THE MINERAL INDUSTRY OF

SWEDEN

By Harold R. Newman

Sweden is endowed with significant deposits of iron ore, certain base metals (copper, lead, and zinc), and several industrial minerals, including dolomite, feldspar, granite, ilmenite, kaolin, limestone, marble, and quartz. The country was well known for the production of high-quality steel. Because Sweden must rely heavily on hydrocarbon imports owing to inadequate indigenous resources, the country has developed nuclear and hydroelectric power.

In 1998 exploration, which continued at increased levels was mostly directed toward base metals, gold, and diamonds. Overall mine production decreased somewhat in 1998 compared with that of 1997 mainly owning to prevailing low metal prices. North Mining Svenska AB's Zinkgruvan Mine and the 11 mines of Boliden Mineral AB accounted for most of the base-metal production. (See table 1.)

Because Sweden lacked a zinc smelter, most zinc ore and concentrate, one of the largest mineral exports, was shipped to Norway. The country imported most of the raw material required to operate its copper and lead smelter. (See table 2.)

Sweden's recycling rate for aluminum cans was high because of close cooperation among the stock producer for cans (Finspong), the can manufacturer (PLM Fosie), the collection companies (Returpak and PLM Fosie), and the secondary smelters (Gotthard Aluminum and Finspong). Consequently, secondary aluminum production has increased in the past few years.

After acceding to the European Union (EU) on January 1, 1995, Sweden liberalized its mineral policy to parallel EU standards. The policy, based on the Swedish Minerals Act, 1992, eliminated laws requiring foreign companies to get special permission for prospecting, annulled the State's participation in mining enterprises (so-called crown shares), and revoked all taxes and royalties, except for a 28% corporate tax, one of the lowest in Europe. Furthermore, an exploration permit holder will not receive an exploration permit until adequate financial and technical capabilities can be proven.

The most important changes were the introduction of the obligatory filing of data after abandonment of an area to avoid duplication of work, the reorganization of the mining inspectorate (Bergmästarämbetet) to increase its effectiveness, the shortened time period in the handling of applications, and the elimination of some elements of discretion that have remained in the handling of exploration applications. Also, more-explicit rules for environmental protection were to be incorporated in the exploration permit (Geological Survey of Sweden, 1998 Mineral policy, law and ordinance, accessed July 15, 1999, at URL http://www.sgu.se/metmin/minlag_e.htm).

Exploration expenditure in Sweden has doubled since new mining legislation was introduced. Expenditures in 1998 rose for the fifth consecutive year to more than $34 million. This was counter to the experience worldwide. Although Swedish budgets were 20% higher in 1998 than those in 1997, exploration expenditures worldwide were expected to fall by at least 30% in 1998 (Mining Journal, 1998b).

Boliden's Aitik copper mine, near Gällivare, was one of the lowest grade and most northerly copper mines in the world and was one of Europe's largest open pit mines. The ore occurs in a shear zone that can be followed from Kiruna, Sweden, to Lake Ladoga in Russia. The gold and silver byproducts contributed substantially to the profitability of the Aitik copper mine.

Boliden announced that it was expanding its Rönnskär copper refinery capacity to 240,000 metric tons per year. Expansion plans also included harbor expansion and improvements, a new flash furnace, a new anode casting plant, and extension of the sulfuric acid plant. Improvements to the harbor would allow three ocean-going vessels to berth at one time. The anode casting plant output would increase from 40 metric tons per hour (t/hr) of anode to 100 t/hr. Cost was estimated to be $245 million, and work was expected to be completed by mid-2000 (Mining Journal, 1998a).

Western Europe's largest gold mine, William Resources Inc. of Canada's open pit Björgdal Mine, continued production in 1998; the former owner, Terra Mining AB, was bought by William Resources in 1996. A plant upgrade that would allow planned production to increase to more than 3,000 kilograms per year was completed. Large-scale processing was helping to keep production costs down. William was continuing exploration activities and reported that this had increased estimated minable reserves to 8.6 million metric tons (Mt) of ore grading an average of 2.32 grams per metric ton gold (Coal Age, 1998).

William Resources announced that Sweden's Licensing Board for Environmental Protection had approved its application to upgrade its gold concentrates to doré bars. The refining plant, the first of its kind in Sweden, will upgrade the low- and medium-grade concentrates to doré bars. The high-grade concentrate would continue to be shipped to an outside refinery. The plant was estimated to cost about $2.3 million (William Resources Inc., 1998, William obtains permit for refining plant at Björkdal, press release, accessed July 8, 1999, at URL http://www.williamres.com/htm/news_releaseapril298.htm).

Luossavaara-Kiirunavaara AB (LKAB) had iron ore mines and processing plants in Kiruna and Malmberget, a pelletizing plant in Svappavaara, and harbors at Luleå and Narvik. LKAB had the world's largest, most modern underground iron ore mine at Kiruna. Mining was large scale and highly automated. In 1998, about 23.2 Mt of crude ore was mined from the ore body; this equates to about 65,000 metric tons per day. The Kiirunavaara ore body runs about 4 kilometers (km) from north to south and averages 80 meters (m) in width and extends to a

depth of about 2 km at a 60-degree incline. A third of the original ore body, about 875 Mt, has been mined to date. In May 1997, the first section of a new mining system, KUJ2000, came into operation. This new main level was at a depth of 1,045 m, and mining will continue near this level until around 2018 (LKAB Kiruna, 1998, Mining in Kiruna, press release, accessed July 20, 1999, at URL http://www.lkab.se/english/kiruna/miningInKiruna.html).

LKAB's Malmberget operations started a major project with the construction of a new main level at 1,000 m, some 185 m below the 1998 level. This was expected to extend the working life of the mine until beyond 2010. In addition, there are projects to increase pellet production, to start production and processing of hematite ores, and to build new facilities for loading and servicing the trains that transport the products to Luleå (LKAB, Malmberget, Mining in Malmberget, press release, accessed July 20, 1999, at URL http://www.lkab.se/english/malmberget/miningInMalmberget.html).

Svenskt Stal AB (SSAB) was Scandinavia's leading manufacture of commercial steel. Most production consisted of steel sheets and plates, produced mainly in three SSAB subsidiaries at Borlänge, Luleå, and Oxelösund. The SSAB Oxelösund AB complex consisted of a coking plant, blast furnaces, a steel mill, and a continuous casting line for slabs and heavy plate of up to 155 millimeters in thickness. The 2-million-metrict-ton-per-year SSAB Tunnplant AB was an integrated steel company with a coking plant, blast furnaces, and continuous casting line for the manufacture of slab and heavy plate.

The Zinkgruvan Mine, the largest zinc mine in Sweden, was operated by North Mining Svenska AB, a subsidiary of the Australian company, North Limited. The operation was producing about 60,000 t/yr of zinc in concentrate.

In the industrial minerals area, extensive changes in ownership have been reported during the past 5 to 6 years. This has been an expanding sector in Sweden, and a significant number of deposits were owned or controlled by international owners.

A prolonged decline in the construction industry had a effect on the cement industry. This was compensated, to some extent, by an increase in civil engineering projects, in particular the fixed-link bridge with Denmark across the Öresund. Cementa AB was the only cement producer and operated three integrated plants at Degerhamn, Skövde, and Slite. A high portion of cement production was exported (International Cement Review, 1998).

Limestone occurs in strata of several geologic ages throughout the country. About one-half of the industrial mineral value was contributed by limestone. A significant amount of limestone production was by Kalproduktion Storugns AB. The company mined about 2.8 Mt at Storugns on the Baltic Island of Gotland. About 40% of this was consumed by the metallurgical industry, and about 30% ended up as burnt lime. Other uses included the chemical and sugar industries and environmental applications. About 55% of total production was exported.

Borghamnsten AB had quarries and a factory equipped to saw raw blocks of marble. The company operated a raw marble quarry at Askersund near the Glanshamar locality. Annual quarry production was about 14,000 cubic meters (m^3), which gave about 2,000 m^3 of marble as raw blocks.

The Swedish peat area covers 6.4 million hectares (ha), which is about 15% of the country's total land area. About 865,000 ha were considered to be suitable for commercial production. In 1998, almost 8,000 ha were in production, most of which was used for fuel; the remainder was used for agriculture. The 70% used for fuel purposes was mainly in cogeneration plants for electric power and district heating. Some local authorities and industrial enterprises used peat as fuel to produce power and heat.

Sweden has a well-developed transportation system, especially in the southern part of the country. There were 97,400 km of highway and 12,000 km of railroads. About 65% of waterborne cargo was handled by the five biggest ports— Goteborg, Helsingborg, Luleå, Stockholm, and Malmo. Truck ferries have become an important form of transportation.

On July 1, 2000, the $2.5 billion, 4.8-mile Öresund fixed-link bridge is scheduled to be completed and opened. It will span the water from Malmo, Sweden, to Copenhagen, Denmark, linking the two cities and creating the eighth largest region in Europe in terms of gross national product (GNP). One-fifth of the combined GNP of Sweden and Denmark comes from the Öresund region, an area of about 3.2 million people living in a 95-km radius. Four lanes on the upper level of the bridge will be open for vehicles, and trains will roll across the lower level. A tunnel, slightly longer than the bridge and to be used for vehicular traffic, will also be part of the connection. On 1998, travel between the two cities was by either hydrofoil or airplane (Sains, 1999).

References Cited

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Sains, Ariane, 1999, The Öresund link: Europe Magazine, no. 388, July-August, p. 16.

Major Source of Information

Geological Survey of Sweden
Mineral Resources Information Office
Skolgatan 4
93070 Malå, Sweden

TABLE 1
SWEDEN: PRODUCTION OF MINERAL COMMODITIES 1/

(Metric tons unless otherwise specified)

Commodity		1994	1995	1996	1997	1998 e/
METALS						
Aluminum metal:						
Primary		83,900	94,500	98,306	98,377	95,670 2/
Secondary e/		33,000	23,000	24,000	24,000 r/	25,000
Copper:						
Mine output, Cu content		79,384	83,603 r/	71,660 r/	86,640 r/	73,685 2/
Metal:						
Smelter:						
Primary e/		79,080 2/	80,000	100,000	100,000	100,000
Secondary e/		19,620 2/	30,000	26,000 r/	28,000 r/	25,000
Total		98,700	110,000	126,000 r/	128,000 r/	125,000
Refined:						
Primary		77,300	78,000	90,000 e/	85,000 e/	90,000
Secondary		25,750	27,100	37,000 e/	32,000 e/	35,000
Total		103,050	105,100	127,000 e/	117,000 e/	125,000
Gold:						
Mine output, Au content	kilograms	6,364	6,528 r/	6,145 r/	6,777 r/	5,944 2/
Metal, primary 3/	do.	7,998	8,200	10,100 e/	10,000 r/	9,000
Iron and steel:						
Iron ore concentrate and pellets:						
Gross weight	thousand tons	19,663	21,634	21,020	21,893	20,930 2/
Fe content	do.	12,587	13,880	14,714	13,912	12,977 2/
Metal:						
Pig iron and sponge iron	do.	3,040	3,020	3,255	3,060	3,373 2/
Ferroalloys:						
Ferrochromium		134,076	130,170	138,110	101,842	123,958 2/
Ferrosilicon		21,392 r/	21,970 r/	21,287	22,000 e/	2,200
Total		155,468 r/	152,140 r/	159,397	123,842	126,158
Steel, crude	thousand tons	4,952	4,953	4,910	5,147	5,062 2/
Semimanufactures, rolled e/	do.	4,000	4,529	4,457	4,545 r/	4,485 2/
Lead:						
Mine output, Pb content		112,787	137,200	98,800 r/	108,600 r/	114,430 2/
Metal, refined:						
Primary		46,600	39,700	42,200	34,700	40,600
Secondary		36,000	51,500	41,900	51,500	52,000
Total refined		82,600	91,200	84,100	86,200	92,600
Molybdenum, oxide, roasted, Mo content e/		4,000	4,000	4,000	3,500	3,000
Nickel, metal: e/						
Unwrought, secondary		250	250	100	100	100
Primary		100	--	--	--	--
Selenium, elemental, refined		30	26	20	20 e/	20
Silver:						
Mine output, Ag content	kilograms	276,042	268,200	271,866 r/	304,048 r/	299,051 2/
Metal, primary 3/	do.	295,000	261,000	301,000	300,000 e/	250,000
Tin, metal:						
Unwrought		10	--	--	--	--
Alloy		500	--	--	--	--
Zinc, mine output, Zn content		159,858	167,090	160,325	155,400 r/	164,711 2/
INDUSTRIAL MINERALS						
Cement, hydraulic	thousand tons	2,300	2,539	2,447	2,320	2,400
Clays, kaolin e/	do.	100	460	460	450 e/	450
Feldspar, salable, crude and ground		44,250	45,000	45,000	50,000	45,000
Fertilizer, manufactured: e/						
Nitrogenous	thousand tons	450	450	400	400	400
Phosphatic	do.	10	10	10	10	10
Mixed	do.	300	300	300	300	300
Graphite		--	--	463	1,470	3,011 2/
Lime e/	thousand tons	500	530 2/	540	600	500
Olivine e/	do.	100	50	--	--	--
Quartz and quartzite e/	do.	500	518	525	500	500
Sodium sulfate, synthetic e/	do.	100	100	--	--	--

See footnotes at end of table.

TABLE 1--Continued
SWEDEN: PRODUCTION OF MINERAL COMMODITIES 1/

(Metric tons unless otherwise specified)

Commodity		1994	1995	1996	1997	1998 e/
INDUSTRIAL MINERALS--Continued						
Stone: e/						
Dimension:						
Mostly unfinished larvikite	thousand tons	150	150	160	150	150
Granite	do.	80	90 2/	100 2/	100	100
Limestone	do.	5	5	5	5	5
Slate	do.	20	20	20	20	20
Other	do.	20	10 2/	10 2/	10	10
Crushed:						
Dolomite	do.	700	700	600	600	600
Granite	do.	5,000	3,200 2/	3,500 2/	3,500	3,500
Limestone:						
For cement manufacture	do.	1,000	4,000	4,000	4,000	4,000
For lime manufacture	do.	700	1,000	1,000	1,000	800
For other construction and industrial uses	do.	1,500	1,700	2,000	1,800	1,600
Chalk	do.	30	50 2/	25	30	30
For agricultural uses	do.	350	450 2/	475 2/	400	400
For other uses	do.	100	1,000	1,000	1,000	1,000
Total	do.	3,680	8,200 2/	8,500	8,230	7,830
Sandstone	do.	50	50	100	100	75
Undifferentiated	do.	30,000	30,000	25,000	25,000	25,000
Other	do.	700	700	500	500	500
Sulfur, byproduct: e/						
From metallurgy	do.	125	125	100	100	100
From petroleum	do.	40	40	40	60	50
Total	do.	165	165	140	160	150
Talc, soapstone e/		25,000	25,000	30,000	25,000	25,000
MINERAL FUELS AND RELATED MATERIALS						
Carbon black	thousand tons	20	--	--	-- e/	--
Coal, anthracite and bituminous e/	do.	10	--	--	--	--
Coke, metallurgical	do.	1,200 e/	1,147	1,145	1,200 e/	1,150
Gas, manufactured: e/						
Coke oven gas	million cubic meters	500	500	500	500	500
Blast furnace gas	do.	4,000	4,000	3,500	3,500	3,500
Peat: e/						
Agricultural use	thousand cubic meters	1,100	1,052	1,084	1,100	1,000
Fuel	do.	2,600	2,624	2,278	2,400	2,500
Petroleum:						
Crude e/	thousand 42-gallon barrels	10	--	--	--	--
Refinery products: e/						
Liquefied petroleum gas	do.	3,000	3,000	3,500	3,500	3,000
Naphtha	do.	500	300	500	500	500
Gasoline, motor	do.	31,500	32,000	32,500	36,932 r/	38,862 2/
Jet fuel	do.	2,500	2,500	2,500	1,872 r/	1,288 2/
Kerosene	do.	50	50	50	50	50
Distillate fuel oil	do.	81,000	80,000	75,000	53,152 r/	56,582 2/
Residual fuel oil	do.	28,000	28,000	25,000	35,304 r/	38,508 2/
Other	do.	4,000	4,000	3,000	7,714 r/	7,800
Refinery fuel and losses	do.	10,000	10,000	5,000	5,000	5,000
Total	do.	160,550	159,850	147,050	144,024 r/	151,590

e/ Estimated. r/ Revised.

1/ Table includes data available through July 1999.

2/ Reported figure.

3/ Includes only that recovered from indigenous ores excluding scrap.

TABLE 2
SWEDEN: STRUCTURE OF THE MINERAL INDUSTRY IN 1998

(Thousand metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity
Aluminum		Granges AB (Electrolux, 100%)	Sundsvall smelter at Kubikenborg	98
Cement		Cementa AB (Scancem, 100%)	Plants at Degerhamn, Skövde, and Slite	3,400
Copper:				
Ore, copper content		Boliden Mineral AB (Trelleborg AB, 100%)	Mines at Aitik, Garpenberg, Kankberg, Kristineberg, Langdal, Petiknas, and Renstrom	68
Do.		Outokumpu Oyj	Mines at Viscaria (closed) and Pahtohavare	22
Metal		Boliden Mineral AB (Trelleborg AB, 100%)	Smelter and refinery at Rönnskär	100
Feldspar		Berglings Malm & Mineral AB (Omya GmbH)	Mines at Beckegruvan, Hojderna, and Limbergsbo	50
Do.		Forshammar Mineral AB (Omya GmbH)	Mines at Limberget and Riddarhyttan	30
Do.		Larsbo Kalk AB (Omya GmbH)	Mines at Glanshamar and Larsbo	20
Ferroalloys		Vargon Alloys AB	Plant at Vargon	175
Gold:				
Ore, gold content	kilograms	William Resources Inc.	Björgdal Mine at Skellefta	3,000
Do.	do.	Boliden Mineral AB (Trelleborg AB, 100%)	Mines at Aitik, Akerberg, Kankberg, Kristineberg, Langdal, Petiknas, and Renstrom	2,000
Metal		do.	Smelter and refinery at Rönnskär	9
Graphite		Woxna Graphite AB (Tricorona Mineral AB, 100%)	Mine and plant at Kringeltjärn, Woxna	20
Iron ore		Luossavaara-Kiirunavaara AB (Government, 98%)	Mines at Kiruna and Malmberget	28,500
Iron and steel		Svenskt Stal AB (Government, 48%)	Steelworks at Borlänge, Luleå, and Oxelosund	3,500
Kyanite		Svenska Kyanite AB (Svenska Mineral, 100%)	Quarry at Halskoberg	10
Lead:				
Ore, lead content		Boliden Mineral AB (Trelleborg AB, 100%)	Mines at Garpenberg, Laisvall, Langdal, Petiknas, and Renstrom	110
Do.		North Mining Svenska AB	Zinkgruvan Mine at Ammeberg	20
Metal		Boliden Metals AB (Trelleborg AB, 100%)	Smelter and refinery at Rönnskär	115
Lime		Euroc Mineral AB	Plants at Limham, Koping, and Storugns	250
Do.		Svenska Mineral AB	Plants at Rattvik and Boda	250
Limestone		Kalproduktion Storugns AB (Nordkalk AB, 100%)	Mines at Gotland Island	3,000
Marble	cubic meters	Borghamnsten AB	Quarry at Askersund	15,000
Petroleum, refined	barrels per day	Skandinaviska Raffinaderi AB	Refinery at Lysekil	210,000
Do.		BP Raffinaderi AB	Refinery at Goteborg	100,000
Do.		Shell Raffinaderi AB	do.	82,000
Do.		AB Nynas Petroleum	Refineries at Goteborg, Malmo, and Nynashamn	54,000
Silver, metal	kilograms	Boliden Metals AB (Trelleborg AB, 100%)	Smelter and refinery at Rönnskär	300,000
Do.	do.	North Mining Svenska AB	Zinkgruvan Mine at Ammeberg	25,000
Zinc, ore, zinc content		Boliden Mineral AB (Trelleborg AB, 100%)	Mines at Garpenberg, Laisvall, and Langdal	112
Do.		North Mining Svenska AB	Zinkgruvan Mine at Ammeberg	60