

# THE MINERAL INDUSTRY OF SWEDEN

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After a brief recovery in the first half of 2003, the Swedish economy experienced a growth slowdown in the gross domestic product (GDP) in the second half of the year. As a result, the GDP grew by only 1.4% compared with 1.9% in 2002. The inflation rate was low and steady at 1.5% (International Monetary Fund, 2003§<sup>1</sup>). Mining and manufacturing industries contributed 29% of the GDP and enabled Sweden to become a leading producing and exporting country in Europe. Sweden mined and exploited some important mineral commodities that included base metals (copper, lead, and zinc), industrial minerals (dolomite, feldspar, granite, ilmenite, kaolin, limestone, marble, and quartz), and iron ore. The country is well-known for the high-quality steel produced by Svenska Stal AB. Sweden also has abundant hydroelectric power.

The Government was looking at the possibility of a total ban on the use of mercury, which was already strictly controlled. Where possible, products were required by law to be mercury free by the end of 2003. Certain exceptions were allowed; a major one was the use of mercury in dental amalgams. The current law did not prevent mercury from being used in new applications that might be developed in the future (Metal-Pages, 2003).

North Atlantic Natural Resources AB (NAN) received an independent reserve estimate by Micon International Limited of the United Kingdom for its Storliden base-metals mine in the Skelleftea region. Proven and probable reserves at the operation were 1.4 million metric tons (Mt) at a grade of 9.7% zinc, 3.6% copper, 0.3 gram per metric ton (g/t) gold, and 30 g/t silver, of which proven reserves were 1.17 Mt at a grade of 9.5% zinc, 3.9% copper, 0.3 g/t gold, and 32 g/t silver. South Atlantic Ventures Ltd. and Boliden Ltd. each owned 38% of NAN (Mining Journal, 2003b).

NAN's drilling program at the Storliden Mine in northern Sweden was to define the ore body in the East Zone and the West Zone better and to investigate possible extensions; the program was completed from underground. The results were used to refine the plans for extraction of the ore from the mine later in 2003. The grades in the East Zone averaged from 3% to 4% copper and from 10% to 12% zinc. Drilling on the upper West Zone intercepted high grades of 47.2% zinc over 0.8 meter (m) within a 2.45-m intercept that averaged 43% zinc (South Atlantic Ventures Ltd., 2003b).

South Atlantic Ventures Ltd. reported that reanalysis of a diamond drill core on the Lieteksavo target at its Norrbotten project indicated a 9.25-m intercept that graded 6% copper, 3.3 g/t gold, and 42 g/t silver. The target is located 35 kilometers (km) southwest of Kiruna. Induced polarization surveying defined a significant copper-gold mineralization along a 500-m northeast-southwest trend. The mineralization was characterized by quartz-tourmaline, magnetite, and copper

sulfide minerals. Anomalous areas were tested by a diamond drilling program in 2003 (South Atlantic Ventures Ltd., 2003e).

South Atlantic Ventures entered into a joint venture with Poplar Resources Ltd. to acquire a 60% interest in the Bottenbacken polymetallic (copper, gold, and palladium with platinum and silver) project in central Sweden through expenditures of \$1.15 million during 3 years. Bottenbacken is located 90 km southwest of Ostersund. Work completed by Poplar Resources included a detailed airborne magnetic survey, an induced polarization survey, and core drilling in 18 holes. South Atlantic Ventures would be the operator of the project (South Atlantic Ventures Ltd., 2003d).

South Atlantic Ventures started an exploration drilling program on the Bottenbacken project to identify the source of induced polarization anomalies that could be associated with copper-sulfide bearing boulders found in the adjacent area. The first phase of the drilling program was expected to be completed by mid-October (South Atlantic Ventures Ltd., 2003a).

Beowulf Gold plc reported assay results of mineralized boulders located on the company's 100% owned gold project area in the Jokkmokk region of northern Sweden. Two different styles of mineralization were indicated—one of iron oxide/gold/copper type and the other of a more classical massive sulfide type. The two new boulder fields were separate from the area of known bedrock mineralization (Beowulf Gold plc, 2003).

MinMet plc of the United Kingdom was in advanced negotiations to acquire the producing Bjorkdal gold mine and its adjoining mining and exploration concessions, which are located 35 km northwest of Skelleftea; the concessions included a mining license for the Barsele project, which is located 40 km east-southeast of Storuman. Bjorkdal was owned by International Gold Exploration AB (50%) and Dormant Properties AB (50%). Previous work outlined a resource of 9 Mt that averaged 1.8 g/t of gold. In 2002, the mine produced 1,017 kilograms (kg) of gold from existing stockpiles. In 2003, it continued to process lower grade stockpiled ore and to produce 1,120 kg of gold. On the basis of a cutoff grade of 0.85 g/t gold, a resource of 8.65 Mt that averaged 2.2 g/t gold was estimated in 1999. The acquisition was expected to cost MinMet 370 million new shares, which represented 43% of the enlarged share capital. Dormant Properties would receive 188 million shares in MinMet and own 26.7% (Mining Journal, 2003a).

Svartliden Guld AB won the right to start gold and silver mining in northern Sweden. First gold production would follow in March 2004 after 9 months of construction. Average output of 1,560 kilograms per year was planned with a first-year production of 2,180 kg. Resources were estimated to be 2.6 Mt of ore at a grade of 4.8 g/t of gold based on a cutoff of 1.5 g/t. Dragon Mining NL of Australia owned 80% of the Svartliden gold project (Reuters, 2003§).

Naturvardsverket, which was the Swedish environment protection agency, lodged an appeal against the Environment Court's decision to grant regulatory approval for the

<sup>1</sup>References that include a section mark (§) are found in the Internet References Cited section.

development and operation of the Svartliden project. The Naturvardsverket appeal was concerned with the design and function of the tailings and waste dam after decommissioning (MineBox, 2003§).

NAN reported encouraging results from its new nickel project at Vasterbotten in northern Sweden. A 25-km trend that hosted three known deposits (Brannorna, Lappvattnet, and Mjovattnet) was identified from aeromagnetic surveying as having potential for discovery of additional mineralization. These deposits were considered to be excellent exploration targets. Massive sulfides were less common but occurred in subordinate amounts in Lappvattnet and Mjovattnet. The Brannorna deposit is located 2 km northeast of the Lappvattnet deposit and was part of the same mineralized zone. The Lappvattnet deposit had an indicated resource of 1.1 Mt at a grade of 1% nickel (South Atlantic Ventures Ltd., 2003c).

Boliden's exploration program at the Lappberget deposit yielded results with high grades especially of zinc, silver, and lead. Parts of the mineralization were classified as "inferred resources" and were estimated to be 7.5 Mt. The discovery of the mineralization between the Garpenberg and the Garpenberg North mines was made in April 2002. The area was covered by an exploration permit and is within 1 km of existing exploitation concessions (Boliden Ltd., 2003).

Boliden Ltd. and Hexagon AB formed the joint venture Boliden Nordic Brass AB. Owing to the overcapacity in the European brass market, the merger of the assets of Boliden Gusum AB and Nordic Brass Co. would result in focusing on the operation of one plant and leading to the shutdown of the other. The companies were in the process of discussing and finalizing the plans, and a decision would be made in April (Metal Bulletin, 2003b).

Boliden and Outokumpu Oyj of Finland signed a letter of intent whereby Boliden would acquire Outokumpu's mining and smelting operations in zinc and copper and sell its fabrication and technology sales units to Outokumpu. Thus, New Boliden would become the fourth largest zinc mining company in the world. The Outokumpu assets included the Tara zinc mine in Ireland; zinc smelters at Kokkola, Finland, and Odda, Norway; Outokumpu Zinc Commercial in the Netherlands; a copper smelter at Harjavalta, Finland; and a copper refinery at Pori, Finland. Outokumpu would become Boliden's largest shareholder with a 49% stake. The Boliden assets were Boliden Fabrication (copper tubes and brass products) in Belgium, the Netherlands, Sweden, and the United Kingdom, and Boliden Contech (technology sales) in Sweden. Boliden would own 2.8% of Outokumpu (PrimeZone, 2003§).

AvestaPolarit AB reversed its strategic decision to end the rolling of bar and billet at its Degerfors plant in Sweden. The meltshop was due to close in September with the loss of 175 jobs. Degerfors would roll 50,000 metric tons per year (t/yr) of bloom supplied from AvestaPolarit's continuous casting facility at Sheffield, United Kingdom. The maximum rolling capacity at Degerfors was 100,000 t/yr. Continuation of long-product rolling operations would secure 50 jobs (Metal Bulletin, 2003a).

Vargon Alloys shut down its ferrosilicon furnaces for annual maintenance in the first quarter of 2003 owing to extended price weakness and soaring hydroelectric power costs. Spot power rates rose to \$100 per megawatthour in January 2003 continuing into the spring compared with \$20 to \$28 per megawatthour in January 2002. The plant had a capacity of 25,000 t/yr of ferrosilicon. Its ferrochrome furnaces were operational, but not at full capacity (Metal Bulletin Research, 2003).

Shell Raffinaderi AB planned to sell all its Swedish operations, which included the refinery at Gothenburg and the petrol stations. Fortum Keilaniemi of Finland was a potential buyer. The sale was expected to be completed by yearend. The refinery was small with a capacity of 4 million metric tons per year (Mt/yr) of crude oil. It produced 3.7 Mt/yr of aviation fuel, diesel, heavy heating oil, light heating oil, and gasoline. A project was underway to desulfurize heating oil and was expected to be ready in 2003. The supply of waste process heat to Gothenburg would be sufficient to heat 70,000 homes (Alexander's Gas & Oil Connections, 2003§).

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PrimeZone, 2003 (September 8), Boliden and Outokumpu to create a world-leading mining and smelting company, accessed September 10, 2003, at URL [http://www.primezone.com/pages/news\\_releases.mhtml?d=44745](http://www.primezone.com/pages/news_releases.mhtml?d=44745).

## **Major Source of Information**

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

TABLE 1  
SWEDEN: PRODUCTION OF MINERAL COMMODITIES<sup>1</sup>

(Metric tons, unless otherwise specified)

Commodity	1999	2000	2001	2002	2003
<b>METALS</b>					
<b>Aluminum, metal:</b>					
Primary	99,340	100,800	101,800	100,600	101,200
Secondary <sup>c</sup>	25,000	26,000	25,000	28,000	30,000
Total	124,340	126,800	126,800	128,600	131,200
<b>Copper:</b>					
Mine output, Cu content	71,200 <sup>e</sup>	77,765	74,269	72,100	83,000
<b>Metal:<sup>e</sup></b>					
Smelter:					
Primary	85,000	95,000	173,000	188,000	185,000
Secondary	30,000	35,000	35,000	35,000	30,000
Total	115,000	130,000	208,000	223,000	215,000
Refined:					
Primary	95,000	105,000	179,000	199,000	189,000
Secondary	20,000	25,000	25,000	25,000	25,000
Total	115,000	130,000	204,000	224,000	214,000
<b>Gold:</b>					
Mine output, Au content	4,400 <sup>e</sup>	3,570	4,986	4,500 <sup>r</sup>	4,300
Metal, primary <sup>e,2</sup>	8,000	8,000	8,000	8,000	8,000
<b>Iron and steel, metal:</b>					
Iron ore concentrate and pellets:					
Gross weight	18,558	20,557	19,486	20,300 <sup>r,e</sup>	21,500 <sup>e</sup>
Fe content	11,506	13,556	12,811	13,000 <sup>e</sup>	14,000 <sup>e</sup>
Metal:					
Pig iron and sponge iron	3,212	3,146	3,614	3,703 <sup>r</sup>	3,700 <sup>e</sup>
Ferroalloys:					
Ferrochromium	131,140	135,841	109,198	118,823	120,000 <sup>e</sup>
Ferrosilicon	21,440	20,000 <sup>e</sup>	22,000 <sup>e</sup>	23,000 <sup>e</sup>	24,000 <sup>e</sup>
Total	152,580	156,000 <sup>e</sup>	131,000 <sup>e</sup>	142,000 <sup>e</sup>	144,000 <sup>e</sup>
Steel, crude	5,075	5,227	5,518	5,754	5,707
Semimanufactures <sup>e</sup>	4,400	4,500	4,500	4,600	4,600
<b>Lead:</b>					
Mine output, Pb content	116,300	106,584	85,975	43,000 <sup>r</sup>	50,400
Metal, refined:					
Primary	38,000 <sup>e</sup>	30,604	31,322	30,000 <sup>e</sup>	24,200 <sup>e</sup>
Secondary	48,000 <sup>e</sup>	47,255	44,056	39,700 <sup>e</sup>	52,000 <sup>e</sup>
Total	86,000 <sup>e</sup>	77,859	75,378	69,700 <sup>e</sup>	76,200 <sup>e</sup>
Molybdenum, oxide, roasted, Mo content <sup>c</sup>	3,000	3,000	3,000	3,000	3,000
Nickel, metal, secondary <sup>c</sup>	60	50	50	50	50
Selenium, elemental, refined <sup>c</sup>	20	20	20	20	20
<b>Silver:</b>					
Mine output, Ag content	284,100	328,737	306,029	299,300	306,800
Metal, primary <sup>e,3</sup>	250,000	250,000	250,000	250,000	250,000
Zinc, mine output, Zn content	174,400	176,788	156,334	148,600 <sup>r</sup>	186,900
<b>INDUSTRIAL MINERALS</b>					
Cement, hydraulic	2,298	2,651	2,600	2,700 <sup>e</sup>	2,650 <sup>e</sup>
Clays, kaolin	450 <sup>e</sup>	--	--	--	--
Diamond, synthetic <sup>c</sup>	25,000	20,000	20,000	20,000	20,000
Feldspar, salable, crude and ground	45,000 <sup>e</sup>	35,000	40,450	40,000 <sup>e</sup>	41,000 <sup>e</sup>
Fertilizer, manufactured <sup>c</sup> :					
Nitrogenous	400	400	400	400	400
Phosphatic	10	10	10	10	10
Mixed	300	300	300	300	300
Graphite	4,500	5,108	963	900 <sup>e</sup>	850 <sup>e</sup>
Lime <sup>c</sup>	500	550	550	580	590
Quartz and quartzite <sup>c</sup>	500	500	600	600	600

See footnotes at end of table.

TABLE 1--Continued  
 SWEDEN: PRODUCTION OF MINERAL COMMODITIES<sup>1</sup>

(Metric tons, unless otherwise specified)

Commodity	1999	2000	2001	2002	2003	
<b>INDUSTRIAL MINERALS--Continued:</b>						
<b>Stone:<sup>c</sup></b>						
<b>Dimension:</b>						
Mostly unfinished	thousand tons	160	160	160	160	170
Granite	do.	100	130 <sup>3</sup>	128 <sup>3</sup>	130	130
Limestone	do.	5	32 <sup>3</sup>	28 <sup>3</sup>	30	32
Slate	do.	20	11 <sup>3</sup>	16 <sup>3</sup>	15	15
Other	do.	10	8 <sup>3</sup>	5 <sup>3</sup>	6	6
<b>Crushed:</b>						
Dolomite	do.	600	488 <sup>3</sup>	456 <sup>3</sup>	450	440
Granite	do.	3,500	3,500	3,500	3,500	3,500
<b>Limestone:</b>						
For cement manufacture	do.	4,000	3,770 <sup>3</sup>	4,070 <sup>3</sup>	4,000	3,950
For lime manufacture	do.	800	800	900	900	950
For other construction and industrial uses	do.	1,600	1,800	1,800	1,700	1,700
<b>Chalk:</b>						
For agricultural uses	do.	30	30	70	70	80
For other uses	do.	400	450	550	600	650
Total	do.	1,000	1,500	1,500	1,500	1,500
Sandstone	do.	75	34 <sup>3</sup>	5 <sup>3</sup>	10	15
Undifferentiated	do.	25,000	30,000	30,000	30,000	30,000
Other	do.	500	580 <sup>3</sup>	371 <sup>3</sup>	400	400
<b>Sulfur:</b>						
Metallurgy	do.	65	91	152	150 <sup>e</sup>	150 <sup>e</sup>
Petroleum	do.	56	61	55	60 <sup>e</sup>	65 <sup>e</sup>
Total	do.	121	152	207	210 <sup>e</sup>	215 <sup>e</sup>
Talc, soapstone		25,000 <sup>e</sup>	20,000	15,000	15,000 <sup>e</sup>	15,000 <sup>e</sup>
<b>MINERAL FUELS AND RELATED MATERIALS</b>						
Coke, metallurgical <sup>e</sup>	thousand tons	1,200	1,200	1,200	1,200	1,250
<b>Gas, manufactured:<sup>e</sup></b>						
Coke oven gas	million cubic meters	500	500	500	500	500
Blast furnace gas	do.	3,500	3,500	3,500	3,500	3,500
<b>Peat:</b>						
Agricultural use <sup>e</sup>	thousand cubic meters	1,460 <sup>3</sup>	1,000 <sup>r</sup>	1,400	1,800 <sup>r</sup>	1,800
Fuel	do.	2,652	1,372	2,496	2,885 <sup>r</sup>	2,900 <sup>e</sup>
<b>Petroleum, refinery products:<sup>e</sup></b>						
Liquefied petroleum gas	thousand 42-gallon barrels	3,000	3,000	3,000	3,000	3,000
Naphtha	do.	500	500	500	500	500
Gasoline, motor	do.	38,000	39,000	40,000	40,000	41,000
Jet fuel	do.	1,400	1,500	1,500	1,500	1,600
Kerosene	do.	50	50	50	50	50
Distillate fuel oil	do.	56,000	57,000	57,000	58,000	58,000
Residual fuel oil	do.	38,000	39,000	39,000	40,000	40,000
Other	do.	7,800	7,800	7,800	7,800	8,000
Refinery fuel and losses	do.	5,000	5,000	5,000	5,000	5,000
Total	do.	150,000	153,000	154,000	156,000	157,000

<sup>e</sup>Estimated; estimated data are rounded to no more than three significant digits; may not add to totals shown. <sup>r</sup>Revised. -- Zero.

<sup>1</sup>Table includes data available through September 16, 2004.

<sup>2</sup>Includes only that recovered from indigenous ores excluding scrap.

<sup>3</sup>Reported figure.

TABLE 2  
SWEDEN: STRUCTURE OF THE MINERAL INDUSTRY IN 2003

(Thousand metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity
Aluminum		Granges AB (Glencore International AG, 100%)	Sundsvall smelter at Kubikenborg	100
Cement		Cementa AB (Scancem, 100%)	Plants at Degerhamn, Skovde, and Slite	3,400
Copper:				
Ore, copper content		Boliden Mineral AB	Mines at Aitik, Garpenberg, Kankberg, Kristineberg, Langdal, Petiknas, and Renstrom	68
Do.		Outokumpu Oyj	Mines at Pahtohavare	22
Metal		Boliden Metals AB	Smelter and refinery at Ronnskar	240
Feldspar		Berglins Malm & Mineral AB (Omya GmbH)	Mines at Beckegruvan, Hojerna, 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	International Gold Exploration AB (50%) and Dormant Properties AB (50%)	Bjorkdal Mine at Skellefte	3,000
Do.	do.	Boliden Mineral AB	Mines at Aitik, Akerberg, Kankberg, Kristineberg, Langdal, Petiknas, and Renstrom	2,000
Metal		do.	Smelter and refinery at Ronnskar	9
Graphite		Woxna Graphite AB (Tricorona Mineral AB, 100%)	Mine and plant at Kringeltjarn, Woxna	20
Iron and steel		Svenskt Stal AB (Government, 48%)	Steelworks at Borlange, Lulea, and Oxelosund	3,900
Iron ore		Luossavaara-Kiirunavaara AB (Government, 98%)	Mines at Kiruna and Malmberget	32,500
Kyanite		Svenska Kyanite AB (Svenska Mineral AB, 100%)	Quarry at Halskoberg	10
Lead:				
Ore, lead content		Boliden Mineral AB	Mines at Garpenberg, Laisvall, Langdal, Petiknas, and Renstrom	110
Do.		North Mining Svenska AB	Zinkgruvan Mine at Ammeberg	20
Metal		Boliden Metals AB	Smelter and refinery at Ronnskar	115
Lime		Euroc Mineral AB	Plants at Limham, Koping, and Storugns	250
Do.		Svenska Mineral AB	Plants at Rattvik and Boda	250
Limestone		Kalproduction 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 Gothenburg	100,000
Do.		Shell Raffinaderi AB	do.	82,000
Do.		AB Nynas Petroleum	Refineries at Gothenburg, Malmo, and Nynashamn	54,000
Silver, metal	kilograms	Boliden Metals AB	Smelter and refinery at Ronnskar	408,000
Do.	do.	North Mining Svenska AB	Zinkgruvan Mine at Ammeberg	25,000
Zinc, ore, zinc content		Boliden Mineral AB	Mines at Garpenberg, Laisvall, Langdal, and Renstrom	112
Do.		Zinkgruvan Mining AB (North Ltd., 100%)	Zinkgruvan Mine at Ammeberg	60