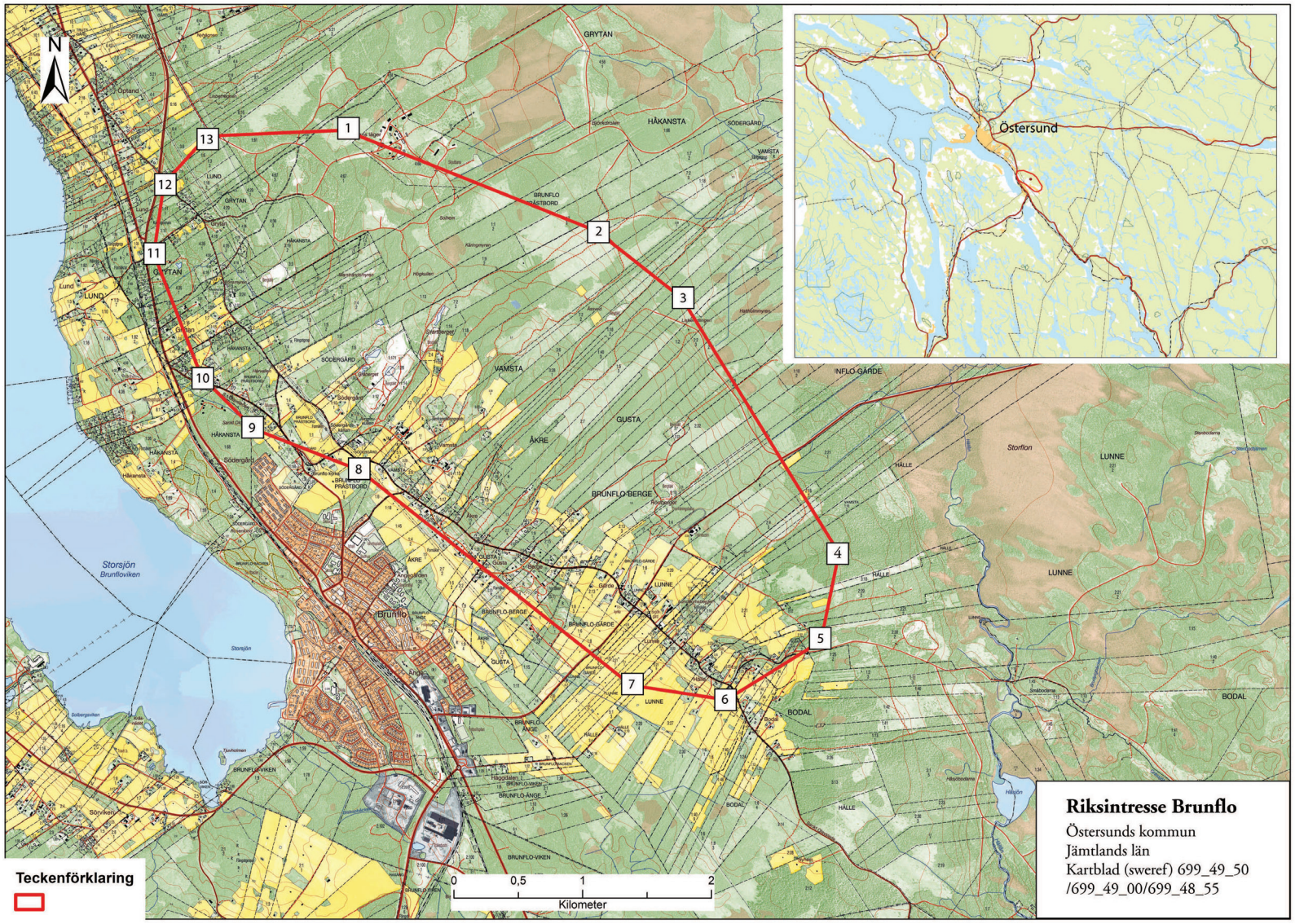

Figure 24. Brunflo Site of national Importance, demarcated in detail.

Table 31. Mineral deposits of national importance, per county.

Name of the deposit	Municipality	Type of material	X-coord.	Y-coord.
Uppsala County				
Dannemora*	Östhammar	Iron ore	6 677 845	658 254
Banmossen	Heby	Wollastonite	6 662 492	598 461
Södermanlands County				
Forsby*	Vingåker	Limestone	6 557 436	554 399
Östergötlands County				
Lemunda	Motala	Sandstone	6 496 181	494 207
Gärstad	Linköping	Clay	6 477 225	539 019
Jönköpings County				
Norra Kärr*	Jönköping	Alkaline rocks	6 440 965	474 476
Adelöv-Nostorp*	Tranäs	Porphyry	6 430 844	480 795
Karsbo-Fåglarp*	Nässjö	Quartzite	6 394 445	471 233
Hjärtsöla-Almesåkra-Norrgård*	Nässjö	Quartzite	6 378 030	477 825
Brogården*	Habo	Special sand	6 420 600	443 232
Baskarp*	Habo	Special sand	6 430 892	451 306
Kalmar County				
Stormandebo	Västervik	Porphyry	6 400 368	578 376
Tribbhult	Västervik	Granite	6 380 928	587 155
Flivik	Oskarshamn	Granite	6 378 707	593 830
Hökhult	Oskarshamn	Granite	6 376 949	597 300
Götebo	Oskarshamn	Granite	6 370 671	594 775
Gillberga*	Borgholm	Limestone	6 331 097	614 779
Albrunna*	Mörbylånga	Limestone	6 243 976	588 271
Gotlands County				
Filehajdar*	Gotland	Limestone	6 404 793	720 827
Västra brottet*	Gotland	Limestone	6 403 914	725 067
Storugns-Klinthagen*	Gotland	Limestone	6 416 818	727 203
Fleringe*	Gotland	Limestone	6 419 025	731 126
Rute*	Gotland	Limestone	6 420 137	734 713
Stucks*	Gotland	Limestone	6 421 625	735 600
Buttle*	Gotland	Limestone	6 366 454	715 741
Blekinge County				
Stärnö*	Karlshamn	Diabase	6 222 391	490 540
Skåne County				
Hägghult*	Osby	Diabase	6 250 799	453 887
Duvhult*	Osby	Diabase	6 255 470	460 129
Boalt	Östra Göinge	Diabase	6 249 634	448 353
Vånga*	Kristianstad	Granite	6 264 565	460 023
Ignaberga*	Hässleholm	Limestone	6 219 023	429 120
Måsalycke*	Tomelilla	Anatase	6 162 687	445 369
Billinge*	Eslöv, Klippan. Svalöv	Kaolin	6 207 451	396 870
Kvarnby*	Malmö	Chalk limestone	6 161 488	380 814
Bjuv	Bjuv	Clay	6 215 687	374 635
Önnemo*	Lund	Gneiss	6 168 692	398 721
Hardeberga /Rögle*	Lund	Quartzitic sandstone	6 173 619	392 667
Lyby	Hörby	Quartzitic sandstone	6 185 839	412 015
Bjuv/Åstorp	Bjuv/Åstorp	Clay	6 210 374	373 248
Eriksdal*	Sjöbo	Quartz sand	6 160 491	424 104
Skrylle*	Lund	Quartzitic sandstone	6 173 960	396 161

Table 31. Continued.

Name of the deposit	Municipality	Type of material	X-coord.	Y-coord.
Hallands County				
Vreda	Falkenberg	Hallandia gneiss	6 300 900	358 244
Svenstorp	Falkenberg	Hallandia gneiss	6 299 937	357 105
Vastad*	Falkenberg	Hallandia gneiss	6 300 897	357 124
Äskered	Falkenberg	Hallandia gneiss	6 299 700	358 208
Äskered	Falkenberg	Hallandia gneiss	6 299 043	357 616
Bårarp	Halmstad	Hallandia gneiss	6 298 360	358 973
Nannarp	Halmstad	Hallandia gneiss	6 292 519	372 235
Västra Götalands County				
Dalen	Bengtsfors/Åmål	Quartzite	6 544 116	351 154
Tansjön	Bengtsfors/Åmål	–”–	6 541 566	351 894
Fengerfors	Åmål	–”–	6 541 577	352 803
Fröskog	Åmål	–”–	6 540 127	353 541
Korpeknatten	Bengtsfors/Åmål	–”–	6 536 745	353 282
Norra KuvetIronet	Åmål	–”–	6 534 903	354 683
Fjällen-Dalberget	Åmål	–”–	6 530 073	354 501
Kilane	Åmål	–”–	6 526 030	354 850
Valön	Åmål	–”–	6 523 659	353 889
Livarebo-Ulerud*	Mellerud/Åmål	–”–	6 525 077	352 123
Dingelvik	Bengtsfors	Copper, silver	6 535 827	341 799
Ryd* (Billingsyd)	Skövde	Diabase	6 476 894	428 066
Våmb*	Skövde	Limestone	6 472 427	430 618
Råda*	Lidköping	Special sand	6 485 917	388 676
Rådene	Skövde	Limestone	6 466 089	427 196
Uddagården*	Falköping	Limestone	6 450 390	418 388
Näshult	Tranemo	Quartz	6 362 286	406 239
Värmlands County				
Gåsgruvan*	Filipstad	Limestone	6 621 818	456 714
Hålsjöberg*	Torsby	Kyanite	6 684 185	402 066
Örebro County				
Zinkgruvan*	Askersund	Sphalerite, galena,	6 519 414	506 023
Forshammar	Lindesberg	Feldspar, quartz	6 624 048	528 249
Hällabrottet	Kumla	Sandstone	6 553 214	515 212
Björkaverken/Glanshammar*	Örebro	Dolomite marble	6 578 336	526 005
Brännlyckan	Askersund	Marble	6 515 982	503 266
Lillkyrka*	Örebro	Marble	6 576 239	526 230
Smedsjön and Dyrkatorp*	Lindesberg	Limestone, dolomite	6 612 940	504 392
Larsbo*	Lindesberg	Limestone, dolomite	6 614 071	505 179
Lovisa*	Lindesberg	Zinc and lead ore	6 620 487	509 479
Skrikarhyttan*	Nora	Metavolcanite	6 591 225	495 051
Västmanlands County				
Höjderna	Skinnskatteberg	Feldspar	6 631 405	533 158
Tistbrottet*	Sala	Dolomite	6 642 215	587 611
Dalarnas County				
Garpenberg*	Hedemora	Sphalerite, galena, silver	6 686 512	567 826
Falu gruva	Falun	Chalcopyrite	6 718 362	533 584
Mjågen	Älvdalen	Porphyry	6 785 635	450 398
Grängesberg	Ludvika	Iron ore	6 660 186	499 519
Mångsbodarna*	Älvdalen	Dala sandstone	6 773 584	424 894
Billingsåsen*	Älvdalen	Dala sandstone	6 796 007	411 992

Table 31. Continued.

Name of the deposit	Municipality	Type of material	X-coord.	Y-coord.
Vanfjället (Lövnäs)*	Älvdalen	Dala sandstone	6 799 620	412 700
Håksberg-Blötberget*	Ludvika	Iron ore	6 666 009	505 444
Gävleborgs County				
Enåsen	Ljusdal	Gold	6 905 258	520 289
Kringelgruvan*	Ovanåker	Graphite	6 808 683	532 954
Gropabo*	Ovanåker	Graphite	6 820 622	521 761
Månsberg*	Ovanåker	Graphite	6 791 524	556 155
Mattsmyra*	Ovanåker	Graphite	6 818 393	523 954
Brickagruvan*	Hudiksvall	Iron , vanadium	6 869 738	581 915
Bläckmyran*	Hudiksvall	Iron , vanadium	6 870 457	584 788
Jämtlands County				
Handöl	Åre	Soapstone	7 015 963	372 463
Brunflo	Östersund	Limestone	6 996 481	492 658
Rönnöfors*	Krokom	Slate	7 061 855	444 853
Granberget*	Strömsund	Sulphide ore	7 128 446	547 573
Västernorrlands County				
Rockliden*	Örnsköldsvik	Sulphide ore	7 072 946	618 658
Västerbottens County				
Långdal	Skellefteå	Sphalerite, galena, gold and silver	7 199 265	747 933
Åkulla-Kankberg*	Skellefteå	Sphalerite, galena, chalcopyrite, gold and silver	7 209 245	748 807
Björkdal*	Skellefteå	Gold	7 213 261	764 402
Renström	Skellefteå	Chalcopyrite, sphalerite	7 209 671	740 651
Åkerberg	Skellefteå	Gold	7 225 446	770 197
HolmtIron	Norsjö	Sphalerite, chalcopyrite	7 228 662	714 692
Kristineberg*	Lycksele	Sphalerite, chalcopyrite, galena, gold and silver	7 228 056	667 278
Kittelfjäll	Vilhelmina	Olivine	7 235 117	521 574
Granlidknösen*	Storuman	Fluorspar	7 240 577	585 036
Varuträsk	Skellefteå	Pegmatite	7 198 617	772 449
Repsjömyran	Vindeln	Diatomite	7 145 452	730 720
GåstIron	Vindeln	Diatomite	7 155 023	732 473
Maurliden*	Norsjö	Sphalerite, chalcopyrite, gold and silver	7 222 898	712 406
Maurliden Östra*	Norsjö	Sphalerite, chalcopyrite, galena, gold and silver	7 221 594	714 037
Norrliden*	Norsjö	Chalcopyrite, sphalerite	7 218 332	716 160
Storliden*	Malå	Sphalerite, chalcopyrite, gold and silver	7 239 127	682 043
Svartliden*	Storuman and Lycksele	Gold	7 185 935	626 203
Fäboliden*	Lycksele	Gold	7 167 708	640 256
StortIronhobben*	Storuman	Gold	7 202 540	624 506
Älgträsk*	Skellefteå	Chalcopyrite, gold	7 219 384	732 938
Älgliden*	Skellefteå	Chalcopyrite, gold	7 222 984	731 892
Rönnbäcken*	Storuman	Nickel, cobalt	7 264 510	519 514
Stekenjokk*	Vilhelmina	Sphalerite, chalcopyrite, galena, gold and silver	7 217 717	473 056
Barsele*	Storuman	Gold	7 215 488	617 457
Norrbottens County				
Laisvall	Arjeplog	Galena, silver	7 338 214	597 680
Aitik*	Gällivare	Chalcopyrite, gold	7 451 772	758 482
Malmberget*	Gällivare	Iron ore	7 463 198	745 186

Table 31. Continued.

Name of the deposit	Municipality	Type of material	X-coord.	Y-coord.
Kiruna*	Kiruna	Iron ore	7 533 282	717 827
Pahtohavare* (part of the national interest Kiruna)	Kiruna	Chalcopyrite	7 533 282	717 827
Viscaria* (part of the national interest Kiruna)	Kiruna	Chalcopyrite	7 533 282	717 827
Mertainen*	Kiruna	Iron ore	7 526 617	742 167
Svappavaara* (Gruvberget and Leveäniemi)	Kiruna	Iron ore	7 517 577	752 178
Nunasvaara*	Kiruna	Graphite	7 523 675	770 845
Masugnsbyn*	Kiruna	Dolomite	7 498 822	801 166
Masugnsbyn	Pajala	Graphite	7 497 362	804 185
Lautakoski	Pajala	Soapstone	7 493 599	814 733
Äpartjåkka	Jokkmokk	Magnesite	7 475 642	625 595
Rakas	Jokkmokk	Magnesite	7 427 292	605 427
Lantanjarkka	Jokkmokk	Wollastonite	7 425 458	656 840
Norvijaur	Jokkmokk	Limestone	7 394 431	692 934
Raitajärvi	Övertorneå	Graphite	7 394 111	861 522
Pajeb*	Arjeplog	Quartz	7 388 598	551 013
Eva-Svartliden*	Arvidsjaur	Sulphide ore	7 247 447	706 005
Pellivuoma*	Pajala	Iron ore	7 492 534	840 058
Sahavaara*	Pajala	Iron ore	7 496 539	854 819
Tapuli*	Pajala	Iron ore	7 502 155	856 707
Kallak*	Jokkmokk	Iron ore	7 412 765	680 300
Laver*	Älvsbyn	Copper ore	7 303 479	739 940
Kiskamavaara*	Kiruna	Cobalt, copper, gold	7 535 285	758 902
Nautanen*	Gällivare	Copper ore	7 464 783	753 999

* Demarcated in detail.

Export and import of mineral ore and metal and mineral products

Sweden's exports of mineral ores and products made from them far exceed imports, in both quantity and value. Swedish exports often comprise products with high value added, except iron ore. Sweden exports high-quality steel, such as stainless steel and high-strength steel, whereas imports consist of carbon steels used for rebar, for example. The mining industry is important to Sweden. Mineral products accounted for 11 per cent of Swedish exports in 2021.

In terms of quantity, ores – mainly iron ores – account for the largest share of mineral exports. This is followed by iron and steel products, industrial minerals, scrap and waste products, as well as construction minerals. Iron and steel products, other metal products and ores have the highest value added.

Imports constitute about 50 per cent of the quantity of exports, comprising mainly iron and steel products, industrial minerals, building minerals and energy minerals. In terms of value added, imports constitute about 75 per cent of exports. The highest value added is for iron and steel products.

Figure 25 shows exports and imports of mineral raw materials and finished mineral products, such as metals, for the years 2016 to 2021. Construction minerals in the diagram include import and export of minerals used in the construction industry. Energy minerals in the diagram include carbon and peat, for example. Metal products consist solely of metal raw materials for industry; finished metal products such as nails and tubes are not included.

The total value of exports in 2021 was 28 per cent up on 2020, although quantities actually fell by 7 per cent. Favourable market conditions with high global demand and a weak Swedish krona have benefited Swedish exports. The main falls in export quantities have been in ore, more specifically iron ore. Ore exports have risen in value terms. Overall, the value of exports increased by 44 per cent and imports by 8 per cent. In terms of quantity, imports of other metal products increased by 43 per cent. Imports of energy minerals and scrap and waste products fell by 4 and 3 per cent respectively.

Stacks of lead ingots. Foto: Mikael Florens/Boliden.

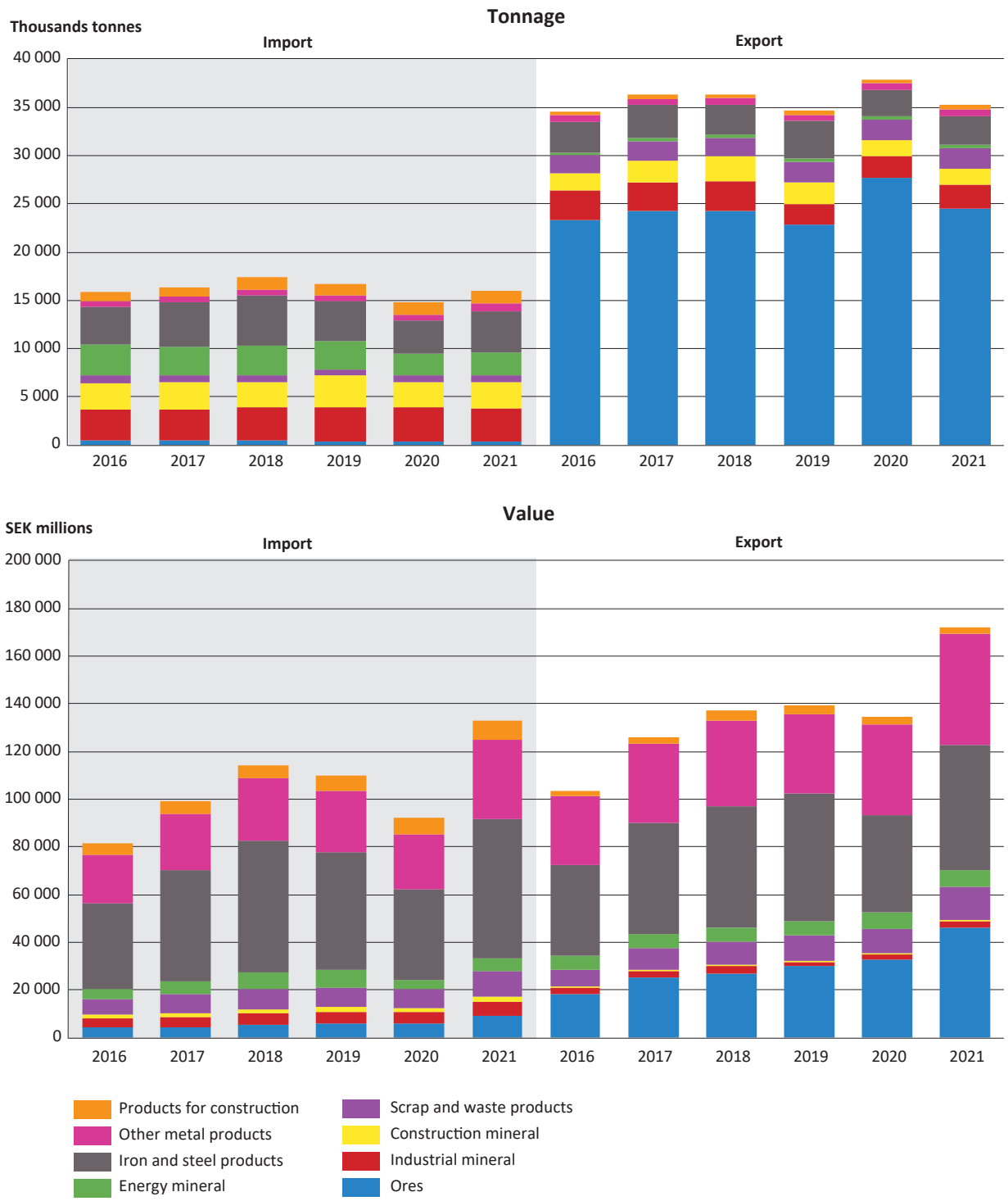

Figure 25. Export and import of ores, metals and minerals 2016–2021 by tonnage and value. Source: Statistics Sweden

Swedish mining industry economics

PRODUCTIVITY

Iron ore and non-ferrous ore extraction productivity increased over time until the 2000s (Fig. 26). Iron ore productivity stabilised in 1995 and has continued to increase ever since. Non-ferrous ore productivity peaked in 2005.

Until 2015 iron ore productivity was just below 10,000 tonnes per person employed and for non-ferrous ores about 13,000 tonnes per person employed. Iron ore productivity has increased since 2015, and is now almost 12,000 tonnes per person employed.

Non-ferrous ore productivity increased between 2008 and 2013. In 2013 productivity was close to 17,000 tonnes per person employed. By 2015, productivity was back at the initial level for the period, as illustrated by the pink curve in Figure 26. The change can be attributed to increased production at the Aitik mine.

As may be seen from the green curve and right axis in Figure 26, base metal productivity has fallen since 2005. This is probably due to lower metal content in the ores.

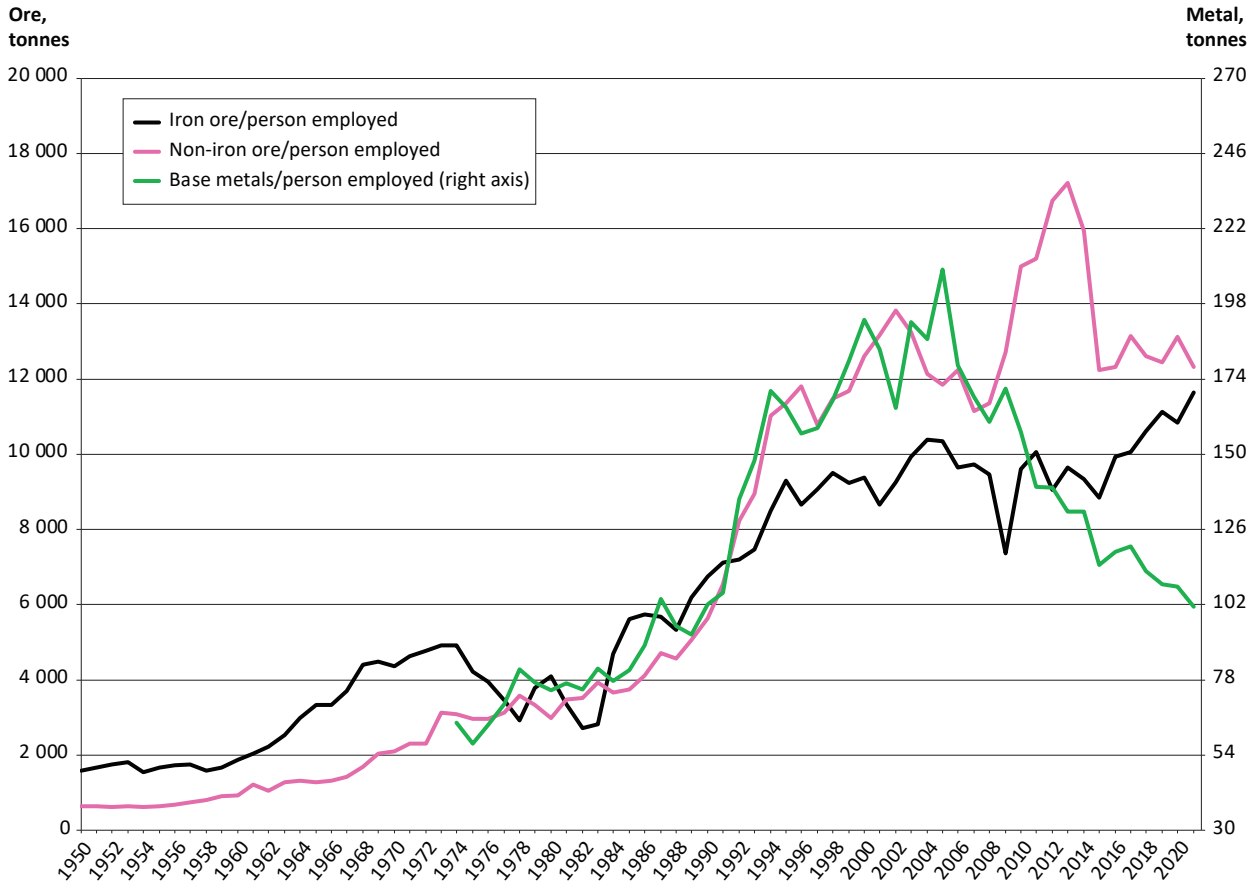

Figure 26. Productivity based on person employed per mined tonne of ore and recovered amount of metals 1950–2021.

SALES

Total sales by the Swedish mining industry (metal mines, not including smelters) continue to increase. Sales totalled almost SEK 69 billion in 2021. Over the past five years Swedish mining industry sales have more than doubled. The increase is largely due to favourable market conditions (Fig. 27). Metal prices, especially for base metals, were high during the year. Additionally, the Swedish krona weakened against the US dollar, benefitting Swedish exports.

Sales have varied over time, however. As may be seen from Figure 27, the lowest level was during the financial crisis in 2009 when sales were less than SEK 20 billion, and during the crisis years 2014–2016. The entire Swedish mining industry faced a headwind in 2014 and 2015, mainly due to the bankruptcies of some newly started mines at Dannemora and Tapuli (Pajala). The figures in the diagram only include the mining and enrichment plants; metal and steel mills and are not included.

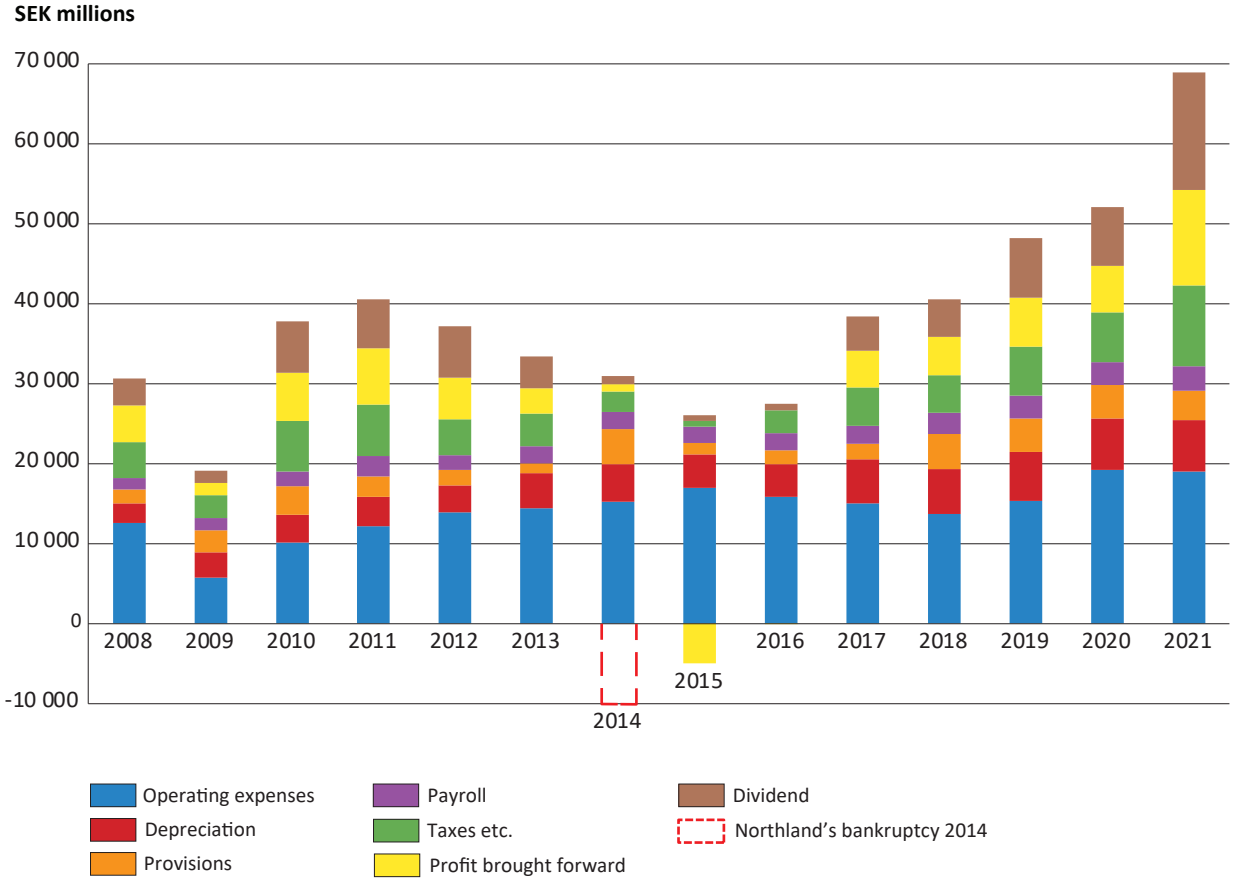

Figure 27. Mining industry sales 2008–2021 with key income items. "Taxes" includes corporation tax, payroll tax and social security contributions. "Profit brought forward" is profit for the year minus dividends.

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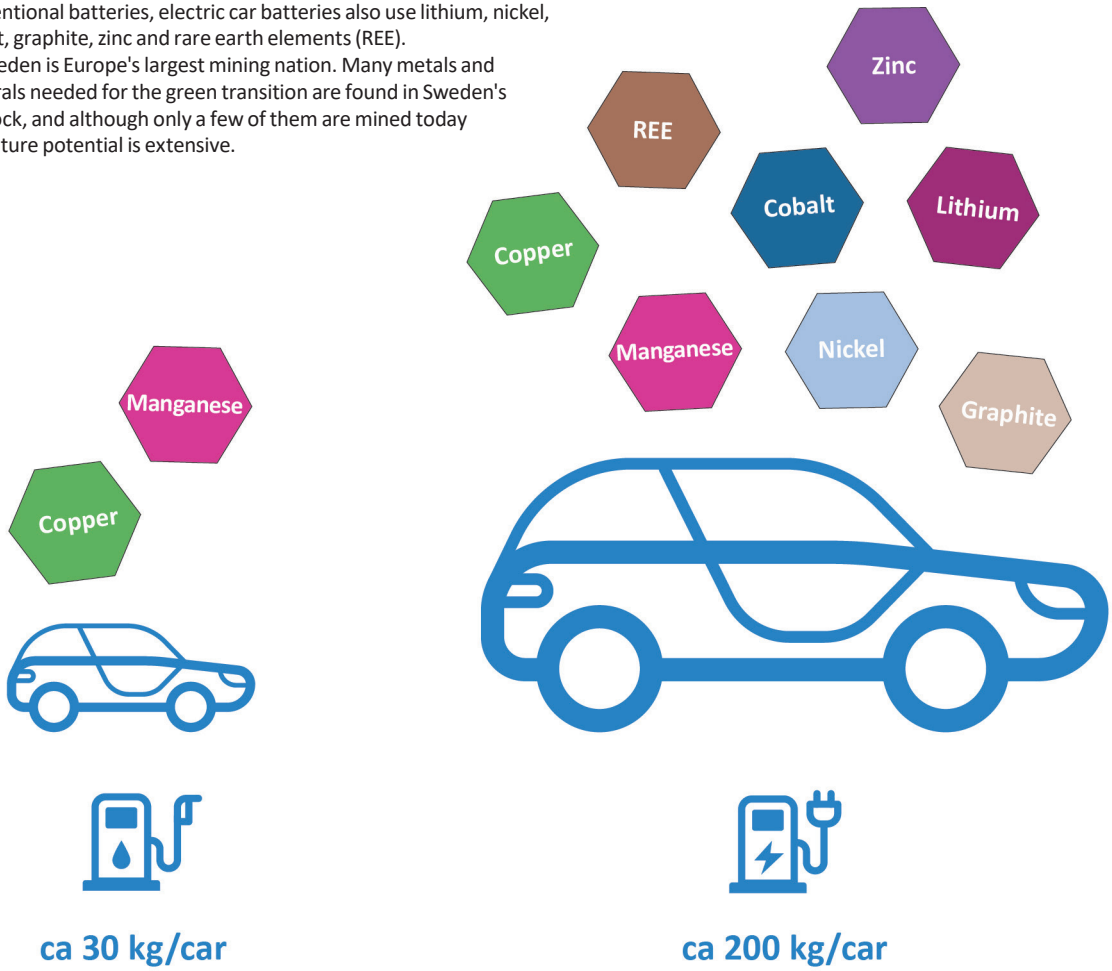
Six times more metal is needed

Almost 500 per cent. This is how large the increase in production of the battery metals lithium, cobalt and graphite needs to be until year 2050 to keep pace with the growing demand for clean energy technology. This according to a forecast published by the World Bank in 2020.

For example, the battery in an electric car requires 6.5 times as much metal and minerals as the battery in a conventional car, according to a report from the International Energy Agency from 2021.

For the electric car there are also significantly more different elements needed. In addition to the copper and manganese used in conventional batteries, electric car batteries also use lithium, nickel, cobalt, graphite, zinc and rare earth elements (REE).

Sweden is Europe's largest mining nation. Many metals and minerals needed for the green transition are found in Sweden's bedrock, and although only a few of them are mined today the future potential is extensive.



Increased need. The battery for the electric car uses about 200 kg of about 8 different metals and minerals, while the conventional car only needs about 30 kg of 2 metals. Copper, nickel and graphite constitute the largest proportion of the need for the electric car. The amount of steel and aluminum is not shown in the figure.

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