

Annual Report 2010



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Joining forces to create values

The Chinese thinker and social philosopher, Confucius (551-479 BC), believed that “the essence of all knowledge is: having it, to apply it; not having it, to confess your ignorance”. However, we who live by producing knowledge have to set ourselves higher goals. It is not enough to possess the knowledge. It must be shared with others. We must also help to ensure that society uses it for the benefit of everyone.

NGU helps to create and secure values in the community and for individual people. We do this by collecting, processing and disseminating knowledge of the physical, chemical and mineralogical properties of the bedrock, surficial deposits and groundwater in Norway. We map Norwegian land and sea areas. We develop and operate national databases and map services about geological properties and processes. We carry out applied research and develop methodology in geology and geophysics. We give advice and disseminate all the knowledge and information we have gained after producing and supplying geology for society for more than 150 years.

Geology is the basis, the very foundation, of what we live on and live from. The food we cultivate requires good water and clean soil. Everything which we cannot grow must be obtained from the earth and the bedrock and be processed into houses, roads and most of what we surround ourselves with and use in our modern, everyday life. NGU works within a wide range of complex and interdisciplinary sectors. We help to acquire knowledge which is essential for gaining access to minerals and water, which helps to ensure that we have the full picture before we take decisions on development or protection of Norwegian land, and which means that we can be assured of a good and safe environment to live in. Obviously, we do not do this alone. We therefore place great emphasis on developing good cooperative relationships with ministries, directorates, counties, municipalities and private sector businesses. We must help them to acquire the essential, basic knowledge of geology to enable them to perform their tasks and carry on their activities in the best possible way.

One of our primary goals is to contribute towards sustainable value creation from geological resources. Increased global demand for raw materials has led to greater interest for the mineral resources in Norwegian rocks. We will therefore increase the effort to map mineral resources in the years ahead. We will also place great emphasis on improving cooperation with regional authorities, and not least on meeting the needs of local authorities for geodata and processed knowledge applied to industrial development, landuse and environmental management.

No knowledge exists that is not valuable. Improving the knowledge base and working well together, nationally and internationally, will help to create new values that will benefit the whole of society.

Morten Smelror, Managing director



Teamwork against landslides

” *NGU’s geological expertise and good ability for teamwork are decisive for the Directorate’s landslide-prevention work*

Agnar Aas, Director, Norwegian Water Resources and Energy Directorate

The Directorate for Civil Protection and Emergency Planning (DSB) has prepared the first national risk vulnerability assessment of the ten events we might fear most in Norway. A serious pandemic, extreme weather and electricity rationing, along with rock avalanches, top the list.

Everything that has been built up is worn down again. Norwegian mountains are slowly eroded over millions of years, but two or three times a century whole mountainsides collapse. Small avalanches and rock slides generally give early warning of such events; then the activity accelerates. Ultimately, rock faces crash down into fjords and valleys, causing major natural disasters.

Are we prepared for this?

NGU is working closely with the Norwegian Water Resources and Energy Directorate (NVE) which, since 2009, has had overall responsibility for national management tasks connected with preventing avalanche disasters. We are also working alongside the Åknes Tafjord Contingency Centre, which is monitoring huge, unstable sections of mountainside in Norway. NGU plays a key role in the mapping and has operative responsibility for the geoscience content in the landslide database in Norway (Nasjonal Skreddatabase).

Cooperation with NVE is progressing well. We are coordinating the database effort and have drawn up a time schedule for the work on major rock avalanches, from regional mapping to monitoring high-risk sites.

In 2010, NGU has continued to map potentially unstable mountainsides in the counties of Møre & Romsdal, Troms and Sogn & Fjordane. So far, as many as 263 mountainsides are judged to be unstable in this country. Nordnes at Kåfjord in Troms, and Mannen in Rauma, Tafjord in Norddal and Åknes in Stranda, all in Møre & Romsdal, are four mountainsides where considerable movements are being recorded. Up to several million cubic metres of rock could crash down these mountainsides, all of which are being continuously monitored. Another 55 mountainsides are under surveillance by periodically measuring movement.

In the light of a new national mapping plan, NGU and NVE are considering extending the effort to cover Rogaland, Nordland and some sites in Telemark. The ultimate target is to identify unstable sections of mountainside throughout the whole of Norway.

NGU geologists, geophysicists and landslide experts are applying their long field experience, supported by satellite data, aerial photographs and digital tools, to the task of mapping potentially hazardous areas for landslides. NGU is working closely with the Northern Research Institute (Norut) and the Norwegian Space Centre to develop methodology and interpret satellite images.

The first generation of susceptibility maps for earth slides and snow avalanches have been published in skrednett.no, and work is ongoing to develop methods to prepare similar maps for debris flows. NVE and NGU are also working closely together with a view to developing guides and methods for hazard zone mapping that can satisfy the requirements laid down in the Planning and Building Act.

In several reports, the Office of the Auditor General has pointed out that cooperation on civil protection is too poor in Norway. NGU takes the comments of Auditor General, Jørgen Kosmo, seriously and we are coordinating our work on landslide and landslide prevention with other bodies.



Finding resources at depth



NGU's aeromagnetic surveys provide good support for the mapping of the continental shelf and the aim of creating the highest possible value from oil and gas activity

Bente Nyland, Director, Norwegian Petroleum Directorate

When natural resources exist at great depths, covered by several kilometres of sea and ocean floor, it is good to know there is something called geophysics. To find natural resources deep beneath the surface, and thereby develop the nation's oil, gas and mineral industries, it is essential to map the geophysical properties of the Earth. NGU has been carrying out airborne geophysical investigations for more than 50 years. 2010 marked 25 years since NGU established its first nationwide geophysical database.

In recent years, NGU has acquired good basic data and revealed the subsurface of large parts of the Barents Sea. In 2010, the most important areas were the eastern part of the North Sea and the coast of western Norway. A total of 125 000 line kilometres of new, high-quality, aerogeophysical data were acquired. NGU's airborne geophysical survey off western Norway is useful for the Norwegian Petroleum Directorate and the petroleum industry, and was performed in cooperation with them.

Fridtjof Nansen would have been 150 years old this year. When his North Pole Expedition in 1893-96, performed the world's first gravity measurements at sea, it would be a long time until the first oil would be pumped from the Norwegian continental shelf. With Nansen's legacy NGU has helped to access important resources in the sea floor. NGU published two new magnetic and gravity anomaly maps in 2010 covering Norway and adjacent areas.

Oil and gas resources have evolved over millions of years. Oil formed following basinal deposition of sediments with a high content of organic matter and is now found in porous reservoir rocks at depth. To locate oil, it is necessary to understand fundamental processes like land uplift, basin formation and temperature development through geological time. That is why NGU's data on magnetism, gravity and heat flow are so important for the mapping of resources on the shelf and the development of the petroleum industry.

Several oil experts believe that up to 25 per cent of the undiscovered oil and gas resources in the world are present in the Arctic. In 2005, six nations (Russia, Finland, Sweden, the USA, Canada and Norway) agreed to jointly compile geological and geophysical maps of the entire Arctic. NGU had responsibility for the geophysical maps which illustrate the variations in the magnetic properties of the Earth's crust and the Earth's gravity. The maps were published in 2010. The national geophysical databases have been supplemented, and have expanded greatly in recent years. Such a product is valuable for further studies of both old and new geological resources.



Traces in the environment

” *NGU is an important partner for the Norwegian Climate and Pollution Agency in the area of ground pollution, and helps to identify and shed light upon important problems*

Ellen Hambro, Director, Norwegian Climate and Pollution Agency

The Norwegian Government has clearly stated that it is necessary to know a great deal about the Arctic environment. For several years, NGU has been studying the content of environmental pollutants like PCBs, PAHs, TBT and heavy metals in urban earth and a variety of products. Recently, the northern regions have been in focus, and NGU has found considerable man-made contamination on Svalbard and in surrounding waters.

Norwegians and Russians have been deeply involved in mining in Svalbard for close on 100 years. Along with the Norwegian Water Resources and Energy Directorate (NVE) and the Norwegian Climate and Pollution Agency (formerly the Norwegian Pollution Control Authority) and others, NGU was involved in 2010 in publishing an environmental atlas for Spitsbergen. It shows that people have left deep tracks behind them.

PCBs are a major villain in environmental pollution. These chemical compounds were developed about a century ago for use in paint, concrete, electrical equipment and a range of other products. Their manufacture and use was banned several decades ago, but they were widely used prior to that, and do not just disappear. The animal life on the bottom of the fjords in Svalbard contains many man-made pollutants. Even long after activities have ceased and settlements have been abandoned, buildings continue to discharge environmental pollutants. Rainfall and spring floods help to disperse this pollution to the vulnerable ecosystems in the fjords.

The contamination can be reduced by relatively simple means, and this is being done. For instance, hundreds of light fittings that contain PCBs are being removed from the abandoned buildings. The Governor of Svalbard is dependent upon knowledge of environmental pollution to be able to manage the archipelago in the best possible way. NGU, along with the Norwegian Climate and Pollution Agency and others, has made this knowledge available.

The “Geochemical Atlas of Spitsbergen” marks the conclusion for the time being of an interest in environmental chemistry in Svalbard that has lasted several decades. NGU has previously published several reports describing the geochemistry and human impact on the Spitsbergen environment.

NGU has also found man-made pollution in geochemical analyses of samples from the seabed in the Barents Sea. This work has been going on for several years, and is part of the mapping of the Barents Sea. The conclusions are the same – contaminants are found over wide areas. This pollution stays in the environment and can destroy ecosystems.



On the road to Europe

“NGU, with its highly qualified staff, is a reliable partner in projects. It is among the most active surveys at the European level and has been instrumental in improving cooperation among the Geological Surveys of Europe.”

Luca Demicheli, Secretary General, EuroGeoSurveys

NGU is a member of EuroGeoSurveys (EGS), an organisation representing 33 geological surveys in Europe. The purpose of the organisation is to advise the EU on all aspects of geoscience, and it is an important forum for developing European cooperation on research and the use of geodata.

EuroGeoSurveys has provided valuable information on mineral resources to the EU commission that has drawn up the EU raw material initiative. Europe has a huge need for traditional and new mineral resources. European industry uses more than 20 per cent of the world production of metals, but mines in EU countries produce only three per cent. China's dominance in many ore and mineral markets has led to a geopolitical situation where old reserves come to the forefront again, and new mapping starts. The EU looks upon Norway and the Barents Region as one of the most promising areas to secure Europe's supply of important ores and minerals. The number of claims has greatly increased, Sydvaranger Gruve AS has re-opened to produce iron ore, Mo i Rana is producing iron at full stretch, and Nussir ASA plans to open copper mines in Kvalsund. In 2010, the Norwegian government promised NGU NOK 100 million over the next four years to map the mineral resources in northern Norway. There is a great potential for copper, nickel, iron and gold deposits in many areas.

Through the raw material initiative, which places emphasis on trade agreements, recycling and enhanced efficiency, the EU has first and foremost chosen to highlight the critical raw materials: metals and minerals that are seriously lacking in Europe. The list covers antimony, beryllium, fluorspar, gallium, germanium, graphite, indium, cobalt, magnesium, platinum, niobium, rare earth metals, tantalum and wolfram. A battery in a Toyota Prius, for example, requires several rare earth metals, most of which are nowadays extracted in China. One of these, lanthanum, helps the batteries to perform better. The car's engine, meanwhile, requires a whole kilogram of neodymium.

What do we have of these in Norway? Can they be prospected and extracted in a way that is both economically attractive and environmentally friendly?

We need to know more, because minerals are found in every product we surround ourselves with, including toothpaste, mobile phones, PCs, cables, windmills, cars, make-up, paint and paper.

The Norwegian mining and quarrying industry currently earns more than NOK 10 billion every year selling 79 million tonnes of mineral resources. The export value exceeds NOK 6 billion. Extraction of metals, crushed rock, gravel, limestone and coal account for the highest values and volumes. Quartz and quartzite sell well and are used in many high-tech products.

EuroGeoSurveys members employ more than 7500 people. The organisation has its secretariat in Brussels and a network of national contacts. NGU is part of this European network. This is important because the mineral industry will become increasingly valuable for Norway and Europe in the years to come.



Web services

NGU makes all its geological data available on its web site, www.ngu.no. Reports, maps, photographs, other publications and access to geological databases are free for web users. In 2010, www.ngu.no was awarded six out of six stars in the annual, government quality assessment of Norwegian web sites, showing that the technology, user-friendliness, design and content are all of high quality.

Geological knowledge linked to data gathered over more than 150 years is the heart of NGU. Such data are traditionally presented as printed geological maps. Today, the most important way of disseminating this data is through interactive map services on the Internet. NGU was one of the first to provide such access to its databases.

In 2010, a new service was made available on the Internet whereby users were not only able to navigate through online maps, but also had the opportunity to download geological data from the whole country to their own computer. This gives public bodies and private companies the freedom to work with NGU's data in a form adapted to their own requirements. The download service is primarily designed for our partners in Norway Digital, a cooperative organisation of some of the major users or producers of geographical data.

Norway Digital is intended to ensure that geographical data are supplied and presented in accordance with current standards and with a specified quality. NGU is both a part of, and a driving force in, the Norway Digital cooperation.

The EU INSPIRE Directive aims to establish an infrastructure for geographical information. In 2010, NGU has followed up INSPIRE by cooperating actively within Norway Digital. A representative from NGU has also been appointed as an expert in the EU thematic working group for "Geology and mineral resources".

The Norwegian Mapping Authority supplies the basic topographic data in NGU's services and is therefore one of its important partners. By using a Web Map Service (WMS), where data are obtained directly from various suppliers and displayed in the same screen image, anyone who wants can download geological data from NGU's databases into their own processing tools, GIS system or online map access. This means that NGU's data are used more widely, and in other contexts, than before - all to the benefit of the user.

” *NGU is a strong driving force for developing better services in Norway Digital, and also contributes valuable data and services*

Anne Cathrine Frøstrup, Director, Norwegian Mapping Authority



Mapping the invisible land

“NGU’s mapping of the sea floor is invaluable for the management of Norwegian marine areas

Janne Sollie, Director, Directorate for Nature Management

When the fjords are included, Norway has more than 25 000 kilometres of coastline. The invisible part of Norway, that which is below sea level, contains large parts of our natural resources. Fish and oil are among the foundations of the Norwegian welfare system.

For several years, NGU has been mapping the seabed along the coast with its own research vessel, *Seisma*, and on the continental shelf using ships belonging to the Norwegian Institute of Marine Research and other organisations. MAREANO, a major research programme, has received most focus in recent years.

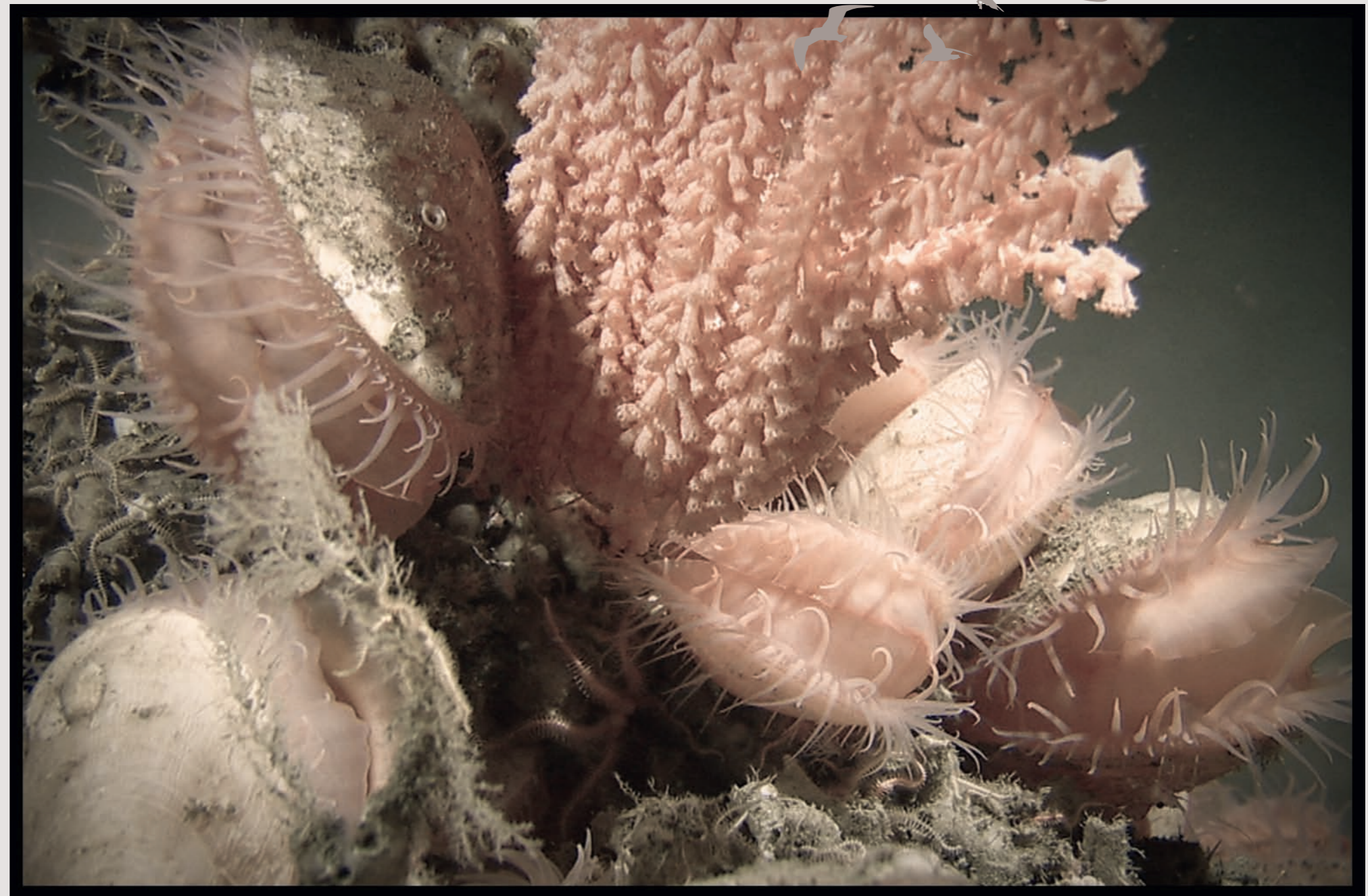
Mapping the Barents Sea and the area off the counties of Nordland and Troms contributes to the fundamental knowledge required to support sustainable management of the natural resources in marine areas. Geology and biology go hand in hand – detailed depth measurements, geological mapping and mapping of seabed ecosystems and pollution form an image of subsea Norway that we have never had before now.

The results of this mapping are presented on www.mareano.no. All the data are freely available here as interactive map services. The seabed’s spectacular landscape can be seen in “Til bunns i Barentshavet og havområdene utenfor Lofoten” (Probing the secrets of the Barents Sea and the area off Lofoten), a book published in Norwegian in spring 2010, which presents in text and illustrations the new knowledge acquired from offshore northern Norway.

The continental shelf has many exploration areas attractive to petroleum companies, but the Norwegian Government has stated that the biology and geology of the seabed must be mapped before a decision is taken on further petroleum exploration in the areas off Nordland, Troms and northwards towards Svalbard. NGU’s work is helping to meet the demands laid out in the management plan for these northern areas.

Closer to land, within the many fjords, NGU has performed more thorough mapping. Subsea maps have been prepared for some areas, and these are valuable for municipal planning along the coast. The local authorities are responsible for safeguarding all interests in the coastal zone, especially fisheries, aquaculture, tourism and outdoor recreation. Thorough documentation and good knowledge are essential for this work.

Using its 55-foot long – nearly 17 metres – research vessel, *Seisma*, which was built in 1985, NGU has been mapping Astafjord in southern Troms for several years. After more than a quarter of a century’s service, *Seisma* now needs to be replaced by a new, modern vessel that satisfies the demands for state-of-the-art technology.



Invisible and dangerous

More and more people are becoming aware that radon is an invisible problem in many homes. It is estimated that several hundred people develop lethal lung cancer each year due to radon in the indoor climate. This is unnecessary. Radon gas can be kept out of buildings, but to do so its presence there must be known. Simple measurements can reveal it.

NGU is working closely with the Norwegian Radiation Protection Authority to map areas where there is a potential risk of radon in buildings. The radon gas comes from the bedrock or from superficial deposits beneath the buildings and is thus part of the natural environment in Norway.

Several ministries have jointly drawn up a national strategy to reduce radon exposure in Norway. The Radiation Protection Authority has presented an action plan to follow up this strategy.

NGU is supporting the work begun by the Authority. It is helping to map the extent of the hazard -the natural radiation- in prioritised areas. NGU believes it is socio-economically important to prioritise on mapping areas with a potential radonhazard. Some areas are known to have radon values that far exceed the intervention level. All such areas must be identified to be able to implement safety measures and enable local authorities to introduce regulations in their land-use planning.

In 2010, NGU assisted the Authority by preparing maps showing areas with alum shale in the bedrock. Alum shale contains a great deal of the element uranium, which decays into radioactive substances, including radium. Radium is the precursor of radon.

Maps for radon have been prepared for parts of south-east Norway. These are based on measurements undertaken from the air and are compared with measurements made by the Radiation Protection Authority in buildings in the same areas. All NGU's susceptibility maps can be viewed interactively at www.ngu.no.

Even though the bedrock and superficial deposits in some parts of the country indicate the possibility of natural radiation, thus increasing the risk of radon in buildings, radon also occurs where there is no natural radon hazard in the ground. To find an explanation for this, NGU is starting a project to investigate the radon contribution from building raw materials like sand, gravel and aggregates. These materials may be transported over distance before being used in areas where natural radiation does not occur.

” *NGU's expertise in geological mapping is important for both radon mapping and nuclear preparedness in Norway*

Ole Harbitz, Director, Norwegian Radiation Protection Authority



Longest and deepest

” *NGU is a reliable,
professional partner*

Terje Moe Gustavsen, Director, Norwegian Public Roads Administration

When the Norwegian Public Roads Administration plans to tunnel beneath Boknafjord and Kvitsøyfjord, north of Stavanger, world-class geological expertise is required. The E39 Rogfast project will be the world's longest and deepest subsea road tunnel.

One of NGU's tasks is to help to improve geophysical and geological pilot studies for tunnels and other constructions in bedrock, in cooperation with the Public Roads Administration and the Norwegian National Rail Administration. In the Boknafjord area, NGU has studied aerogeophysical data, the physical properties of the rocks, and the seabed topography, and has also carried out geological mapping on land.

All told, the work has provided those responsible for this gigantic project, which is so far estimated to cost as much as NOK 6 billion, with new information on the geology.

The tunnel is planned to go from Harestad in Randaberg to Arsvågen in Bokn, and will be some 25 kilometres long in two bores. There will also be an arm, about two kilometres long, up to the island of Kvitsøy. The road will replace the Mortavika-Arsvågen ferry link. The lowest point in the tunnel will be approximately 360 metres below sea level. Excellent geological knowledge is essential.

The results of NGU's digital structural analyses were used when new seismic investigations were carried out by the Public Roads Administration in 2010. A major fault zone has also been mapped in the bedrock a few hundred metres beneath the seabed between Randaberg and Kvitsøy. Another fault zone is thought to be present just north of Kvitsøy. These will now be tested and investigated, in part by obtaining deep, long drill cores in the area.

NGU's analyses also suggest that weathered bedrock may be present at depth, and this will show up as clay in zones along the projected tunnel. It is therefore important to study the landscape development after the last Ice Age. If the glaciers eroded more than 300 metres of the bedrock, there is less chance of finding such deep weathering. Detailed investigations are being made so that the construction company can be as well prepared as possible for whatever it may meet at depth. Thorough knowledge of the bedrock quality simplifies planning.

At the same time, the preparatory work has a great deal to say for the cost of the project. If the bedrock is of poor quality, the construction company will have to spend more money on rock support.

The surface geological mapping revealed outcrops on the islands between Randaberg and Kvitsøy of what the geologists regard as part of the Karmøy ophiolite complex. Ophiolite is a generic term for a group of magmatic rocks that were formed on or beneath the sea floor. There are probably large quantities of gabbro here, which can be used as aggregate when the tunnel is being driven beneath the seabed.

E39 Rogfast is part of the National Transport Plan. Construction is intended to start sometime between 2014 and 2019, and take five years to complete.



Academic interest

” *NGU employees who act as adjunct professors supply an added dimension to the teaching and contribute valuable expertise in the mapping of natural resources on land and the sea floor*

Torbjørn Digernes, Rector, Norwegian University of Science and Technology (NTNU)

NGU is an international workplace characterised by good cooperation with universities and colleges in Norway and other countries. Thirty of NGU's scientists hold professor status, and many help to recruit new geologists through their teaching, field courses and course reading materials.

NGU wants to be broadly present in academia, as it is in the rest of society. It is important and essential to educate new, able geologists who can map the country. Geology is, after all, at the root of everything. Norway needs to find and extract new natural resources, it needs good land-use planning that also safeguards geological assets, and it needs to know where there is a risk of landslides. Put simply, it's all a matter of resources and risks.

This is one reason why NGU funds summer jobs for students who want to work on projects in several branches of geology, both in the field around the country and at the head office in Trondheim. The scheme is first and foremost aimed at students at the Bachelor level, but those embarking on a Master's degree may also apply. In 2010, 13 students were involved for two months from June to August. NGU believes this valuable arrangement helps to improve recruitment to geology.

Geoscience has at long last become a subject in its own right in Upper Secondary Schools. NGU has made staff available to hold geology courses for teachers. They have been given the chance to study geological maps, seen how NGU databases and map services function, been given help to find excursion routes and been taken to localities in the field to acquire more knowledge for their teaching.

The most able scientists required by NGU for special tasks are often not to be found in Norway today. However, by recruiting more than 70 staff from 24 countries, NGU has at the same time developed contacts and reached far into academia in increasing numbers of foreign institutions.

Our international scientific cooperation in recent years has been wide ranging. True enough, the first foreign geologists came to NGU as early as the 1950s, but the curve began to rise steeply after 1990. That was when NGU began to advertise posts internationally when university training or a doctorate was called for.

The number of articles published in scientific journals has increased significantly in recent years. This is mainly connected with more funding from the Research Council of Norway, particularly in research related to petroleum and climate. In 2010, staff with a minimum of a Master's degree in geoscience published, on average, 1.2 articles in scientific journals. Such publication in scientific journals and other works involves extensive cooperation with fellow workers in other institutions, both in Norway and other countries.



Drying out

” Groundwater data from NGU is helping to save Bryggen in Bergen

Jørn Holme, Director, Directorate for Cultural Heritage

The level and quality of the groundwater are decisive for preserving valuable archaeological occupation layers ‘in situ’ – in their original position. Such organic layers, which are found in Norwegian medieval towns, are among the most important cultural heritage remains in this country.

Because of its hydrogeological expertise, NGU is working with the Directorate for Cultural Heritage and others to safeguard the world cultural heritage site in Bergen. The wharf at Bryggen in Bergen, with its deep occupation layers and building remains from 1702, is a complex relic that is absolutely dependent upon sustainable water resource management.

Over the past 25 years, the groundwater beneath parts of Bryggen has sunk more than one and a half metres. Several buildings have suffered serious settling damage. The Directorate is also concerned about the many metres of occupation layers concealed under the buildings. Bryggen is a protected site right from the bedrock to the rooftops.

The Directorate for Cultural Heritage reports that over a period of 700 years, from AD 1000 to the time of the great fire in 1702, metre upon metre of occupation layers accumulated beneath the Bryggen warehouses. Throughout this time, the moist earth conserved and protected these layers with their bones, textiles, pollen, corn and other organic remains. Now that the water table is sinking, oxygen is reaching them and the organic matter is decaying and disappearing. If this decay is allowed to continue, only stone and pottery objects will be left for future archaeologists. The rest will have become earth.

Now NGU is also taking part in the EU inter-regional project, North Sea Skills Integration and New Technologies (SKINT). The project focuses on groundwater in urban areas as part of the water balance of towns. Bryggen is included because it is an outstanding example. Seven institutions in four countries, and across four disciplines, are working together to find the best ways to implement sustainable solutions for dealing with water in the North Sea region. This will enable SKINT to help to achieve the targets of the EU Water Framework Directive and Floods Directive, improve the water quality and reduce the flood risk in urban locations.

The balance in the groundwater conditions must be re-created to safeguard Bryggen and prevent further subsidence of the terrain and loss of occupation layers. Hydrogeological mapping showed that a major building development thirty years ago was the main reason for the water table at Bryggen sinking. The subsurface changes resulted in much of the groundwater beneath Bryggen draining away and being flushed into the adjacent inlet, Vågen. The plan now is to restore the natural water balance by implementing various technical measures in close cooperation with the city of Bergen. The groundwater level must be monitored continuously.

Oslo, Bergen, Trondheim, Stavanger, Tønsberg, Hamar, Sarpsborg and Skien have protected occupation layers. NGU believes it is very important to consider hydrogeology and archaeology when the towns seek solutions dealing with surface water and groundwater. Cooperation is essential.



Accounts

Accounts 2008-2010

Expences by type	NOK million		
	2008	2009	2010
Salary/nat. ins. expenses	122,4	126,4	135,9
Other expenses	79,6	81,5	79,6
Investments	10,5	10,4	8,2
Total expenses	212,5	218,3	223,7
Income	2008	2009	2010
Ministry of Trade and Industry	140,3	137,4	140,5
Other income	68,0	84,0	80,9
Total income	208,3	221,4	221,4

Accounts 2010 by main objective (NOK million)

Main objective	Total	External finance
Sustainable added value from geological resources	67,9	25,5
Effective use of geoscience knowledge in land-use planning and development	64,6	27,1
Better knowledge of geological development and processes in Norway	67,1	23,7
Management and dissemination of geological data and knowledge	24,1	2,6
Other income		2,0
Total	223,7	80,9

NGU's total productions of reports, publications, presentations and maps for 2006-2010

Product type	2006	2007	2008	2009	2010
NGU-reports	79	73	85	67	66
Articles, refereed journals	98	125	145	166	138
Other published articles	60	90	74	41	32
Presentations, teaching and posters	379	458	545	484	542
forskning.no	24	20	19	19	16
Bedrock and surficial deposits maps	12	4	14	9	12

NGU's employees

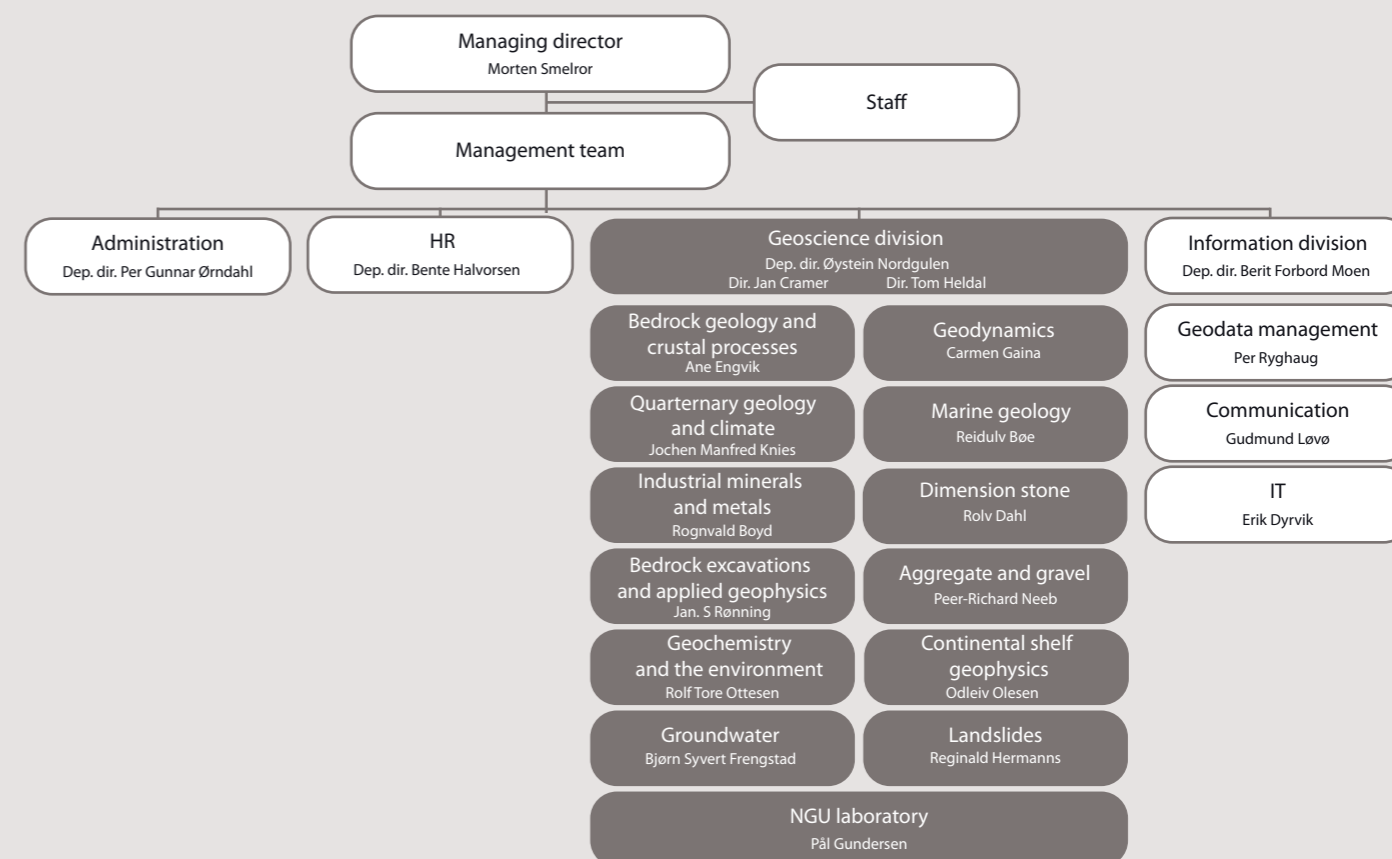
	2008	2009	2010
Full-time equivalents	213	209	214
Total number of employees	222	216	221
With Masters Degree	145	142	150
With PhD	77	77	81
Number of foreign employees	70	67	72

Number of appearances in media 2005-2010

Type of media	2005	2006	2007	2008	2009	2010
9 selected national media	72	79	51	156	99	134
18 selected regional media	211	131	102	514	267	310
All media monitored by Retriever	942	777	799	1.590	1.049	827

Web usage 2008-2010

Web pages	2008	2009	2010
www.ngu.no			
Number of visits to ngu.no	240.000	287.500	339.000
Number of visits to map services	130.000	123.200	135.000
www.prospecting.no			
Number of visits	3.200	2.700	2.800
www.grunnvann.no			
Number of visits	19.700	20.300	24.000



The Geological Survey of Norway (NGU) is the leading national institution for knowledge of bedrock, mineral resources, superficial deposits and groundwater. NGU is a government agency under the Ministry of Trade and Industry.

NGU must ensure that geological knowledge is utilised for efficient, sustainable management of the nation's natural resources and environment. NGU's expertise can be used in development aid projects. As a research-based management agency, NGU also advises experts in other ministries on geological matters.

Under the vision "Geology for Society", NGU provides better maps and organises quality-assured geological information in national databases. Its activity is aimed at the following main objectives:

- Sustainable added value from geological resources
- Effective use of geoscience knowledge in land-use planning and development
- Better knowledge of geological development and processes in Norway
- Management and dissemination of geological data and knowledge

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