

# stabilit

A MAGAZINE FROM SVEMIN • THE SWEDISH ASSOCIATION OF MINES, MINERAL AND METAL PRODUCERS

Biggest, best & most beautiful!?

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SOON TO BE AN AUTHORIZED MINE SURVEYOR

**Therese Edlund surveys Zinkgruvan**

*"Longed to see something new"*

Linus Bolin is a raise boring operator in the Himalayas **Page 3**



To rock mechanics, environmental engineers, mechanics, geologists, planners, metallurgists, loaders, maintenanceworkers, etc. of the future...

*Hi there – how are you?*

**I and 8,000 other people in the Swedish mining and metal industry would like to welcome you to an exciting industry. Social development needs metals and we need you!**

People with commitment, knowledge and creative thinking are needed to operate mines. The mining industry is exciting in many ways. Metal is sold on the world market and we always work closely with other countries and cultures. The industry uses very advanced technology and equipment. The work involves interaction between people with different knowledge. All of this creates an interesting working environment.

There are many career paths in the mining industry. You can start at one end and finish

at a completely different one. It is not unusual to work abroad for periods of time. I came to the mining industry after many years in the engineering industry. I am now MD of the metal company Boliden and president of SveMin, which is an organisation for mines and mineral and metal producers in Sweden.

This magazine is called 'Stabilit' (Stable) and I would like to welcome you to an industry with both a tradition and a future. The mining industry is constantly changing but it remains a stable industry. Our mines cannot move abroad, and people need metal.

I hope you enjoy the magazine!

**Lennart Evrell**  
President of SveMin

## Miner

# "Freedom with responsibility"

**"I wanted to have a chance to get into LKAB and have a permanent job. And I wanted to do something that I thought was fun."**

These were Ola Huru Henriksson's reasons for applying for LKAB's miner training. Beforehand, Ola had worked as a welder, a mechanic and as a miner for a company that works for LKAB, among others.

Six people of various ages began the training. Half of them had experience of mining.

"The training felt right from day one," says Ola. "We had good teachers who had been in the industry for a long time. The aim was clear. Everyone wanted to get a job when we were done. And we all did."

The pupils had to choose two topics to learn thoroughly. Ola chose scaling and loading. He first worked with a miner teacher, then with a supervisor. The supervisors are ordinary miners with a lot of experience. The pupils were then 'released' and started to work independently. The training included some theory as well, including safety and blasting.

"I have a varied job. I usually work on my own. I have freedom with responsibility. You are in your own world in the mine and the days pass by fast. The next topic I will train in is rock reinforcement."



Photo: Fredric Alm

**NAME** Ola Huru Henriksson, born in 1980.  
**TRAINING** LKAB's training program for miners, 8 months. **WORKS** Miner in LKAB.

## Did you know that...

... the world's deepest mines are in South Africa. They are used to mine gold and diamonds and the mines can be 4,000 metres deep.

... the Stora Stöten open-cast mine at Falu Mine measures 1.5 km in circumference and is 100 metres deep. During the 17th century, Falu Mine was the biggest copper producer in the world.



Photo: Falu Mine

*Mine visitors, Falu Mine.*

... rising ore prices mean that Swedish mines that were previously closed are now resuming operations, for example Dannemora in Uppland and several mines in Bergslagen.

... Sweden is responsible for 93% of EU iron ore production (2010).

... China, Brazil and Australia are the three biggest producers of iron ore in the world.

... one of the world's biggest wheel loaders is used at Boliden's mine in Aitik. The machine weighs 210 tonnes and the scoop can load just over 30 tonnes. The diesel engines produce 1,800 bhp and the fuel tank holds 4,600 litres. One tyre costs as much as a new Volvo!

... ore has been mined continuously from the same ore horizon in Zinkgruvan since 1857. One million tonnes of ore are mined every year today.

... there are over 400 km of roads in LKAB's mine in Malmberget.



Photo: LKAB

... 10–12 ore trains travel from LKAB's mine in Kiruna to Narvik every day. The trains are 750 metres long and carry 6,800 tonnes of finished iron ore products. Each train is pulled by the strongest double electric locomotive in the world.

... since 2010 it has been possible to drive vehicles down into Zinkgruvan. The new decline is three kilometres long and connects to the mine at a depth of 650 metres. Previously everything and everyone had to travel by lift.

... there are 180 different occupations at LKAB.

... Bergteamet bores holes that are several hundred metres long and up to six metres in diameter.

# SveMin

En del av Industriarbetsgivarna

**Produced by Industriarbetsgivarna i Sverige Service AB for SveMin**, Swedish Association of mines, mineral and metal producers. SveMin comprises around 40 companies with 8,000 employees. The Mining Employers' Association (Gruvornas Arbetsgivareförbund or GAF) is part of SveMin. GAF signs agreements with the employee organisations for the mining industry.

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**More information** At [www.sveemin.se](http://www.sveemin.se) you can find links to our member companies. This include mining companies, various contractors and manufacturers of advanced equipment for our industry.

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**Raise boring operator**

**NAME** Linus Bolin, born in 1984. **TRAINING** At Bergteamet **WORKS** Raise boring operator for Bergteamet AB.

## Holes in the Himalayas

**"You need to adapt," says Linus Bolin on the phone from India. "Not everything is perfect here. At first you can't believe how different everything is. Then you get used to it and start to see the charm of it all."**

Linus and his Swedish colleague have been working in the state of Uttarakhand in northern India for a few months. The state borders on Nepal and China. They bore wide, long holes through the rock of the Himalayas. The holes are designed to take water down to the turbines in a new hydroelectric power plant.

Linus Bolin began to work as a truck driver at home in Sundsvall. He drove grit and cleared snow from the streets. But he wanted to see something else.

"Bergteamet was looking for raise borers and someone told them about me. I was called for an interview down in Gävle," Linus explains.

With his feel for machines and his flexibility, Linus was perfect for the job. He was employed on the spot and a day later he was

in Köping on machine maker Sandvik's course for raise borers. He was 22 at the time.

Bergteamet's equipment and know-how are highly specialised. Therefore, they offer their services to companies worldwide. During the time Linus has been employed, he has bored in Sweden, Finland, Spain, Ireland and India.

"It is a very varied job. We usually do everything ourselves, but not here in India. Here you are sort of site manager and are expected to just stand and point. I can't even hang up a cable without someone jumping in and doing it for me."

When the working day is over, Linus is driven by his chauffeur to his hotel in Joshimath. The monsoon rain has made the roads almost impassable. The hotel is draughty and Linus sleeps in thermal underwear so he doesn't freeze.

"My work gives me the opportunity to see different countries and new places. I would like to travel to South America, perhaps Chile. In this job, you can't be homesick. No way!"



**Site supervisor**

**NAME** Anette Waara, born in 1984. **TRAINING** Natural Science Programme at upper secondary school. Master of Science in Engineering (Roads and Water) at Luleå University of Technology. **WORKS** Site supervisor (construction) for LKAB in Malmberget.

## Site supervisor for new main level

**Anette Waara has been given an important task. She was employed by LKAB as site supervisor (construction) for the new main level being created in the Malmberget mine.**

When iron ore is mined at increasingly deeper levels, the centre of the mine ultimately has to move down as well. Otherwise the distance will become too big to the workshops, canteens, offices and, in particular, the skip in which the ore is hoisted to the surface.

Over 300 people are working together to build the new 'M1250' level. Anette Waara and her colleagues, around 40 people who are managing and planning the project, are housed on surface in a temporary project office. The main schedule is Anette's responsibility.

"I hold several meetings every day," says Anette. "It is necessary to coordinate the work and maintain good communication between everyone involved, on surface and under ground."

Anette comes from Gällivare. When she started studying science at upper secondary school, she had a plan:

"I wanted to train in a job that would allow me to stay up here. My dream workplace at the time was LKAB, perhaps as a rock mechanic."

However, Anette became interested in construction and took the Roads and Water Construction course at Luleå University of Technology. She got a job with a large construction company and began managing projects. She then took this experience with her to LKAB.

So, overall things have gone according to Anette's plan: construction, LKAB and a nice home in Gällivare 5 minutes from work, shops, the forest, skiing and the gym.

**Truckdriver**

## Outdoor and snowmobile in her free time

**Her mother drives a truck in Aitik and her father used to be a miner. Therefore, the mining industry was an obvious choice when Cecilia Arvola was looking for a job.**

She began as a truck driver under ground for LKAB and then applied to work at Boliden's copper mine in Aitik. This is the biggest open pit in Scandinavia.

"You don't know whether you will like it until you have tried," says Cecilia.

In Aitik, she first had to go on a five-week introductory course to learn to drive the big trucks.

"I drove with an instructor. I learned to reverse and picked up all the tricks that make driving easier. Strangely enough, it is soon just like driving a car because the roads are wide and everything is big here. So you forget how big the truck is. The small trucks take loads of 218–240 tonnes. The big ones take over 300 tonnes."

Cecilia thinks it is good that there are many people on a shift. There is a wide range of ages, from a gang of people her age upwards.



Photo: Boliden

**NAME** Cecilia Arvola, born in 1988. **TRAINING** Social Science Programme at upper secondary school, specialising in business. **WORKS** Truck driver in Aitik, Boliden AB.

"Another good thing is that you learn a lot here," says Cecilia. "You may not always drive a truck. You have the chance to develop."

# Mining in Sweden

We have mined ore and produce metal in Sweden for over a thousand years. Iron ore has the longest tradition, followed by copper. In recent centuries, the mining of zinc and lead ore has been added. Sweden is also an important producer of the precious metals gold and silver. This map shows you where mining takes place today. To the right is some information on three Swedish mining companies.



Graphic: SVENSKA GRAFIKBYRÅN



Photo: Torsten Berglund/Imagebank

## LKAB

LKAB was founded in 1890. For over a hundred years, the company has been an important cog in the Swedish export industry and the industrial development of the country. For just as long, iron ore from LKAB has supplied European steelworks with the raw material they need for their production. Iron ore is mined in LKAB's mines in Kiruna, Malmberget and Svappavaara and has been supplemented by other natural minerals over the years. 4,500 people work for the group.

LKAB is a high-tech mineral group with large-scale operations. It has customers worldwide.



Photo: Boliden

Aitik open-cast mine is Boliden's biggest mine. Copper ore, which also contains gold and silver, is mined there.

## BOLIDEN

Boliden is a leading European metal company. Its principal metals are zinc and copper. Other important metals that Boliden produces are lead, gold and silver. The company was founded in 1925 and currently operates mines and smelters in Sweden, Finland, Norway and Ireland. Recycling of metals is a growing part of operations.



Photo: Bild & Kultur

## ZINKGRUVAN

The oldest mine in Sweden still in operation, Zinkgruvan, is in southern Närke. Zinc ore has been mined from the same ore body since 1857. The company's mill, where zinc, lead and copper ore is beneficiated, is right next to the mine. Metal is produced at various European smelters. Zinkgruvan Mining has been owned by Lundin Mining since 2004 and approximately 330 people work there. The Lundin group also has operations in Portugal, Spain and the Democratic Republic of Congo. 1,300 people work for the group.



## Rock mechanic

# From Iran via Norrland to Närke

**Shahram Mozaffari is a rock mechanic. His job is to find movements in the rock that may create risks in the mine. To help him, Shahram has an advanced seismic system that measures stresses.**

"I work both on surface and under ground. At times, I am in the mine every day. We measure how the rock moves, inspect the rock reinforcement and try to identify whether there has been any damage to the rock after blasting."

Shahram comes from Iran. He was trained as a geologist there and worked on various projects in the Iranian mining industry. Shahram wanted to specialise in rock mechanics by taking a Master's.

"I chose Luleå University of Technology for several reasons. One was its proximity to heavy mining industry but primarily because Luleå is the world leader in rock mechanics."

Shahram did not suffer much culture shock on arriving in Sweden. His time was taken up with his studies and the study environment was very international. His fellow students came from all over the world and the teaching was in English.

Photo: Bild & Kultur



**NAME** Shahram Mozaffari, born in 1975. **TRAINING** Geologist training in Iran. Rock mechanics at Luleå University of Technology (total of 6 years). **WORKS** Rock mechanic at Zinkgruvan Mining AB.

When he had finished his studies, Shahram had two offers.

"I said no to a research position in Germany and started work at LKAB in Malmberget instead. I wanted to be involved in the industry."

A desire to move further south took him to Zinkgruvan, the southernmost underground mine in Sweden.

"My work is exciting and fun! I have to find answers to questions that are related to each other. Each mine has its own conditions and possibilities and there are different solutions to the problems every time."

## Surveyor's assistant

# "I can find my way everywhere"

**It is the morning break in Zinkgruvan. Mine surveyors, surveyor's assistants and mappers are gathered in an office room 800 metres below ground. The coffee is hot and the sandwiches are being unwrapped from bags and cling film. The room is like a normal office except that there is no window and the inner wall is reminiscent of an underground station, slightly concave from the rock.**

Therese Edlund is a surveyor's assistant in Zinkgruvan. She drives around the mine and spray-marks where all the holes are to be drilled. After blasting, she and her colleagues measure precisely the dimensions of the new excavation. Using the measurements, they draw maps of the mine.

"I do a lot of driving in the mine," says Therese. "After a few weeks in the job, I suddenly had a Eureka moment. I had a map of the mine in my head. Now I can find my way everywhere."

Therese was unemployed after taking maternity leave. She managed to get a work experience place in Zinkgruvan in the mill. She soon landed a temporary position and after a year or so she had a permanent position.

Photo: Bild & Kultur



**NAME** Therese Edlund, born in 1980. **TRAINING** Hotel and restaurant study programme at upper secondary school. Trained at Zinkgruvan Mining. Will take further training to become an authorised mine surveyor. **WORKS** Surveyor's assistant at Zinkgruvan Mining AB.

Therese found the shift working in the mill tough and after her second period of maternity leave she started working under ground as a surveyor's assistant. Her colleagues trained her.

She will soon begin training at the Swedish School of Mining and Metallurgy in Filipstad to become an authorised mine surveyor. She will then assume principal responsibility for the map of the mine and report regularly to the Swedish Chief Mining Inspector on the layout of Zinkgruvan. The previous authorised mine surveyor at Zinkgruvan suggested that she should take further training.

"I was very happy, of course. It's an opportunity you don't get every day."

## Up to speed with mining terms?

Every industry has its technical terms to describe its working day. Here are a few of the words we use every day.

**Drift** A tunnel without a surface opening. A person who makes new drifts is called a Drift Jumbo operator.

**Ramp or decline** A drift with a slope. Ramps are required to be able to move vehicles vertically in the mine. They often run like serpentine roads inside the rock.



**Shaft** A vertical connection in rock. It either goes up to the surface or connects different levels under ground. There are lift shafts, ventilation shafts, shafts for handling ore and waste rock, etc.

**Raise** A narrow shaft, for example for ventilation.

**Head frame** A tower-like building above a lift shaft. The lift machinery (mine hoist) is at the top of the head frame.

**Ore** A mineral resource that can cover all production costs involved. The world market prices can turn a mineral resource into ore overnight!

**Blast** All charged drill holes that detonate at the same time, either in drifting or for production of ore.

**Boulder** A block of rock that is too large to be handled and must therefore undergo secondary blasting.

**Cuttings** The pulverised rock that is forced up out of the drill hole during rock drilling.

**Scaling** Clearing walls and roofs of loose rock.

**Open pit mine** An ore deposit that is close to the surface and is mined in open air.

**Fines** Ore concentrate in powder form.

**Beneficiation / milling** A method used to extract minerals from ore. The ore is crushed and ground. The various ore concentrates are then extracted via various processes.

**Flash furnace** A furnace type used to smelt fines (ore). The smelting is the first stage of metal production in the smelter.

**Slag** A by-product of metal production that contains parts of the ore that are not value adding metals.

# A film star in the mill

The Swedish film 'Jag saknar dig' (I miss you) had its premiere in autumn 2011. It is about twin sisters Tina and Cilla who are about to turn 15. The story is about Tina being on her own after Cilla dies in a car crash. The film is about relationships, love and grief.

Tina and Cilla are played by twins Erica and Hanna Midfjäll from Kiruna. It is their first film. Hanna had done some theatre before but Erica, who played the role of Tina in the film, had not. Erica Midfjäll works far from the world of stages and film cameras. She is a process operator in LKAB's new mill KA3 in Kiruna.

"I dreamed of becoming a geologist," says Erica Midfjäll. Therefore she attended the LKAB upper secondary school, specialising in industry. Theory and practice were

sandwiched and as the study programme was completely new, the students helped to design the course.

"It was a good education and it is nice to have it to fall back on," says Erica.

Working below ground was not for her and she applied to one of LKAB's mills. She is now undergoing internal training there. The task of the operators is to ensure that the plant operates 24 hours a day.

"We have a wide variety of tasks. You never get tired because it is so varied. Right now I am controlling the entire process from the control room."

The operators are responsible for a long chain of elements that are interconnected: mills that grind ore into powder, magnetic drums in which metal grains are separated from the ground rock and then flotation, where the concentrate is further refined.

"I am happy where I am now," says Erica Midfjäll. "I have weeks off as I work shifts. Then my sister and I travel to film festivals in Europe. The film was a major thing and I haven't quite come back down to earth yet!"



**NAME** Erica Midfjäll, born in 1990. **TRAINING** LKAB upper secondary school, industry study programme. **WORKS** Process operator for LKAB, Kiruna.

## Mill operator



Photo: Fredric Alm

## Process developer

# Changes between white coat, blue overall and shirt

"I have been employed at Rönnskär for just over a year," says Jonas Bäckström. Before that I did my work experience here during my training. I got a summer job and later did my degree project here as well.

Rönnskär is one of Boliden's smelters for the production of copper. Metal concentrate from the mines is smelted with recycled material in large furnaces. The metal is subsequently purified in various processes. The result is mainly pure copper, as well as lead, gold and silver. Jonas works in the smelter's development department.

"My main tasks are to help if a problem occurs in production and to come up with process solutions that improve production, both new processes and improvement of those we already have.

In his job, Jonas moves between the lab, production and his desk. He holds discussions with the operators in the control room, tries to find solutions and conducts tests in the lab.

"The best part of the job is testing in reality what you have arrived at by trial and error on a small scale in the lab. When you find the links and see how things fit together. New processes are fun too."



Photo: Boliden AB



Photo: Dannemora Mineral

## Geologist

**NAME** Stefan Sandberg, born in 1982. **TRAINING** Science at upper secondary school, earth science programme at the University of Gothenburg (4 years at that time – now the course is 3 or 5 years). **WORKS** Geologist at Dannemora Mineral AB.

# Interest in nature and a love of discovery

"As a geologist, you should be practical, like solving problems and not be afraid of getting dirty," says Stefan Sandberg.

Stefan is a geologist at Dannemora mine in Uppland. He describes the work of a geologist as detective work. All rock has its own history and leaves clues about how it came into being, was formed and was folded over the millennia. A geologist needs to understand the order in which things have happened and how the clues should be interpreted.

"I am very interested in nature and wanted to study biology or geology. Geology creates the conditions for everything that lives. Society depends on metals and it is simply great to look for them. I enjoy the aspect of discovery in my work."

When Stefan took his degree, it was hard to get a permanent job as a geologist. But just a year later, both construction companies and mining companies began to cry out for geologists. He got his first job at Zinkgruvan, then he moved to Dannemora. The future will show what happens next.

"I may work abroad at some stage. As a geologist, you can work absolutely anywhere in the world. You can also specialise in different fields."

**NAME** Jonas Bäckström, born in 1986. **TRAINING** Master of Science in chemical engineering, specialising in mineral engineering and metallurgy (5 years) at Luleå University of Technology. **WORKS** Process developer at Boliden's Rönnskär copper smelter in Skellefteå.



## Mine mechanic

# "Freedom is the best thing about my job"

Jonas Dagbro is an under ground mechanic at LKAB. With his colleagues, he is responsible for all the stationary systems in the mine functioning, for example crushers, conveyors and mine hoists.

"You need to be handy and inventive for this job," says Jonas. "And be able to weld. We repair both old and new equipment. If we can't find spare parts, we build them ourselves."

Jonas starts the day by driving down to the main level at 815 metres. This is where the workshop, rest room and managers' office are located. The tasks are assigned and the mechanics go out to work.

"We always work in pairs. New things happen all the time. Most of them are unique."

Jonas Dagbro attended the LKAB upper secondary school, specialising in industry. The pupils acquired a broad knowledge of mining there: "We tried out most things and got to see all the elements right up to the ore wagons rolling away. But we did not commit to working for LKAB and the company was under no obligation to employ us either," says Jonas.

But now he does, of course: "I have no desire to leave here! The freedom is the best thing about my job. We are not subject to strict management and we move throughout the company. And I spend a lot of time outdoors when I am off work."



Photo: Fredric Alm

**NAME** Jonas Dagbro, born in 1990. **TRAINING** LKAB upper secondary school, specialising in industry. **WORKS** Mine mechanic, LKAB.

# At work every other week

"I wanted to work with ships. After having been in the navy, I studied to be an engine-room officer at Chalmers in Göteborg. But I changed my mind and I needed a job. A friend at home told me that Drillcon was crying out for people."

Drillcon AB supplies mining companies with drilling services in Sweden and abroad. Anna went for an interview at Drillcon's head office in Nora and got a job as a core driller.

"I have learned the job by doing it. At the beginning, I had to accompany other drillers as they worked. You learn from your mistakes and from those of others. Now I drill on my own."

Down in the mine, Anna drills long holes in the rock. Rods of rock are removed from the holes, metre after metre of them. They are taken to show how the ore body continues. Anna has bored holes in various locations in Sweden: Garpenberg, Zinkgruvan and Malmberget.

"I go where Drillcon sends me. I work every other week and when the week is over I go home to Lindesberg and have a week off. Therefore, it makes no difference where I work."

## Core driller

Photo: Fredric Alm



**NAME** Anna Gyoni, born in 1986. **TRAINING** Engine-room officer at Chalmers. **WORKS** Core driller for Drillcon AB.

On a good day at work, the drilling goes according to plan. On other days, the equipment may break and then it is Anna's job to get everything working again.

"It is important to think sensibly when you are working below ground. You don't take risks. You think about safety," says Anna Gyoni.

## WHO IS ALLOWED TO MINE?

# That is decided by the Chief Mining Inspector!

The title 'Chief Mining Inspector' (bergmästare) has existed since the Middle Ages. Today, Sweden has just one Chief Mining Inspector, who is also the director of the Mining Inspectorate of Sweden. The Chief Mining Inspector is responsible for supervising mines, issuing permits for new mines and reporting to the government.

### SWEDISH MINERALS ACT

The Swedish Minerals Act governs the decisions of the Mining Inspectorate of Sweden. This Act regulates the exploration for and exploitation of mineral deposits in Sweden. The law of Sweden has stipulated for hundreds of years that anyone who can explore for or mine a mineral deposit can also be granted a permit to do so, regardless of who owns the land.

An exploration permit is required to explore for ore. Anyone who finds something worth mining can apply for an exploitation concession.

### WHAT ABOUT THE LANDOWNER?

For several years now, the Minerals Act has stipulated that a landowner must receive a share of the money generated by deposits on his land.

The Mining Inspectorate of Sweden has offices in Luleå and Falun and comes under the authority that is Sweden's centre for geological information, SGU in Uppsala. SGU is the Geological Survey of Sweden and is responsible for issues relating to rock, soil and groundwater in Sweden. ■



## TARA

Boliden's Tara mine in Ireland is approximately 50 km from Dublin. Tara is the biggest zinc mine in Europe today. The mine supplies part of its zinc concentrate to smelters in Kokkola, Finland, and Odda, Norway. Approximately 2.5 million tonnes of ore are mined every year.



## NEVES-CORVO

Lundin Mining is a growing mining and prospecting company with operations in Portugal, Spain, Sweden and the Democratic Republic of Congo. One of the company's mines is the zinc and copper mine in Neves-Corvo in Portugal. 2.2 million tonnes of copper ore are mined there every year.



## TENKE

Lundin Mining has had a share in the extensive Tenke Fungurume copper and cobalt deposits in the Democratic Republic of Congo since 2007. The area covers 1,500 square kilometres, making it big enough to be called a separate mining district.



# Going to the mine?

**There are many paths leading to a job in a mine. Short or long training, theory or practice – it is your decision. Here are a few suggestions and ideas for possible training paths.**



Photo: Leif Nyberg

## UPPER SECONDARY SCHOOL

The industry programme, building and civil engineering and electrical, vehicle and energy programmes are a good basis for working in a mine. This can then be followed by more specialist training on site.

The technology and science programmes at an upper secondary school are another good basis for students who want to continue to study at university or other institutes of higher education.

**LKAB upper secondary school:** The upper secondary schools in Kiruna and Malmberget offer specific programmes designed in collaboration with LKAB. These programmes provide insight into the company and knowledge oriented directly towards specific occupational roles in mining. The programmes involve a lot of work experience linked to LKAB's operations.

More information on Vålkommaskolan in Malmberget and Hjalmar Lundbohmsskolan in Kiruna: [www.laplands.se/sv/gymnasium](http://www.laplands.se/sv/gymnasium)

## VOCATIONAL COLLEGE PROGRAMMES

Studying at a vocational college is a fast-track route into work. Vocational colleges offer short study programmes combined with work experience.

The programmes are designed for students who have attended upper secondary school. 90% of students who complete a vocational college programme have a job within six months. There are over 500 different vocational college programmes in many locations throughout Sweden.

More information: [www.studentum.se](http://www.studentum.se)



Photo: LKAB

## DALARNA UNIVERSITY

Master of Science in Engineering graduates with expertise in materials technology are much in demand. The material design programme (5 years) is offered at the university in Borlänge.

Material design means that you customise the structure of a material to give it desired properties. Students specialise in a group of materials, for example metals.

Dalarna University collaborates with the Swedish School of Mining and Metallurgy in Filipstad and offers several master's programmes for those who want to gain a higher level of education.

More information: [www.du.se](http://www.du.se)



Photo: Bergsskolan

## THE SWEDISH SCHOOL OF MINING AND METALLURGY IN FILIPSTAD

The Swedish School of Mining and Metallurgy is a small school with a close community of teachers and students. The school has around 170 students.

The Swedish School of Mining and Metallurgy was founded in 1830 and has supplied the mining and steel industries with qualified engineers and technicians ever since.

Students must have taken the technology or science programme at upper secondary school to study on the mining and civil engineering programme. Mining and civil engineering is a three-year programme and there is also a two-year version.

Students can then study at master's level at any institute of higher education or university in Sweden.

More information: [www.bergsskolan.se](http://www.bergsskolan.se)

*Simulator training is one way of learning a new profession. The photo shows simulated flotation during teaching at LKAB.*

*Students on the natural resources technology engineering programme at Luleå University of Technology.*

## ROYAL INSTITUTE OF TECHNOLOGY (KTH)

KTH in Stockholm has teaching and research covering fields from science to all branches of technology, plus architecture, industrial economics, social planning, work sciences and environmental engineering.

The Master of Science in Engineering programme in material design contains teaching on various rocks and how the metals of the future can be developed. In the last two years of the five-year programme, students can choose to specialise in work sciences.

More information: [www.kth.se](http://www.kth.se)

## LULEÅ UNIVERSITY OF TECHNOLOGY

The university is a centre for mining studies and research and has several programmes designed for students who want to work in the mining industry. One of these is the Master of Science in Engineering programme in roads and water, specialising in soil and construction in rock. Students study how to blast rock, which machines are used and how construction can take place so that the rock does not fracture. These studies can lead to work as a rock technician or rock mechanic.

Another is the Master of Science in Engineering programme in natural resources technology, specialising in ore geology and environmental geochemistry. On this programme, students learn about where and how minerals are formed and which methods are used to find them. The programmes last four and a half years and can be supplemented with six months of work experience.

A new three-year programme that was launched in autumn 2009 is industrial environmental and process engineering. This programme is available only at Luleå University of Technology. Students learn to use and develop the processes for sustainable raw materials supply and resource utilisation.

Broad-based research is conducted in the field of mining engineering and metallurgy throughout the mining industry, from prospecting to production of metals and finished products.

More information: [www.ltu.se](http://www.ltu.se)



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