




Soil



Rock



Seabed



Groundwater



Moraine terrain, Kinna.

# This is the Geological Survey of Sweden

The Geological Survey of Sweden (SGU) is the authority that deals with matters concerning groundwater, soil, bedrock and seabed in Sweden. With advanced surveying methods and analysis, we gather, process and provide geological information for the benefit of society.

By the greater use of geological information in physical planning, society has a lot to gain. Therefore, SGU is actively working to increase the use of geological information. Some of the benefits that geological information contributes to are improved groundwater protection, environment-friendly and more appropriate land use, greater resource efficiency in the mineral processing industry and a faster development towards a non-toxic environment.

Sweden is rich in natural resources such as groundwater, minerals and rock. However, the management of these resources requires great respect for the environment, as well as for other interests in society. Thanks to our expertise in all aspects concerning bedrock, soil and water, SGU can provide substantial benefits to society in cooperation with local authorities, companies, county administrative boards and other authorities. In today's global world, international cooperation is increasingly important. Therefore, SGU has an active exchange with our sister organisations in the EU, within many different areas.

SGU is assigned to support Sweden's mining and mineral processing industry. The commitment includes developing of a sustainable supply of materials, for example by recycling scrap metal and old mining waste, and by replacing natural gravel with crushed rock. SGU also strives to spread awareness of environmental impact and working environment in the mining industry to countries where this knowledge is less well developed. Within SGU is also the independent decision-making body Bergsstaten, which decides on permits for exploration and mining.

Anneli Wirtén  
Director-General



**Anneli Wirtén,  
Director-General**



# Soil, rock, seabed and groundwater

**SGU is a Swedish authority founded in 1858 and responsible for issues related to the country's geological status and mineral management. The authority provides geoscientific information.**

Europe faces major challenges and opportunities where knowledge of soil, bedrock and water is important. To guarantee sufficient access to food and water we must safeguard the quality of our groundwater resources and soil types and in order to do so the natural resources must be known. SGU's geological know-how, data and information provide support when facing the upcoming challenges.

## **Appropriate use of soil, rock and groundwater**

To make well-founded decisions, geological information is necessary. We offer support by collecting and providing basic geological information and expert evaluations. We also improve and clarify our work on the environmental objectives, climate issues and ecosystem services. We cooperate with other authorities, companies and organisations, and provide open data both to the business community and the public sector. We take an obvious position in the planning processes of local and county administrative boards.

## **Sustainable utilisation of the country's mineral resources**

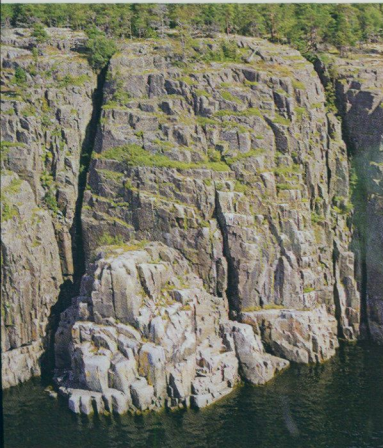
Geological information and knowledge of Sweden's assets are needed in order to create sound preconditions for a sustainable utilisation of Sweden's mineral resources. We support this by being active throughout the entire mineral processing chain, from exploration to aftertreatment and recycling, by actively contributing to the EU's Raw Materials Initiative, by improving SGU's work on sustainable development and natural resource issues, as well as by actively participating in the development of legislation and control instruments.

## **An attractive, accessible and efficient authority**

To carry out our assignments in the best possible way, a well-functioning, flexible, efficient and competent organisation is required. We achieve this by establishing consensus on fundamental values, by developing leadership, by making SGU even more visible and by creating a secure and active administration of our information.

## **SGU's vision**

Sweden has a sustainable social development. Land and water are used and developed for purposes best suited for them. The mineral processing industry and other natural resource sectors are vigorous and takes responsibility.



# SGU nationally and internationally

**Geological knowledge is necessary in order to understand and use the environment in a long term sustainable way. SGU's most important task is to supply geological information to meet the needs of society, both in the short and the long term.**

SGU has wide-ranging and exciting activities. The authority's geologists are concerned, among other things, with collecting, documenting and adapting information on Sweden's geology so that it can be used within, for example, community development, environmental care and exploration.

SGU's Head Office is situated in Uppsala but we also have a number of local offices throughout Sweden.

SGU is organised under the Ministry of Enterprise and Innovation, and it is the government that decides on the preconditions for the Authority's work. Furthermore, the work of SGU – like other Swedish authorities – is directed by the general regulations on economic control and by the authority and obligations of the authorities.

## **Collaboration projects**

Many of the questions that SGU are working on, and not least those relating to risks and the identification of risks, concern the areas of responsibility of other authorities and organisations, for example environmental

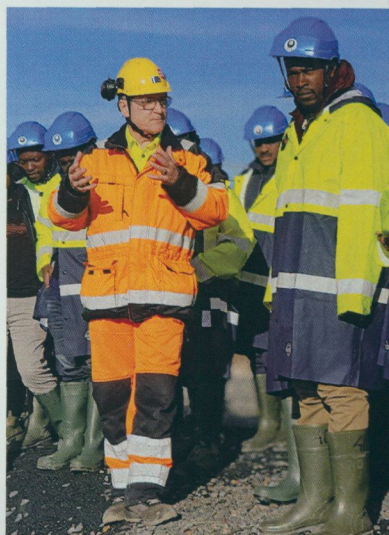
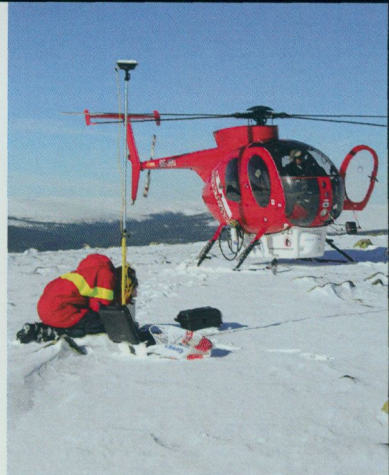
work, water as a foodstuff, geographical information and radiation protection.

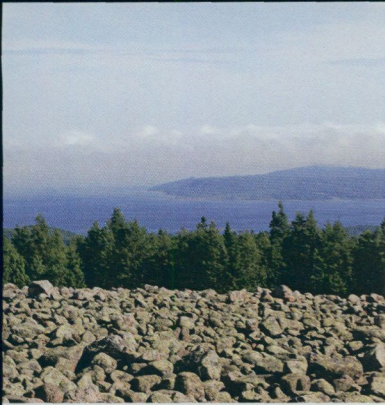
## **International cooperation**

Geology is an international science that concerns the study of the earth and its history, as well as the processes and occurrences that build up and still form conditions on the Earth.

The EU plays a key role for SGU's international undertakings. SGU is represented in a number of work groups and committees in which the work focuses on questions that concern the environment, critical raw materials (CRM) and the exchange of information connected with earth sciences.

EuroGeoSurveys (EGS) is the integrating organisation for the geological surveys in 38 European countries. The principal task of the organisation is to shed light on the geoscientific questions in an EU context.





# Rich in metals and minerals

**Sweden is a mining and mineral processing country with ample access to metals and minerals. The supply of ore and minerals has to a large extent contributed to the national wealth and welfare of present-day Sweden.**

Access to raw materials is fundamental to a modern and sustainable society. Technological developments and innovations generate increasingly complicated products that require a range of metals and raw materials hardly used before. Economic growth and development have increased global demand for many raw materials, and this trend is expected to continue.

## **A history of mining**

Sweden is one of Europe's leading mining countries, with a mining history stretching back more than 1,000 years. Through the gathered documentation of mining and exploration, available in SGU's archives and databases, we have a good knowledge of how much iron, base metals (copper, zinc, lead, nickel) and precious metals that have been mined in the past and how much is available in the forms of resources and reserves.

## **Sustainable utilisation of resources**

To increase the resource efficiency in society, SGU makes inventories of the

extraction and recycling potential of the Swedish metal and mineral assets. Production, processing and extraction of main and by-product metals have generated mining waste that contains unknown quantities of several metals including critical raw materials. Mining waste as a potential source for metals is currently being investigated by the SGU.

## **Core samples**

SGU's core sample archives, located at the Malå office, consist of over 3 million metres of core samples from more than 18 000 boreholes from all over Sweden. New core samples are constantly added. Over 230 000 metres of samples have been scanned, and data are continuously being made available via our web site [www.sgu.se](http://www.sgu.se).

For many of the core samples there are mapping reports, results from geophysical borehole measurements and chemical analyses. This information can be used within geological knowledge development, mineral exploration and ore-related research.

This is the average quantities of minerals you use during your life:

- Copper: 0.6 tonnes
- Gold: 11 grams
- Zinc: 0.35 tonnes
- Cement: 33 tonnes
- Iron: 15 tonnes
- Lead: 0.4 tonnes
- Clay: 9.7 tonnes
- Ballast: 775 tonnes
- Other minerals and metals: 30 tonnes

# Mining Inspectorate of Sweden

**The Mining Inspectorate of Sweden (Bergsstaten) is the department of SGU that deals with matters concerning exploration and mining. Bergsstaten is directed by the Inspector of Mines, who makes decisions in accordance with the Swedish Minerals Act.**

Bergsstaten issues permits for mineral exploration (exploration permits) and mines (exploitation concessions). Bergsstaten also carries out inspections of mines and provides information on mineral legislation and prospecting in Sweden. Bergsstaten is headed by the Chief Mining Inspector who decides on matters falling under the Minerals Act (1991:45). It was established as a state authority in 1637.

## Exploitation of minerals

For hundreds of years, Sweden has had minerals legislation aimed at guaranteeing the supply of metals and minerals which an increasingly developed society needs. This legislation has dealt with the exploration and exploitation of important rocks and minerals which are rare and require such special expertise and so much capital that, apart from odd exceptions, landowners have been considered unlikely to have the



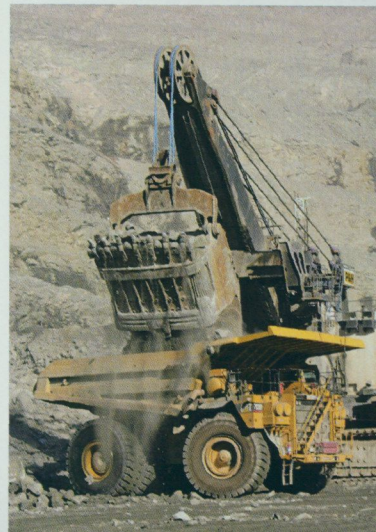
capacity to undertake the necessary operations.

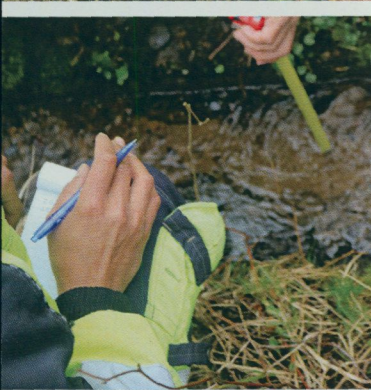
From an international geological perspective, Sweden's bedrock has good potential for minerals exploitation. Despite such good potential, mineable deposits are hard to come by. The Minerals Act and other minerals legislation have been introduced by the state in order to make rational exploration possible. Other favourable conditions for mining which Sweden offers include political stability, a developed infrastructure, easily accessible information on the national bedrock, a stable system of regulation, a well-trained workforce, and the skills and experience of companies and state bodies in the area of minerals exploitation.

## Mineral laws in Sweden

Sweden have had legislation about the right to undertake exploration and exploitation since the Middle Ages. The oldest known mining laws are from the 1300s.

Supervision conducted by the Inspectorate involves checking work carried out under exploration permits and exploitation concessions. Supervision may be initiated by the Chief Mining Inspector. It may also result from a report made by someone who considers that supervision is justified.





# The best water in the world

**Water is one of the most important natural assets and the most important foodstuff. Access to clean water is crucial for all of society. SGU's information on groundwater is an important input in the planning of Sweden's water supply.**

SGU's groundwater information is used in matters that concern land use and physical planning in general. This could be basic input for environmental impact assessments, for action plans, for protection of the groundwater and in the construction of roads, disposal sites and industrial plants.

## **Monitoring of groundwater**

To be able to follow the impact of acidification, eutrophication and the fallout of airborne metals into the groundwater, SGU monitors the groundwater and its chemical composition. The measurements provide knowledge of variations in the groundwater in relation to geology, topography and climate.

Since the measuring stations are situated in areas free from impact from local pollution sources, they can also be regarded as reference stations and thus be used to follow up on effects of efforts for reducing the impact of airborne pollution on the environment.

## **Good-Quality Groundwater**

The Swedish Government and Parliament have decided that Sweden, by the next generation, shall have solved the biggest environmental problems. 16 environmental objectives describe how Sweden wants the environment to be by then.

SGU is responsible for the environmental objective Good-Quality Groundwater. This means that we together with other authorities and interested parties – are to collect data, develop suitable indicators, report on goal fulfilment, propose additional efforts and in other respects work to achieve the environmental goal.

## **Reduction in the use of natural gravel**

Natural gravel deposits are of great importance for drinking water supplies, and more. Several activities at SGU support work to reduce the use of natural gravel, and to gradually phase out natural gravel pits and replace them with bedrock quarries.

Today, over a million people in Sweden have private water supplies. This means that some 15 per cent of the population have their own wells. A well should be located so that it is protected from pollutants such as sewage, manure heaps, arable land, etc.

# Marine geology

**The sea is a natural resource, which provides us with energy, food, raw materials, recreation and transport routes. Securing these valuable services for the future requires sustainable planning and administration based on profound knowledge of the sea and its ecosystems.**

Knowledge of the physical characteristics, conditions, processes, content of toxins and nutrients, and an understanding of the factors that influence them, is an important aspect of the work to map the marine environment and the preconditions for blue growth in and around the Baltic Sea.

## **Contaminated sediment**

In marine environments and lakes, the sediments in deposition areas contain deposited metals and resistant organic compounds. By collecting sediment samples, SGU studies variations in concentrations over of time. As a result of erosion or oxidation, metals and organic substances can circulate from the sediment into the water. When metals and organic substances are released, there is an increased risk of uptake in organisms and further distribution of toxins through the ecosystem.

## **Fibre banks**

During recent years, SGU has conducted several projects in order

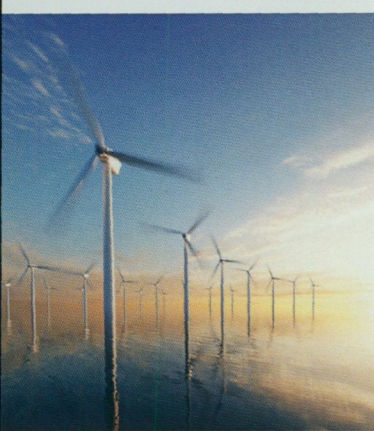
to identify and assess the extent of fibre banks and to investigate their environmental chemical status. The results will contribute to achieve a number of environmental goals, including a non-toxic environment. The results can also be used as input when decisions are made to cost-efficiently direct and conduct further investigations and decontamination efforts in areas considered to have got the most environmental disturbance.

## **Sustainable coastal zone and marine planning**

In order to implement sustainable ecosystem-based marine planning in Sweden, extensive knowledge and planning input is needed. SGU is developing cartographic data and information adapted to current requirements and challenges within Swedish coastal zones. The information can be used when deciding on matters such as gravel pit operations, suitable areas for wind or wave power plants, how to handle of dredged material, etc.

With aid from our specially equipped vessels Ocean Surveyor and Ugflan, an inventory of the seabed geology is being made in order to gain knowledge of rock and soil beneath the sea.





The sea is a natural resource. It provides us with valuable services such as energy, food, raw materials, recreation and transportation routes. In order to secure these services for the future, there is a need for sustainable planning and management based on sound knowledge of the ocean and its ecosystems.

# Physical planning

**In a wide sense, physical planning is planning of society and its development. SGU present geological information for planning at the regional and local level – for efficient, secure, climate-adapted and sustainable land use.**

Geological information is relevant and quality assured input, of considerable importance to many problems and planning issues. The information can be used for assessments of ground stability, ground conditions, groundwater occurrence and natural resources such as peat, natural gravel and rock suitable for crushing. SGU's role is to provide this information and to make sure it results in good plans and decisions.

## **Carbon capture and storage (CCS)**

One way to reduce the large-scale emissions of carbon dioxide into the atmosphere is to capture and store carbon dioxide in the bedrock. SGU have knowledge of the bedrock that could come into consideration for storing carbon dioxide in Sweden. We monitor advances in the CCS area – both in terms of legislation and of research and development. We participate in European networks and research partnerships on CCS.

## **Open data**

Information free to access and use

is referred to as Open data. SGU has developed several such services within the environment and groundwater area. SGU is of the opinion that access to the authority's data is beneficial both to the own work, as well as to society in general. For a long time we have worked to provide our data in simple and free applications, such as the web based Map viewer.

## **Sulphide soils – a potential environmental problem**

In areas with sulphide soils, acidic sulphate soils are often formed. This frequently has an extremely negative effect on the water chemistry in watercourses. High concentrations of metals and low pH values could in certain situations result in fish-kill. Ditching and other forms of excavation are activities that expose the soils to oxygen and thus affect the environment negatively. SGU has mapped out where in Sweden you can encounter sulphide soils. This information is of use to the building industry, among others.

# Contaminated areas

**One of Sweden's environmental objectives is A Non-Toxic Environment. As the responsible authority, SGU actively work to achieve this goal by investigations and by remediations of contaminated areas.**

There are some 80 000 potential or confirmed contaminated areas in Sweden. About 1 300 of these are judged to pose extremely serious risks to people's health or environment, and probably need remediation. SGU contributes to the work on the environmental objective A Non-Toxic Environment by investigating, surveying, and dealing with contaminated areas so that they will not pose any threat to human health or environment.

## **Aftertreatment of contaminated areas**

Since 2006 SGU has served as the responsible authority for investigations of contaminated areas. SGU is also responsible for treatment of contaminated areas where a former government player previously has been responsible. SGU also cooperates with the Swedish Environmental Protection Agency and county administrative boards in aftertreatment of contaminated areas that, according to the Swedish Environmental Code, lack a responsible party. At request from local authorities, we can then be

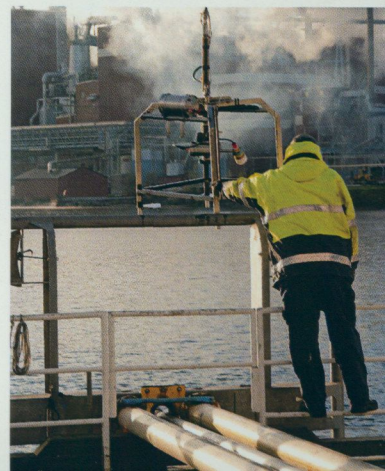
the principal for objects for which the local authority is not judged to have the capacity to run the survey or carry out the aftertreatment.

## **Dioxin decontamination in Marieberg**

SGU has served as the principal for Sweden's largest dioxin decontamination assignment to date – the decontamination of Marieberg's old sawmill, located outside Kramfors. A total of 52 000 tons of contaminated soil and rock have been replaced by backfill. The aftertreatment has dealt with the existent risks, so that the area can continue to be used as workplace, summer accommodation and as a recreation area.

The sawmill in Marieberg operated from the 1860s until July 1970. The contaminants, which are mostly dioxins, originate from the last 30 years of operation. Dioxins are extremely toxic, they break down very slowly and are bio-accumulated, which gives them high priority in environmental work.

The environmental objective A Non-Toxic Environment: "The occurrence of man-made or extracted substances in the environment must not represent a threat to human health or biological diversity. Concentrations of non-naturally occurring substances will be close to zero and their impacts on human health and on ecosystems will be negligible."





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