Sveriges geologiska undersökning

A comparative study between the Geological Surveys of Britain (BGS), Ireland (GSI), Finland (GTK), the United States (USGS), and Sweden (SGU)

Naz Ahmed Shaikh & Lars Persson

SGU
Sveriges geologiska undersökning
Geological Survey of Sweden

British Geological Survey
NATURAL ENVIRONMENT RESEARCH COUNCIL

GSI

GTK

USGS
science for a changing world

SGU-rapport
2005:6

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“All things good to know are difficult to learn” (Greek proverb)

Contents

Background and objectives

The Geological Survey of Sweden has been working mainly under a long-term plan, which will be accomplished in 2008. To obtain an international view for the forthcoming plan, SGU started a comparative study aimed to help SGU in determining its present position and above all to monitor its future services. Directors Naz Ahmed Shaikh and Lars Persson were responsible for this study. Director Jacob Johnson accompanied when visiting BGS, GTK and USGS.

A Questionnaire was worked out and sent to each organisation before the actual meeting and they were requested to prepare the answers in writing. During the visits, which generally lasted two days, detailed discussions took place and various aspects were elaborated. Ample additional material was provided by each organisation. With the help of this material together with the discussions SGU prepared a relevant coverage for the respective organisation. They scrutinised this and these are attached in extenso to this report.

The main purpose of this study is to know how the chosen organisations are fulfilling their tasks according to the changing demands of the Society and how the organisations have adapted to such changes in respect to domestic domain and also internationally. It should be fully understood that there exist many differences, not only in respect to geological and geographical conditions, but also on historical and economic developments. Each Survey organisation works under the guidance of its respective government and the role given to it. Many public-funded organisations in the past were mainly working within a discipline context. What today is needed interplay, not only among the public-funded organisations, but also with those in the private sector. Further interplay between market and policies is necessary. An active work must be done in strengthening the combined knowledge base and not least to develop awareness and ability to make use of it. It is evident that today an increasing extent, knowledge is produced in an application context. Furthermore it is often created in multidisciplinary constellations.

On behalf of SGU we wish to express sincere thanks to the Director General David Falvey and Director David Ovadia, BGS, Director General Peadar McArdle and Director Ralph Horne, GSI, Director General Elias Ekdahl and Director Keijo Nenonen, GTK, Director General Chip Groat and Staff Scientist Rama Kotra, USGS and all co-workers who made this study possible and for the full collaboration in a very professional way.

Response to the Questionnaire

The British Geological Survey (BGS)
The Geological Survey of Ireland (GSI)
The Geological Survey of Finland (GTK)
The United States Geological Survey (USGS)
The Geological Survey of Sweden (SGU)

The reponses from the five geological surveys to the questionnaire from SGU are reported on pages 4–118.

British Geological Survey, BGS

The British Geological Survey (BGS) was visited on November 23rd and 24th by representatives from the Geological Survey of Sweden (SGU) Lars Persson, Naz Ahmed Shaikh and Jacob Johnson for benchmarking. From BGS among others David Ovadia, Chris Green and Dave Water. David Ovadia arranged the visit and took part during both days´ discussions.

Photo: Lars Persson

The British Geological Survey (BGS) was founded as early as 1835, mainly for the supply of coal and iron ore and for support to the construction of railways and canals. BGS is a component body of the Natural Environment Research Council (NERC) — one of the seven research councils that fund and manage scientific research and training in the UK. The NERC uses a budget of just over £270 million (approx. 390 mill Euros) a year to fund independent research and training in the environmental sciences. About half of its budget goes to universities, and half is invested in its own research centres. The NERC deals with earth system science with the aim of advancing knowledge of planet Earth as a complex, interacting system. Its work covers the full range of atmospheric, earth, terrestrial and aquatic sciences, from the depth of the oceans to the upper atmosphere. The NERC's mission is to gather and apply knowledge, create understanding and predict the behaviour of the natural environment and its resources. The NERC's current strategic priorities are: to prioritise and deliver world-class environmental science to understand the Earth system; to use NERC-funded science to identify and provide sustainable solutions to environmental problems; to train and develop skilled individuals to meet national needs; and to provide effective national and international leadership for the environmental sciences.

The BGS is a public-good not-for-profit organisation. The funding is derived from government-funded strategic geoscience, distributed through the NERC´s allocation of the Science Budget, and income from external sources for delivery of commissions, sales, and services. The commissioned portfolio itself includes a significant proportion of fully funded geoscience that directly enhances the Core

Strategic Programme and increases the skill base of the organisation. Income from sales and chargeable services also feeds back into enhancing the Core Strategic Programme and developing additional products and services. Principal offices are in Nottingham, Edinburgh, Oxfordshire, London, Exeter, Belfast and Cardiff.

Website: www.bgs.uk

SGU´s Questionnaire

The currency used is given in £ but also in Euros according to the exchange rate of 1 £=13 SKR, I Euro=9 SKR

General questions

- **Mission of the Survey**

Advance geoscientific knowledge of the United Kingdom Iandmass and its continental shelf by systematic surveying, long-term monitoring, effective data management and high-quality applied research.

Provide comprehensive, objective, impartial and up-to-date geoscientific information, advice and services, to the client and user community in the United Kingdom and overseas, enabling safe, sustainable and efficient choices to be made in managing the environment and utilising its resources, thereby contributing to national economic competitiveness, the effectiveness of public policy and the quality of life.

Disseminate information in the community, and promote the public understanding of science, to demonstrate the importance of geoscience to resource and environmental issues.

- **Vision**

No special as it is usually too vague.

BGS Corporate Aims

The aims of the BGS are to:

- address the needs and requirements of all our customers and users through provision of relevant, comprehensive and up-to-date information and advice to modern standards and to appropriate specifications;
- determine customer/user needs and requirements through consultation and provide work of assured quality within the context of an agreed framework of standards against which it can be judged;
- operate at all times to the highest professional standards; emphasise impartiality, confidentiality, reliability and promptness, and value for money;
- remain committed to the management of health and safety in providing a secure and healthy workplace, meeting legal obligations and incorporating appropriate safety and environmental risk assessments in all programmes, projects and facilities;
- maintain and develop well-founded laboratories and information systems and services;
- be an equal opportunities employer;
- foster a culture of team work, provide staff with a stimulating work environment, modern facilities and first-class training.

- To which Ministry it is allocated

The Department for Trade and Industry via Office of Science & Technology and Natural Environment Research Council (a non-Departmental Public Body)

- Number of employees

809

Geoscientists, %

63% (513)

About 30 engineering geologists are employed

- Others, %

37% (296)

- Number of employees, development the latest 5 years

No significant change in real terms

- Geoscientists
- Others
  - Financing
- Total budget

Euro 55.1 million (£38.663 million)

- State budget

Euro 29.83 Million (£20.931 million)

- Other sources (name the three most important)

Euro 25.27 million (£17.932 million)

Commissioned work for Government, Sales and licensing, work for foreign governments

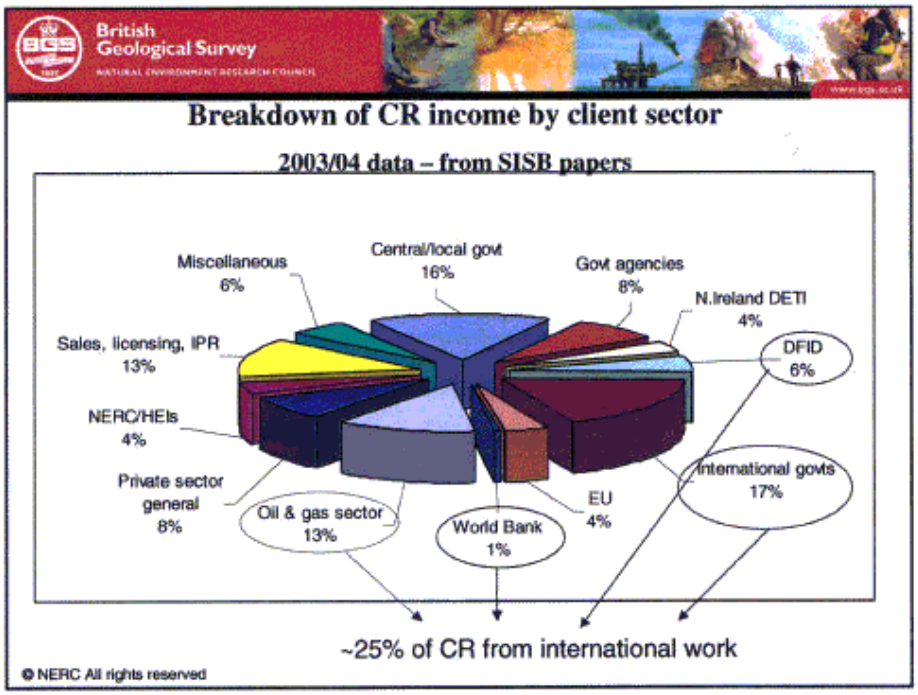
- Development latest 5 years

No significant change in real terms

- Total
- State budget

The same

- Other sources



- Who initiates/determines the program of the Survey?
  - The Ministry
  - External Board
  - The DG
  - Others (please explain)

CR – the market; SB – NERC Council

- Is your Survey considered as a center of excellence?

A center of geoscience information and skills

- % of the total yearly budget spent on research and development
  - Development the latest 5 years

Is integral within projects

- % of the total yearly budget spent on marketing

2% (marketing and information are different things)

  - Development the latest 5 years

No significant change

- Please describe briefly your fields of international co-operation

Mainly World Bank, EU, DFID, and foreign government contract mapping for minerals etc (see pie chart)

- Please describe your involvement in various EU-financed project, their type, size, extent and partners for the last 3 years and future outlook

<£100k/yr (approx.145KEuros) on FP work, which has to be co-funded

- How needs of societal geoinformation are taken into account
- Through permanent advisory boards with user representatives

Yes – regional advisory groups

- By regular meetings with user organisations and decision makers at various level

Yes – e.g. BGS Board

- Surveillance by the survey itself

Yes – via our ISO procedures

- By complimentary directives from the Ministry

Departmental papers & directives e.g. ODPM policy on housing growth in SE England

- Who makes the priority among the various societal demands and how?

Executive Committee and Board based on priorities that are set down from our parent body and government along with experience of knowing what we are best able to achieve and in the best position to provide

- How the performance of the survey is evaluated/measured
- Regular external evaluation

Yes, every 5 years, by Science and Management Audit

- Showing performance indicators in the Annual Report

Some, but more output performance measures, e.g. publications, reported to NERC

- Do you have quality management ISO 9001

Yes, ISO 9001:2000

- What is your prime objective in communicating?

Both, as marketing our geoinformation is vital but so is continued funding to allow us to continue this in future. Also for public understanding of science

  - To receive more funding
  - To market the geoinformation you have in an understandable way
  - Please describe your main customers or users of your information and services

Very wide ranging from Government (central and local) to, agencies, EU, other international, oil and gas, energy and power, civil engineering, minerals, environmental industries etc.

- Please describe the main societal sector where your products and information is used today

There is no one sector that would be considered our main sector as explained above. We work across a broad range of society. However a large percentage of our work is either done directly or indirectly for government (c. 50% in SB and c. 20% in CR)

- Do you have a policy for the pricing of your products?

Yes. Main areas of deliveries: publications/digital products, georeports, records (boreholes) and data licensing. The Survey tries to cover the costs – the price of the print on demand-products depends on production time and reproduction costs. The Georeports are common geological issues with fixed price = full cost. Data licensing is increasing in volume. Inquires are most important. The total income is £2.4million (approx. 3.5 mill Euro) to be compared with £700 000 (approx. 1 mill Euro) 5 years ago. The main customers are: insurance, oil and water companies, civil engineering, property private (contamination of land etc.)

Organisational structure

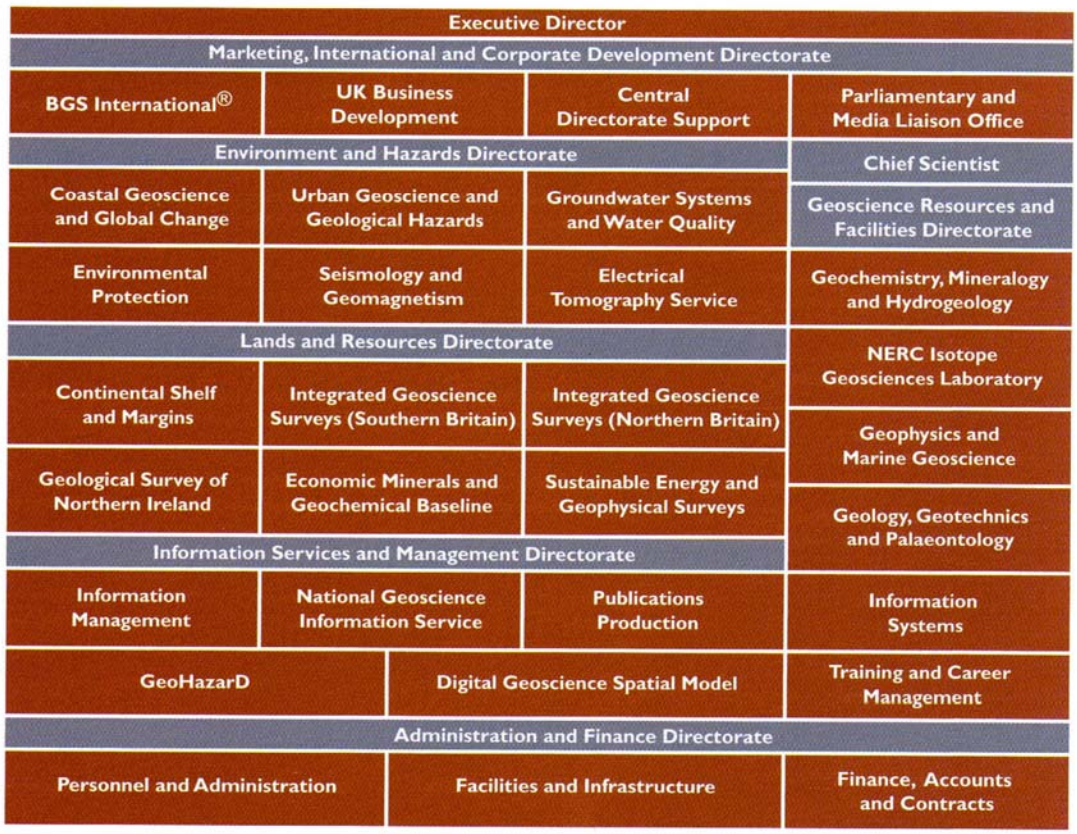
- What organisation type has the Survey?

- Hierarchic
- Matrix (programs and projects)
- Please provide an organisation chart

- Do you consider your Survey as

- A demand oriented organisation, yes
- A traditional geoinformation producer organisation

- If you are demand oriented, what changes were necessary to adapt to this role
- How much of the project work is outsourced ((in house/out-house activities, % of the total amount spent in the last 3 years) In principal zero



Activities

- How much of the land area (%) and continental shelf area is covered by modern (not older than 30 years) geological maps in various disciplines. Almost 100% also most of continental shelf. The land 1:50,000, shelf 1:250,000. Geophysical maps are not covering and that is why an airplane from Finland was newly bought. Investigations with high density 50 m – 200 m. Magnetic in priority, gravimetric lower. No activity offshore today-NERC had one vessel but never BGS. It is too expensive and not appropriate with own vessel. Base-line maps cover 2/3 of the country. Quaternary mapping is starting now-hydrogeological in catchment areas where the demand is
- Resources provided in last 3 to 5 years to various core projects respective disciplinary projects

Science budget (core) projects have been funded at around £20million per year for the last few years (approx. 29 mill Euros)

- Is both primary and synthesized information in digital form and available in databases?

Yes

- Is geological data accessible for users/customers on line?

All metadata and much geoscientific data, accessible (mostly internal) but not free. 1:250 000 and more detailed data is locked for external users

- Is it possible for users to download information from your databases on line?

Not yet-we are developing it. Credit card will unlock the key.

- If so how is that financed and what are the terms of usage?

Payment system evaluated

- What is your linkage with other players in the innovation system?

There is commercialisation and spin out targets following the UK Treasury Baker Report guidelines. Electrical resistivity tomography e.g. commercialised.

- What is the general length of a project?

Projects range in length from a couple of days to 4 years or more

- Core projects (need for society, e.g. geological mapping)

15 years (1990 – 2005)

- Co-operation and research projects (not 100% funded but partially subsidized. These projects also include bilateral projects

We do not do subsidised projects! Co-funded projects, e.g. EU FP, are 1-3 years

- The activities are grouped in disciplines (programs in Britain)
- Bedrock geology
- Quaternary geology
- Mineral prospecting
- Hydrogeology
- Geophysics
- Geochemistry
- Marine geology
- Environmental geology
- Medical geology
- Engineering geology, geotechnics
- Applied geology

Projects are grouped into programs according to the BGS organogram - not in strict monodiscipline areas as set out above

Commercial activities

- Turnover, USD

Euro 25.27 million (£17.732 million)

- Development the latest 5 years

Sales, licenses, international up (by c. 100%) domestic consultancy work down. Overall no significant change

- National (name the three most important sectors)

Commissioned work for Government, Sales and licensing

- Development the latest 5 years

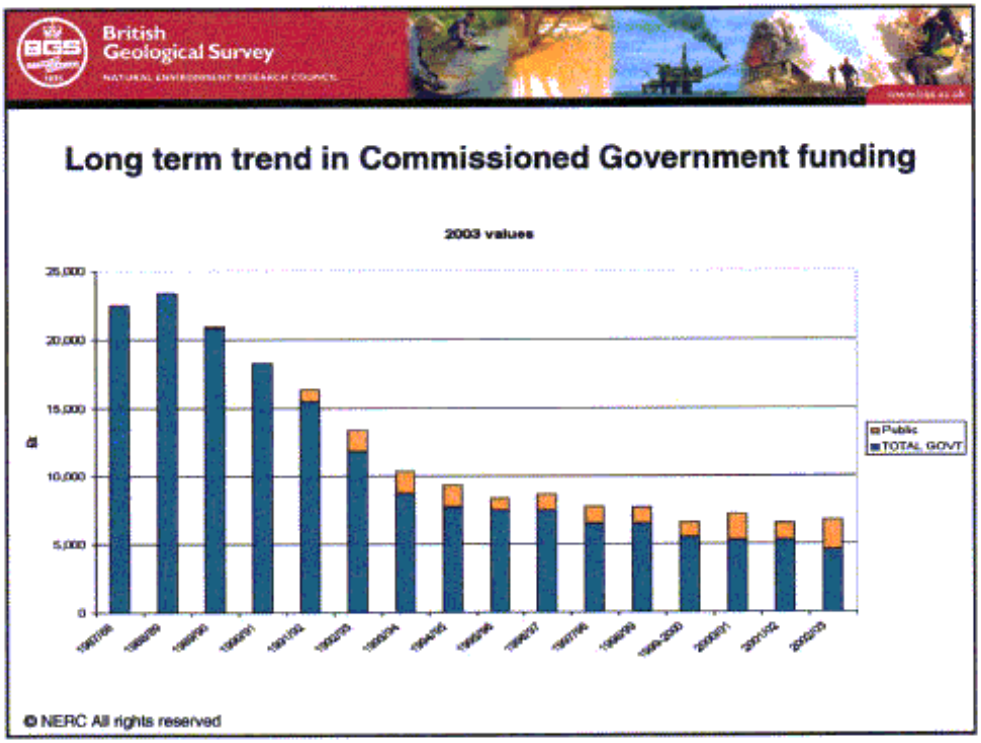
Sales, licences, international up (by c. 100%) domestic consultancy work down

- International (name the three most important sectors)

Foreign Governments, World Bank and EU

- Development the latest 5 years

Overall increase in World Bank funded work



- Is external income demanded? Yes. If yes what limit is given?

Limited by the supply side

- Is the pricing of services/products standardized?

Yes – but the details are commercially sensitive

- How high and what type are the overheads?

The details are commercially sensitive

- Are there any especially designed profit centers?

All Programs must balance their income against full cost recovery, including salaries and overheads

- What is done with the profit gained?

Any surplus, or deficit, is carried forward

Future outlooks

- Does your Survey have a strategic plan for the next 5-10 years?

The 2000 – 2005 plan (copy given) is soon to be updated for the next five years (available January 2005)

- Tendencies for the future budgets (ratio of state's budget and external income)

Currently under review. The Science budget will probably not increase in the future.

- How the various EU directives affect your present and future activities

If these become UK law, we will have responsibilities to UK government advise as required

- Tendencies for commissions, volume and trends

Very small real term growth over last 5 years – sales, licenses, international up (by c. 100%) domestic consultancy down

- Investments in the future (please describe in which fields)

Capital spent on buildings, laboratories and IT. Laboratories will increase organic capabilities. The building in Keyworth was bought for £2 million (approx. 2.9 mill Euro) in the 70ties

- Do you think that geological mapping will be still an activity in the next decade and be your core activity?

Still active but it is already not our single core activity but part of our core activities (see attached list of Program contents)

- How you listen to decision-makers to identify important future issues

Research policies, consultations, advisory panels, stakeholders' meetings (invited guests (everybody) talk (biscuits and wine), media, government, academia, organizations; 1000 invitations -150 coming, London in October after the Annual report) etc.

- How do you respond to the expectations of society?

Stakeholder meetings, client contacts, media responses etc.

- How you influence public perception of your work?

Media initiatives, parliamentary and other briefings (information to Parliament). Not funded to make education

- What services are likely to be abandoned in the future?

No major services or activities will be abandoned but all will evolve e.g. into 3D mapping!

- What services are going to be extended?

On-line access to information, modeling, 3D and 4D visualizations. Problems such as security supplies, climate change (georisks, geohazards, climate change, water supplies (mostly quality), postindustrial waste disposal (contaminated land), medical geology in some sense (base-line work), energy, mineral resources, mineral intelligence, aggregates have to be solved. Geomagnetic investigations have to be started. Water quantity like salt-water intrusion is no big issue in Britain, merely water quality. The quantity of water may concern some parts in southeast England. Neither surface water is of interest; however there are rising water levels in London. This like remediation work can be done by others. Other problems to be solved concern shallow sites of radioactive materials, mine-water (acid) and methane in mines. Geotechnical/engineering problems such as slides, shrink, swell and subsidence are of interest meaning collection of information from infrastructural works, borings, cores etc. Geotourism is for the moment not very large but could be expanded. Schools in field geology are necessary to start.

- Are any new services planned, if yes which?

At this stage, the details of our next 5-year science program are still under review by NERC Council.
Groundwater chemistry will shrink (water companies, private companies responsible), groundwater modeling increase, urban geochemistry important, aggregates, contaminated land, land-use, planning, transport links, urban geology.

Lands and Resources Directorate

The Lands and Resources Directorate operates through six integrated programmes designed 1) to define the onshore and offshore surface and sub-surface geology of the United Kingdom, 2) to provide information on the distribution of energy and mineral resources, and 3) to carry out research on the sustainable utilisation of the land, the seabed, and the nation's natural resources. A major component of the overall work programme is concerned with geological mapping and revision together with supporting research, not only in the UK, but worldwide through international research projects and comrnissioned contracts.

The ***Continental Shelf and Margins Programme*** undertakes research and coordinates information on all aspects of the continental shelf and ocean margin, including seabed properties, 3D geology and structure, tectonic evolution, energy resources, and geohazards. The programme maintains strong links with the offshore oil and gas industry through its involvement in a variety of industry-supported research consortia.

The objectives of the ***Economic Minerals and Geochemical Baseline Programme*** include 1) the delivery of information on the nation's mineral resources (metallic, industrial, construction and coal), 2) the development of new approaches to mineral resource assessment, 3) mineral exploration and life cycle planning, and 4) providing UK-wide geochemical baseline information for resource and environmental applications. Two further objectives of the programme are 5) to develop a scientific understanding of the natural and anthropogenic geochemical environment, and (vi) determine the fundamental geological, geochemical and structural controls on metalliferous ore-forming processes. The programme is very active internationally, both through BGS International and on its own account. Many of these projects (with funding from the European Commission, international development banks and national governments) focus on mineral resource evaluation, promotion, and the attraction of controlled inward investment.

The ***Sustainable Energy and Geophysical Surveys Programme*** has a dual remit 1) to support development of sustainable energy options through research and provision of strategic information, and 2) to provide national coverage of modern airborne and ground geophysical data, and define the deep structure of onshore UK through modelling and interpretation. Responsibilities in the energy sector include both renewable and fossil sources. A key responsibility of the programme is that of developing technologies and best practice for the underground storage of carbon dioxide as away of reducing global warming and ocean acidification from the burning of fossil fuels.

Environment and Hazards Directorate

The Environment and Hazards Directorate operates five long-term programmes concerned with groundwater systems and water quality, urban geoscience and geological hazards, environmental protection, coastal geoscience and global change, seismology and geomagnetism, and one sub-programme (the Electrical Tomography Service) to explore scientific exploitation options. The directorate's constituent programmes work with the common aim of developing a better understanding of geoscience processes, translating existing information into parameters needed by users, and producing new data collection and mapping protocols that will feed into future BGS digital survey methods. Many environmental problems cannot be solved by the BGS alone, and the Environment and Hazards Programme Directorate works increasingly with social scientists, economists, ecologists and many other disciplines.

The ***Groundwater Systems and Water Quality Programme*** provides essential underpinning and multidisciplinary science to facilitate effective groundwater management, supply and use in the UK and the developing world. The programme is responsible for the National Groundwater Survey, and is guardian of the National Groundwater Archive. As well as resource assessment and aquifer modelling, the programme makes an important contribution to public health issues connected with, for example,

the presence in groundwater of problematic levels of naturally occurring arsenic and fluoride, or the chemical and bacteriological contamination of groundwater from wastewater recharge, onsite sanitation, fertilisers, pesticides and farm waste, including the impact of carcass burial.

The objectives and responsibilities of the ***Urban Geoscience and Geological Hazards*** *Programme* are to provide the user community with information on, understanding of, and solutions to problematic ground conditions and land quality, particularly in urban areas. Activities include 1) 3D modelling of the shallow subsurface, 2) assessing the likely occurrence of geological hazards, 3) determining the geotechnical and engineering characteristics of rock and soil formations, and 4) measuring the physical and mechanical properties of materials. Geohazard research has focussed on landslides, swelling and shrinking clays, collapsible soils, dissolution (e.g. of gypsum and limestone ground), and assessing areas susceptible to flooding.

The ***Environmental Protection Programme*** undertakes applied research aimed at characterising pollutant sources and pathways through site characterisation, process understanding, risk assessment and site clean-up. It offers expert and impartial advice on strategy, methodology and scientific defensibility, and promotes and enhances public understanding of geo-environmental issues. Particular areas of interest include pollutant transport from landfill sites, pollution from mine-water drainage and mine tips, natural radioactivity, environment and health, risk assessment, and containment properties.

The aim of the ***Coastal Geoscience and GIobal Change Programme*** is to provide the user community with information on, understanding of, and solutions to, problems relating to coastal geoscience or global change. The information, based on multi-disciplinary, integrated science, is commonly applied to strategic or medium to long timescale problems that include coastal change, erosion, accretion, flood management, coastal contamination, land-ocean interactions of materials, preservation of natural coastal resources (habitats), the role of natural climatic drivers, and managing the impacts of climate change.

The ***Seismology and Geomagnetism Programme*** includes long-term monitoring of 1) natural and human-induced earth tremors and quakes, and 2) fluctuations in the earth's magnetic field, as well as a specialist project in seismic anisotropy. Objectives include provision of data for research into planetary processes, and support to UK national interests and industry. The latter involves, for example, assessing the risk and likely frequency of earthquakes, and the generation of the British Global Geomagnetic Model which is critical for navigation and directional drilling.

The ***Electrical Tomography Service*** was spun off from the Environmental Protection Programme in April 2002 in anticipation of its future potential as a commercial venture. ETS is a non-invasive geophysical technique that allows the detection and 3D-mapping/imaging of subsurface features such as concealed voids (e.g. abandoned mine shafts) or zones of contamination from, for example, landfills or oil/solvent spills. BGS has acquired a leading edge capability in ETS through the development of several innovative technologies and applications.

Information Services and Management Directorate

The information Services and Management Directorate has corporate responsibility for the management and delivery of the BGS's information. The directorate's mission is to manage and deliver information in a coherent way, through a corporate, best practice approach. Its twin objectives are to underpin efficient and effective delivery of all the BGS programmes, and to ensure maximum benefit to external clients and users of the BGS's data and information. The directorate operates through two long-term programmes (Information Management, and the National Geosciences Information Service) and two major projects (the Digital Geoscience Spatial Model, and GeoHazard), and also manages Publications Production as an internal Service. A major achievement of recent years has been the completion of national coverage of 1:50 000 scale geological map data in digital format. The BGS is regarded as an exemplar organisation in terms of environmental information management and delivery. It frequently hosts visits from other Geological Surveys wishing to observe the leading

edge systems and procedures that have been developed. Furthermore, it has been invited to provide advice and services on geoscience information to several Geological Surveys around the world, to central and local government and to the commercial sector.

The ***Information Management Programme*** manages all the information assets of the BGS. Its objectives are 1) to store the information in appropriate environments to assure its long-term potential, 2) to ensure that appropriate metadata is provided for datasets and records, and provide fast and friendly digital indexes to actively used datasets, 3) to provide a service for the conversion of analogue records into digital records, and 4) to provide applications that enable geoscientists to use the BGS information with confidence.

The overall objective of the ***National* Geoscience *Information* Service *Programme*** is to increase the availability and optimise the delivery of BGS information to external users. Its data resource consists of material collections (rock, mineral and fossil specimens, including panned concentrates, drill core and cuttings), and documentary and digital collections (geologists' notebooks and field maps, borehole, mineshaft and well records, site investigation reports, mine plans, mineral exploration studies, geophysical data, photographic collections, historic and corporate archives, printed books and maps). This material includes data generated by BGS itself and that derived from a variety of external sources. The BGS also interfaces with the non-professional public and the education sector through its Public Understanding of Science activities.

Geoscience Resources and Facilitates Directorate

The main objective of this directorate is to develop methodologies and techniques to underpin and enhance projects managed by the three customer-facing programme directorates (Environment & Hazards, Lands & Resources, and Information Services and Management). ln addition to the research element inherent in this role, the directorate maintains corporate and national standards in geoscience and IT, often in collaboration with external bodies. It has an important responsibility for developing and maintaining the capability of an impressive suite of state-of-the-art laboratories (petrographic, mineralogical, chemical, geotechnical, palaeontological, and isotopic) as well as workshops and training facilities. The laboratories address a wide range of requirements in analytical geochemistry, hydrogeochemistry, mineralogy, petrology, hydrothermal and aquifer processes, geomicrobiology, geotechnics, biostratigraphy and geochronology.

Geological Survey of Ireland, GSI

The Geological Survey of Ireland, GSI, was visited November 1st and 2nd for benchmarking. From Geological Survey of Sweden, SGU, Lars Persson and Naz Ahmed Shaikh took part and from GSI among others: General Director Peadar McArdle, Ass. Director Ralph Horne, Principal Geologist Pat O´Connor, Chief Technologist Clive Murray, Head of Administration John O´Donoghue, Deepak Inamdar, Eibhlin Doyle, Marine/Seabed Programme, Brian McConnell, Bedrock Programme, Geoff Wright, Groundwater Programme, Matthew Parks, Geological Heritage and Geotourism Progamme, Gerry Stanley, Minerals Programme, Koen Verbruggen, Information Management, Willie Warren, Quaternary Programme, Ronnie Creighton, Geotechnical Programme, Naimh Redmond, GSI liaison and Michael Guilfoyle, Assistant Secretary at the Ministry with responsibility for GSI.

Photo: Lars Persson

GSI was established in 1845 with the aim of determining the extent of the mineral resources and subsequently its databases were pivotal to the successful mineral exploration drive in the later decades of the 20th century. GSI is a line division of the Department of Communications, Marine and Natural Resources (DCMNR). The GSI Statement of Strategy (2003-2005) sets out the programmes and activities, which are intended to deliver these goals. The Statement of Strategy should be read in conjunction with the Business Plan, which sets out critical success factors, human resources issues and measures of effectiveness for the three-year period. The programmes are the following: Information management, Bedrock, Quaternary and Geotechnical, Minerals, Marine, Groundwater, Heritage and finally Support Services.

The strategic goals of GSI are as follows:

- To provide easily accessible and accurate geological information
- To support sustainable development, environmental protection and national development plans
- To map Ireland's earth resources
- To promote public understanding of the role of GSI and geology in Irish society
- To provide a stimulating, motivating and rewarding work environment for GSI staff.

Website: www.gsi.ie

Photo: Lars Persson

SGU´s questionnaire

General questions

- Mission of the Survey

The Geological Survey of Ireland, GSI, seeks to support the sustainable management of Ireland's natural resources through underpinning high-quality decision-making at EU, national and local levels with appropriate geological services, information and advice. In this role it responds to customer/stakeholder needs as an impartial multidisciplinary organization within the State sector founded on integrity and innovation.

- Vision

GSI will be a recognized national provider of quality geological services, information and advice to support policy and decision-making at EU, national and local levels, as well as to inform all relevant sectors.

- To which Ministry it is allocated

Department of Communications, Marine and Natural Resources

- Number of employees

46 "geology permanent (16 with 5 vacancies), cartography (9), technicians (5), general service 15 (variable contract staff ranging from 15 to 40 with an average of about 30).

    - Geoscientists, %

    61%, including temporary contract staff

    - Others, %

    39%

- Number of employees, development the latest 5 years

    - Geoscientists

    Has decreased over last 5 years – several vacancies have remained unfilled

    - Others

    Has remained about the same over several years

- Financing
    - Total budget, Euro, %

4,633,000 Euros (2004); 5,682,000 Euros (2003)

    - State budget, Euro, %

90% of total budget

    - Other sources, Euro, % (name the three most important)

Local (County) authorities in Ireland – for groundwater services and minerals planning

EU – various programme funds

    - Development latest 5 years, Euro, %
        - Total

GSI Administrative budget has increased over the last 5 years broadly in line with or a little above inflation

        - State budget
        - Other sources

INCOME AND EXPENDITURE ACCOUNT

INCOME	**2003 €000's**	**2002 €000's**	**2001 €000's**	**2000 €000's**	**1999 €000's**	**1998 €000's**
Administrative Budget	3250	3361	3193	3032	2894	2575
Partial Revenue from Sales	0	91	11	8	9	13
Carry-over from previous year	0	0	82	116	54	146
Information Technology	500	650	622	622	412	254
Subscriptions to International Organisations	161	100	88	51	48	13
Change Management Fund	0	0	0	6	6	6
National Seabed Survey Project	1771	4500	9465	5556	132	0
Receipts from external sources for Projects	575	650	635	317	254	190
Total Income	**6257**	**9352**	**14096**	**9708**	**3809**	**3197**
EXPENDITURE						
Administrative Budget	3352	3452	3374	3074	2841	2679
Information Technology	435	650	620	611	411	223
Subscriptions to International Organisations	161	100	89	1	21	13
Change Management Fund	0	0	0	4	6	6
National Seabed Survey Project	1970	4500	9465	5547	72	0
Expenditure of external funds on projects	575	650	635	317	254	191
Total expenditure	**6493**	**9352**	**14183**	**9554**	**3605**	**3112**
Surplus/(Deficit)	**(236)**	**0**	**(87)**	**154**	**204**	**85**

- Who initiates/determines the programme of the Survey?
    - The Ministry
    - External Board

    Consultative Committee, advisory committee set up by the Director
    - The Director
    - Others (please explain)

    The GSI management sets out its Programme proposals in its annual Business plan and this is by agreement with departmental management (in the form of the Assistant Secretary with responsibility for GSI – Michael Guilfoyle)
- Is your Survey considered as a center of excellence?

GSI Management certainly considers it to be so! And customer surveys and feedback and information from our Consultative Committee suggest that this is a view held by our stakeholders and customers

- % of the total yearly budget spent on research and development
    - Development the latest 5 years, Euro, %

    GSI tends not to identify most of its activities as R&D – we emphasize the applied nature of most of our work. If R&D means the traditional long-term data gathering survey type work, a rough estimate is about 10%.
    Under the National Seabed Programme, GSI is currently fostering about 19 research topics.
- % of the total yearly budget spent on marketing
    - Development the latest 5 years, Euro, %

    Very difficult to determine – approximately 0.4%
- Please describe briefly your fields of international co-operation

GSI is very actively involved with EuroGeoSurveys (many of the Policy Sector Groups) and with FOREGS (Forum of European Geological Surveys). A MoU between the Government of Ireland and the Government of Newfoundland and Labrador, GSI and the Geological Survey of Newfoundland and Labrador enables GSI to organize the North Atlantic Minerals Symposium every 2 years held alternately in Ireland (Dublin to date) and eastern Canada. There is cooperation in Groundwater issues with the Environment Agency of England and Wales, the Scottish Environment Agency and the Northern Ireland Environment and Heritage Service. There is ongoing close cooperation between GSI and the Geological Survey of Northern Ireland on practically all sectors of activity, particularly promotion of cross-border Geotourism initiatives. GSI is engaged with other partners in the European Geoparks Network and in projects funded under Interreg 3B and 3C in this sector. GSI is participating in the Integrated Ocean Drilling Programme. GSI acts as one of the national delegates to the EU – ESA GMES Advisory Council.

- Please describe your involvement in various EU-financed projects, their type, size, extent and partners for the last 3 years and future outlook

GSI currently are partners in the Breifne Project - a cross-border project involving the Geological Survey of Ireland, the University of Ulster and 5 local authorities (see www.breifne.ie). The project has a gross budget of about €2.5 million and is funded under the EU Peace and Reconciliation Programme 2.
GSI are currently partners in the Copper Coast Geopark Project funded under the Interreg 3B and 3C programme.
GSI is a partner in the FP5 project EUROSEISMIC.
GSI is involved in Europamines project funded under the CULTURE 2000 programme.
GSI is a partner in the ESA run Terrafirma project (GMES service element).

- How needs of societal geoinformation are taken into account
    - Through permanent advisory boards with user representatives

    GSI has a Consultative Committee made up of key representatives of stakeholder and customer organizations

- By regular meetings with user organisations and decision makers at various level

GSI staff has regular meetings with users, through personal meetings, seminars etc. However, not in a standard way

- Surveillance by the survey itself

Customer survey (customer satisfaction on 4 years basis)

- By complimentary directives from the Ministry

Yes, Seabed investigations for example

- Who makes the priority among the various societal demands and how?

This would be determined in the context of the draft Business Plans and agreed with HQ

- How the performance of the survey is evaluated/measured
  - Regular external evaluation

  A formal customer survey every four years
  - Showing performance indicators in the Annual Report

  No
  - Do you have quality management ISO 9001

  No
- What is your prime objective in communicating?
  - To receive more funding
  - To market the geoinformation you have in an understandable way

  Both to justify our funding and to make our products and services widely available
- Please describe your main customers or users of your information and services

Our main customer/user groups include- roughly in order of importance – our parent department, Local Authorities, other Government departments and State agencies, commercial companies in the environmental/resources sector, consultant geologists and engineers, fishing community, marine navigation authorities, the academic community, energy, etc.

- Please describe the main societal sector where your products and information is used today

The main areas would include – environmental/resource protection, infrastructural development, minerals [non-metallic and metallic] exploration and development etc.

- Do you have a policy for the pricing of your products?

Yes, we price products and services at a level which recoups some of the immediate production costs while not being so high as to significantly inhibit sales/take-up

Organizational structure

- What organization type has the Survey
  - Hierarchic
  - Matrix (programmes and projects)

  GSI has currently a structure which is a mixture of hierarchic and matrix
  - Please provide an organization chart

  The Senior Management meets regularly and works as a team. However, the Sections report, in a hierarchical sense, as follows: Bedrock, IT, IM and Heritage to John Morris
  Quaternary/geotechnical, Minerals and Groundwater to Pat O'Connor
  Marine Geology and Geophysics to Mick Geoghegan, Administration to John O'Donoghue, Cartography and CTS to Ralph Horne, who also has responsibility for Finance

ORGANISATION CHART

GSI is a division of the Department of Communications, Marine and Natural Resources

Senior Management				
Peadar McArdle	**Director**		**GSI ORGANISATION CHART**	
Ralph Horne	Assistant Director, Finance, Support Services			
John O'Donoghue	Assistant Principal Officer, Administration Service			
John Morris	Principal Geologist		Heads of Section **in bold**	
Pat O'Connor	Principal Geologist		Contract staff in *italic*	
Mick Geoghegan	Principal Geologist			
Clive Murray	Chief Technologist			
Niamh Connolly	Management TGA			
Bedrock	Quaternary/Geotechnical	Minerals	Groundwater	Marine and Geophys
Andy Sleeman	**Willie Warren**	**Gerry Stanley**	**Donal Daly**	**Deepak Inamdar**
Brian McConnell	Ronnie Creighton	Irene Hogan [pt]	Geoff Wright	Eibhlin Doyle
Sarah Gatley	John Butler	*Phelim Lally*	Kathryn Hill	Archie Donovan
Markus Pracht	*Rodger Connell*	*Vincent Gallagher*	*Monica Lee*	Irene Hogan [pt]
Rory Dunphy	*Xavier Pellicer*	*Jacqui Connolly*	*Silvia Caloca*	*Sean Cullen*
Barry Long	*Beatriz Mozo*	*Charise McKeon*	*Coran Kelly*	*Xavier Monteys*
[Scientific Visitor]	*Lorraine Gallagher*	*Brian Carroll*	*Una Leader*	*Enda Gallagher*
	Michael Sheehy		*Natalya Hunter-Williams*	*Oisin O'Briain*
			Grainne O'Shea	*Rosemary Jordan*
Central Administration	Irish Geol Heritage/Archives		*Caoimhe Hickey*	*Tracey Walsh*
Tony Glackin	*Matthew Parkes*	Information Technology	*David Broderick*	*Roger Sweetman*
Joe Carey	*Sophie Preteseille*	**Mary Carter**	*Denise Taylor*	*David Hardy*
David Ivers	*Petra Coffey*	Sean McKeon	*Silvia Caloca*	
Theresa Williams		James Trench	*Jenny Rush*	
Carol Lodola	Cartography	*Emma McSweeney*		
Caroline O'Shea	**P Connaughton**			
Bernie Mockler	John Dooley		Central Technical Services	
Wendy Bastick	Marie Marini		Tom McIntyre	
	Raymond Weafer	Information Management	Chris McDonnell	Services Officers
	Eddie McMonagle	**Koen Verbruggen**		Paddy Fitzsimons
Accounts	Eddie Hand	*Christine Colgan*		Joe Duffy
Margaret Nolan	Ann Scanlon	*Joanne Gavigan*	Drilling Unit	
	Gerry French		Kevin Crilly	
	Micheal Kinsella		Dick O'Brien	

- Do you consider your Survey as
    - A demand oriented organization

      Yes
    - A traditional geoinformation producer organisation

      GSI is now a demand-orientated organisation
- If you are demand oriented, what changes were necessary to adapt to this role

GSI reduced its focus on traditional national data gathering [map series] work and now acquires data mainly as a by-product of commissioned/sharedcost projects etc. New activities were also introduced, e.g. geotourism, education in schools

- How much of the project work is outsourced (in house/out-house activities, % of the total amount spent in the last 3 years)

In most commissioned/shared cost projects GSI contributes the permanent staff and overhead costs while the external monies support the contract staff and T&S. So little of this is outsourced. In the Seabed Project, however, the entire marine surveys [multibeam, geophysical and groundtruthing] have been outsourced.

Activities

- How much of the land area (%) and continental shelf area is covered by modern (not older than 30 years) geological maps in various disciplines

This varies a lot between different disciplines.
Onshore 100% Bedrock Coverage at 1:100K scale, c 40% Quaternary/Subsoil Geology coverage at 1:50K scale.
Offshore 450,000 sq.km done of 850,000 sq.km of Continental Shelf. > 200m water depth 100% complete. 30,000 sq km of the <200m has been completed leaving approx. 125,000 sq km to be done. Geological maps not yet available for full area.

- Resources provided in last 3 to 5 years to various core projects respective disciplinary projects

A number of core projects in Information Management area were progressed through Information Society funding from the Department of the Taoisaeach (Prime Minister's office) added to GSI Funds: These included
Central Database Project €900K (InfoSoc 80%)
Document Management System €540K (InfoSoc 70%)
Metadata Web Server €50K (InfoSoc 70%)
Funding of Core Projects in other areas:
Water Framework Directive
Groundwater Protection Schemes
Irish National Seabed Survey
Aggregate Potential Mapping (Local Authorities €200K)

- Is both primary and synthesized information in digital form and available in databases?

Generally yes, although levels of completeness of digital datasets varies (as above), e.g. 100% of our 1:100K Bedrock mapping and Irish National Seabed Survey data, 70% of our Geotechnical Reports are scanned to date

- Is geological data accessible for users/customers on line?

Not for all datasets, but through web mapping most groundwater and seabed survey high level data is available, also metadata for all datasets is available

- Is it possible for users to download information from your databases on line?

Generally no. However, maps can be queried on line and simple reports produced

- If so how is that financed and what are the terms of usage?

Development was largely funded by initiatives listed above and staff time. Provision of all metadata is free. An eCommerce website is being redeveloped (after former service provider withdrew from market), and formerly provided online ordering of maps and publications. An online map driven eCommerce system for data provision is being evaluated but is estimated to cost >€100K.

- What is your linkage with other players in the innovation system?

Via initiatives of our parent Department (DCMNR), joint InfoSoc Projects, National Groups such as IRLOGI (Irish GIS User Group), and attendance and networking at conferences and meetings of "best practice" such as the Geological Surveys IT Group IGSECS and membership of new IGC Information Management Group

- What is the general length of a project?
    - Core projects (need for society, e.g. geological mapping)
    - Co-operation and research projects (not 100% funded but partially subsidized. These projects also include bilateral projects
    - The activities are grouped in disciplines
        - Bedrock geology
        - Quaternary geology
        - Mineral prospecting – carried out by the private sector

        No mineral intelligence. Mineral potential mapping (MPM) under work. 300 licences concerning active prospecting (private sector), 63 km cores in GSI, 6500 entries for mineral localities
        - Hydrogeology

        6 river basin projects, groundwater and surface water
        - Geophysics
        - Geochemistry

        Geochemistry of soils, stream sediments for approx 15% of land area
        - Marine geology
        - Environmental geology
        - Medical geology
        - Engineering geology, geotechnics
        - Applied geology

Aggregate potential mapping, APM under work. Aggregate production 100 -120 Mt.

- Geological heritage and geotourism

Commercial activities

- Turnover, Euro

-

  - Development the latest 5 years

Increasing. Increasing importance in the future

- National (name the three most important sectors)
  - Development the latest 5 years
- International (name the three most important sectors)

Hydrogeology, marine geology, geotourism

  - Development the latest 5 years
- Is external income demanded?

No

If yes what limit is given?

No

- Is the pricing of services/products standardized?

Yes

- How high and what type are the overheads?

GSI tends to use a generalized figure of 47% as overhead charge on basic salary cost

- Are there any especially designed profit centers?

No

- What is done with the profit gained?

No profit is generated from activities.

Future outlooks

- Does your Survey have a strategic plan for the next 5-10 years?

Yes

- Tendencies for the future budgets (ratio of state's budget and external income)

It is likely that the proportion of income coming from external sources will increase in proportion to State funding – but only slowly

- How the various EU directives affect your present and future activities

EU directives, particularly those relating to groundwater, result in great pressure coming on GSI from Ministry of Environment, Environmental Protection Agency and Local Authorities etc. for information and advice

- Tendencies for commissions, volume and trends

Increase

- Investments in the future (please describe in which fields)

Outsourcing

- Do you think that geological mapping will still be an activity in the next decade and be your core activity?

Yes, but demand-oriented

Documentation-cost-effective-road-cuttings, infrastructural information from motor-roads, quarries, cores etc. Note that national Quaternary average stands at 40% only.

- How you listen to decision-makers to identify important future issues

Yes, very much. Through co-financing, committees

- How do you respond to the expectations of society?

We keep abreast of national and international developments and best practice among our peer surveys in Eurogeosurveys.

- How you influence public perception of your work?

GSI does a lot of outreach work – publication Annual Report, GSI News (a regular newsletter), popular booklets / brochures on a range of aspects of geology, lectures, exhibitions and fieldtrips. Many inquires are coming to GSI (more than 4000 during 2003) which are answered directly or by the various specialists. Most inquires are regarding 1. Groundwater 2. Bedrock maps and bedrock information and 3. Mineral exploration. Activities such as MPM, APM, abandoned mineral remediation, geological heritage, geoparks, coastal zone management, geohazards, database development, the Website, handling of information and education will be increased. Contacts with engineering geologists and geotechnicians are more and more abundant. Another examples is the Annual Seabed Seminar.

- What services are likely to be abandoned in the future?

Anyone for which demand is low or reducing. Routine regional mapping and all geological disciplines are necessary and complements each other relative the demands

- What services are going to be extended?

Services related to environmental planning and conservation in the land and marine areas are likely to increase

- Are any new services planned, if yes which?

GSI has proposed a major Resource and Environmental Survey of Ireland [RESI] designed to provide modern national coverage of high-resolution airborne geophysics and ground geochemistry – to provide the sort of national database for the land areas that we have for the marine area. Many of these issues are covered in the documents "Geosolutions"and "Cherishing our Earth". One particular project is update the geochemical and geophysical information, air-borne geophysical and geochemical info, and geotourism

Appendix

Outlook for 2015

The next ten years are set to see significant changes in Ireland: socio-economic and demographic trends, allied to increased urbanization, infrastructure development and use of renewable energy, will place new pressures on our environment and physical landscape. These changes will have a significant (if currently unpredictable) impact on the range of geological services we provide.

GSI will continue to maintain contact proactively with stakeholders and customers to ensure its services - and the priority of each - matches the national evolving needs. The success of our services will also depend on the level and nature of resources available to GSI. The following scenarios are based on current indications:

- Nation-wide groundwater protection schemes will be completed and available on our website to support effective planning and inform the public, working in collaboration with the Environmental Protection Agency, local authorities and Regional Fisheries Boards;
- Onshore geological mapping will be available on demand over the web, with higher-resolution maps available for bedrock and subsoils for 40% of the country, with a focus on key prioritized areas;
- With over 30% national coverage of aggregate potential maps at county level, there will be better-informed mineral planning decisions and improved support for infrastructure development;
- Offshore bathymetric and geological mapping will be available for the entire Irish seabed area, including all strategic inshore areas;
- Online information on urban areas and transport routes will include ground stability and depth-to-bedrock;
- GSI will have streamlined its co-operation with other divisions of the Department (e.g., Exploration and Mining Division, Inland Fisheries and Marine Leisure and Research Division, Petroleum Affairs Division), other agencies, local authorities, third level! Institutes, the private sector and, especially, with strategic partners such as the Marine Institute, the Environmental Protection Agency and Regional Fisheries Boards;
- GSI will do business remotely and effectively over the Internet with its customer base, thus

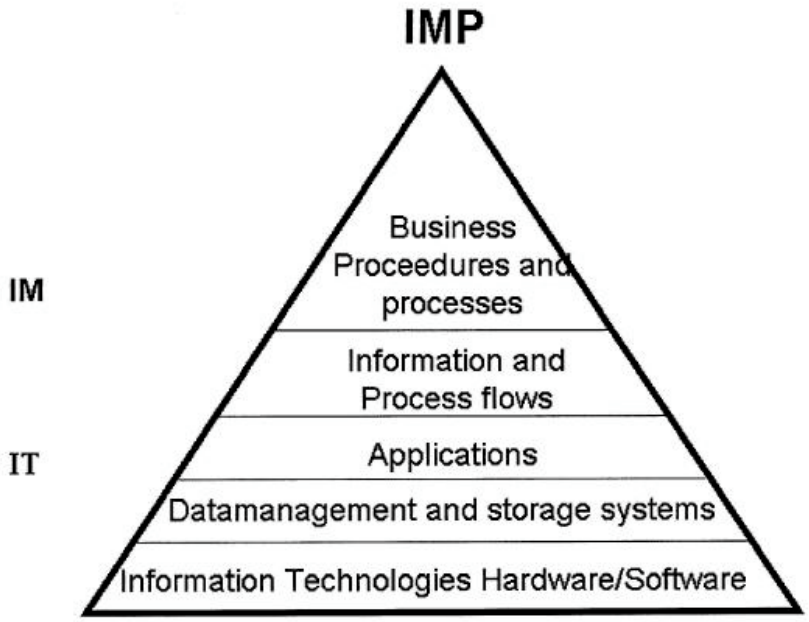
eliminating any perceived disadvantage with its proposed relocation;

- Appropriate legislation will be in place to ensure valuable data is deposited with and resides in GSI as a strategic resource;
- Comprehensive characterization of mine wastes at historic mine sites and the environmental risks they pose as a basis for remediation strategies;
- Staff will have the key skills and experience to ensure the sustainable delivery of customer services effectively into the future.

The GSI *Statement of Strategy (2003-2005)* sets out the programmes and activities, which are intended to deliver these goals. This Statement of Strategy, which should be read in conjunction with this Business Plan, sets out the critical success factors, human resources issues and measures of effectiveness for the three-year period. This Business Plan sets out the targets and quarterly milestones, which will be achieved during 2005 in each of the programmes and activities. These programmes and activities are closely aligned with the above corporate goals, as described briefly here.

Information Management Programme: This is the primary programme response to achieve the first goal, being responsible for managing and developing all data within an increasingly integrated and digital database system. However, it also contributes in a subsidiary way to the second and fourth goals.

IT / INFORMATION MANAGEMENT PROGRAMME



The Information Management Programme(IMP) contains two sections. The information management (IM) section deals with information flows business processes, the web and GIS The Information Technology Section(IT) is fundamental to the information infrastructure of the GSI. The *information technologies* (H/W and SW) that are standard across the GSI facilitate data sharing and the sharing of technical expertise, and provide internet connectivity, email, and office automation. The data collected is represented in standard formats developed in the GSI in our *data management and storage systems*. A summary data management plan is provided in the attached Gannt chart. *Applications* are developed to convert information and data into automated systems to provide direct support to business functions. These systems organise the capture and manipulation of Information. *The information and process flows* directly support the GSI business procedures and are supported by IM. It is our aim to provide systems and software which are required to exchange information efficiently and understandably across organisational boundaries. This includes hardware and software licences that are used across the GSI and Dept CMNR in support of our goals. The systems also aim to facilitate data sharing and sharing of technical expertise

Bedrock and Quaternary Programmes: These contribute most directly to the second and third goals, providing essential geological maps and data for a wide variety of customer needs. They work in an increasingly cross-functional manner in order to achieve the priority needs of stakeholders, often in a customised way. They also make maps and explanatory booklets available, which are widely marketed and so, assist with the fourth goal. They now contribute significantly to the second-level schools Geography curriculum.

BEDROCK GEOLOGY PROGRAMME

Summary of Main Projected Outputs for 2004

1:100,000 Bedrock Map Programme

- Publication of the last booklets in the 1:100,000 scale map series.
- Preparation of 2nd Edition of Sheet 6 Booklet.
- Complete editing the transfer of the 1:100,000 scale Programme maps to a seamless GIS registered to the 1:50,000 base in ArcView.

1:500,000 National Map Programme

- Finish the booklet for schools to accompany a simplified Bedrock map of Ireland, which is to be published as part of the 1:500,000 National Map

Programme (both map and booklet are to be published in time for the introduction of the new Geography Leaving Cert. Syllabus in September 2004).

- Compile 1:500,000 scale National Bedrock map (paper version) ready for publication.

1:50,000 GIS Bedrock Map Programme

- Set up prototype 1:50,000 Bedrock GIS *map* (Sheet 77 Wexford) for completion 2004
- Commence mapping 1:50,000 Sheet 28 (Monaghan)

Bedrock Databases (ERIW)

- Data entry to the Stratigraphic Lexicon database to support 1:50,000 Bedrock GIS.

Geotechnical and Minerals Programme: These programmes are aimed at primarily fulfilling the second goal, with its focus on providing information for infrastructural projects and land use planning, but they also comprise a key component in ensuring be third goal is accomplished.

MINERALS PROGRAMME

The goals of the work of the Minerals Section are to contribute to national infrastructure and sustainable development by assisting local authorities and the minerals extraction sector.
The work of the Minerals Programme is best described under the four headings:

1. Minerals Potential Mapping.
2. Information Services.
3. Research and Other Project Work.
4. Minerals promotion.

Programme Objectives

The Objective for each work area is:

- To assist in the land use and planning process by developing a robust and defensible assessment of the mineral potential of the country based on available relevant data sets and current views on the formation of mineral deposits. This may be carried out on a county, regional or geological unit basis.
- To provide minerals related information (in both a raw state and in an interpreted state) from the GSI´s extensive data holdings to assist the State in meeting its objectives under sustainable development, in an efficient manner.
- To gain a better understanding of Irish mineral deposits through a range of carefully selected projects, which will directly assist in achieving the other two objectives. This work may be funded directly by the GSI or through external agencies.
- To promote the minerals industry in Ireland through participation and organizing selected conferences and symposia.

GEOTECHNICAL PROGRAMME

Programme Objectives

- To create an extensive national archive of site investigation records derived from civil engineering projects. These detail the site investigations undertaken, such as boreholes and trial pits, as well as the resultant field and laboratory testing.
- To develop, for these records, a Geotechnical Database in Oracle with a GIS interface. This will allow speedy access to borehole logs and locations. The database will form a key component of an integrated GSI borehole/ depth to Bedrock facility.
- To provide, through this database, an efficient and effective service to a range of sectors concerned with environmental development and conservation. These would include civil engineering, landscape planning, groundwater development and protection, wildlife services and heritage agencies.
- To produce specific outputs from the database such as borehole location maps, depth to bedrock and rockhead OD contour maps, and cross sections. It is also intended to provide customised outputs for clients on borehole location and associated data.

- To liaise with the engineering sector on the development of the Geotechnical Database to ensure it has appropriate query and output capability.
- To promote the use of the Geotechnical Database in both terrain evaluation for site/route selection and as a precursor to site investigation design.
- To participate in the GSI initiatives concerning Geohazards.

Marine Programme: This programme, which manages the National Seabed Survey, is clearly geared towards the third goal, but it also supports the others. It has had a particular impact on the fourth as a result of the publicity it has generated.

SEABED MAPPING PROGRAMME

Marine Geology and Geophysical Section – National Seabed Survey Business Plan – 2004

The main goals for the section and the National Seabed Survey (NSS) in 2004 are as follows:

Data Acquisition

- Acquisition using RV Celtic Explorer. Q1 to Q3 in northwest.
- Acquisition using RV Celtic Explorer. Q3 in Irish Sea
- Acceptance and QA of data from RV Celtic Explorer Q2 to Q4
- Acquisition of high-resolution seismic data on Hydrate targets in conjunction with PAD and ISPSG. Q2 with preparation in Q1
- Acquisition in Zones 1 and 2. Cooperation with outside groups Q2/Q3
- GSI Acquisition with Celtic Voyager. Q4
- Tide Gauge programme Q1, Q2, Q3, Q4

Data Storage and Processing

- Supervision of Agreement with Petroleum Research Group re processing and integration of Hades Deep Seismic data, Q1 to Q4
- Analysis of Ground Truthing Data including samples. Q1
- Ensuring adequate IT facilities to store and process data. Q1 to Q4
- Training and Mentoring of GSI staff in facilities and software. Ql to Q4
- Production and interpretation of Sub Bottom Isopach Maps. Q1 to Q4.
- Production and Interpretation of Seabed Classification Maps. Q1 to Q4.
- Production of Fisheries products under BlM MOU. Ql to Q4.
- Data Transfer and supervision of progress under GSI/BIM/BE contract. Q1 to Q4.
- Production of and interpretation of Gravity and magnetic maps. Q1 to Q4.
- Supervision of activities under studentship schemes (3). Q1 to Q4
- Data sales and transfers. Q1 to Q4.

Other Activities

- Organizing National Seabed Forum as an EU Presidency event Ql
- Organizing National Seabed Seminar in conjunction with Hydro 04. Q1 to Q4
- Integrating NSS with other GSI activities. Q1 to Q4
- Staff Training - as required. QI to Q4.
- Euroseismic: Final year for compilation of metadata.
- EUMARSIN: Particle size analysis of historical samples.
- lODP; continued involvement with lODP

Constraints

- Continuing availability of adequate staff including contract staff.
- Implementation of GSI recruitment programme.
- IODP/GSI MoU sanetioned and resources made available.

Groundwater Programme: Its key activities contribute to the second and third goals, assisting with the sustainable management of water resources and providing important information on water resources through aquifer maps.

Heritage and Geotourism Programme: The activities of this programme are fully aligned with the fourth goal. Heritage and tourism products reach a wide public and support important national objectives at the same time.
All Programmes and Support Services: Contribute to the fifth goal. Consultation and partnership with staff is key to all that GSI achieves. Training and development of staff is central to this.

CENTRAL TECHNICAL SERVICES (CTS)

Central Technical Services is a reactive group, which will provide a wide range of technical services across the Geological Survey and also to other sections within the Department of Communications, Marine and Natural Resources. CTS as a support section of the Geological Survey will react to the projects and programmes of various mapping sections. This can only be achieved by the flexibility of highly qualified technical staff and the co-operation with heads of sections. The Technical Staff within CTS is committed to providing a quality service with the resources at their disposal. Planning is only possible on a tri-monthly basis.

Central Technical Services work programme will be carried out in the following areas in 2004:

1. GSI Drilling

- A Drilling programme will be produced to cover the mapping sections requirements in 2004.
- Auger 60 boreholes in Westmeath/Offaly for the Quaternary mapping programme.
- Auger 120 boreholes in Co, Louth for Quaternary mapping programme.
- Core 4-10 boreholes for Bedrock section mapping 50k sheetNo.28 in Co. Monaghan.
- Auger 15 holes, depth to bedrock in Fingal and Offaly for Groundwater.
- Shell & Auger two hole in Co. Donegal for Groundwater.
- Core one hole on Co. Offaly for Groundwater.
- Mobilisation and Demobilisation of Drilling Mg from the various drill sites.
- Maintenance of Drilling Rig.

2. GSI Transport

- Purchase new vehicles.
- Have all the vehicles serviced & road tax vehicles.
- Records of mileage and usage throughout the year.
- Supply truck and backup vehicles to drilling unit.
- Supply vehicles for field mapping staff, sample collection, and transportation of equipment.

3. Core Store Operations

- Collection core from the Mining industry in Athlone, Arcon and Anglo America.
- Collection of core from the GSI drilling programme.
- Rock and store core at Sandyford Core Library.
- Record details of core for entry into the borehole database,
- Arrange visits to the core library and assist clients.

4. Lecture Theatre Facilities

- Running and management of the theatre.
- Technical assistance at booked seminars, lectures, and training courses.
- Maintenance of audio visual aids.
- Technical assistance with exhibitions.

5. Laboratory Services

- Sample preparation.
- Production of micro thin section.
- Calibration of equipment.
- Purchase of consumables for laboratories and field operations.
- Maintenance of lab equipment.
- Maintenance of the Effluent Plant.

6. Technical Stores

- Operate protective clothing, laboratory consumables, field equipment and drilling stores.

- Purchase, issue and stock control of technical stores.
- Inventory of stocks held in field, clothing and drilling stores at the start of 2004.

Some key results of 2003

- The completion of the 100K scale Bedrock map Series. Available in full color and an explanatory booklet.
- Seamless GIS version of the above-mentioned 25 map-sheets
- Simplified 1:1 million bedrock map for schools completed
- GSI Customer Centre opened-500 000 documents and fully operational digital eStore
- EU Water Framework Directive (WFD). River Basin District projects
- Ireland's infrastructure requires the support of high-quality databases. Especially depth-to-bedrock information and Geotechnical Borehole database is of importance
- Aggregate Potential Maps are made to ensure the continued availability of high quality aggregates in areas of competing land uses
- Quaternary mapping with similar aims (aggregates) is performed
- The National Seabed Survey derived maximum national benefit
- Work on Hades deep seismic project n the Hatton Basin is intended to promote hydrocarbons exploration
- Seabed data acquisition has continued
- Irish Geological Heritage-16 themes convened and it was anticipated that the final candidate site lists would be completed 2004 to support site designations by the Dept of the Environment, Heritage and Local Government as well as local authority environment plans
- GSI was partner in EU Interreg 3B funding to promote European Geoparks, allocating 1,7 million Euros for the Copper Coast Geopark in County Waterford
- GSI reaches out to society through Heritage Week and Science Week events.

THE VALUE OF GEOLOGICAL SURVEYING

Geological Surveys contribute to national wealth creation and public good. A 2003 study by Roger Tym and Partners[1] addressed how the British Geological Survey (BGS) contributes to the wider UK economy and what the value of that contribution is. It used two different approaches, cost-benefit and value-added, and focused on commissioned research, which represents 50% of BGS turnover.

The cost-benefit approach concluded that the tangible and intangible benefits, including cost savings and additional revenues, of BGS outputs considerably exceed the prices that customers pay for them. Indeed 50% of the BGS turnover comprises Government core funding in recognition of the element of value for which customers do not pay. From the analysis it is concluded that total benefit considerably exceeds the BGS annual turnover of £40 million.

The value-added approach measures contribution to the economy by estimating the total output (or Gross Value Added, similar to Gross Domestic Product) to which BGS contributes. Thus the value-added measure of the BGS contribution is the total value of all the goods and services which used BGS products/services as an input. Unlike the cost-benefit approach, it does not quantify the size of these inputs nor does it include intangible benefits. The total value added of national output to which BGS contributed in 2001 lies in the range £34-61 billion (about 5-8% of total UK output) – and many orders of magnitude greater than the BGS turnover.

[1] Roger Tym and Partners. The Economic Benefit of the British Geological Survey – Executive Summary, November 2003

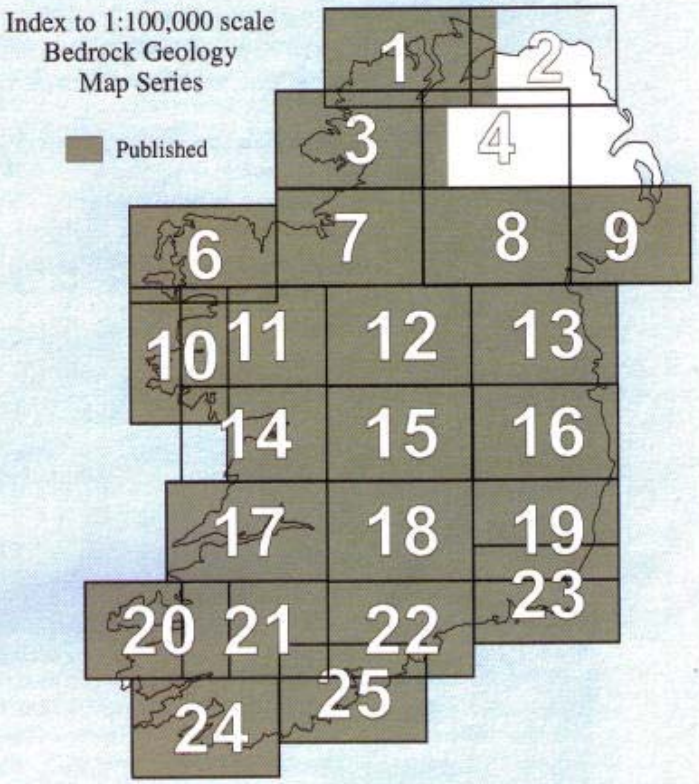
BEDROCK – FOUNDATION WORK

Bedrock geological maps are fundamental to much of the work that a geological survey undertakes. Yet in 1992 there was no twentieth century nation-wide coverage available for Ireland. Accordingly priority was given to completing national coverage in the most pragmatic and timely manner. The 1:100,000 scale map series was chosen, substantial work having already been completed on four out of the 25 sheets in that series. The maps would be compilations based on existing data, with limited field-checking, and would be published as black-and-white dyelines.

It quickly became clear that such dyelines would be difficult to interpret – and they would have a very limited shelf life. Accordingly it was decided not only to change to full colour production but also to implement a Digital Map Production System, and to publish an attractive explanatory booklet to accompany each map. This was based on a cost-benefit analysis which indicated that digital maps would be cheaper to produce provided at least 300 copies of each map were sold. The final maps in the series were published in 2003 (although a few booklets still remain to be printed) and the estimated final cost is €2.2 million.

The series has proved very successful with most maps selling well above the 300 copies target and there is every indication that the more recently published maps will follow suit. Recently digital copies of these maps have been sold in response to a demand which was not foreseen in 1992. In the near future a nation-wide digital version will be available as a seamless GIS (geographical information system), adding yet more value to the original product.

The Geological Survey of Spain recently completed a national map series at a cost of €120 million. This substantial mapping programme is widely regarded as beneficial to Spain, with the estimated benefit:cost ratio approaching 20:1. Completed over a thirty year period, this mapping was at the scale of 1;50,000 and involved detailed field work. GSI is about to embark on a similar mapping programme at the same scale. Comparing the areas of Spain and Ireland would suggest the GSI programme when completed would cost €16.6 million. This in turn points to the high value for money involved in our relatively cheap 1:100,000 map series.



	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	Totals
Sheet 6*	66	78	44	111	118	175	125	28	21	13	779
Sheet 23		106	46	44	95	50	65	42	36	26	510
Sheet 19		114	57	49	82	61	50	40	33	13	499
Sheet 16		120	87	95	97	85	84	107	81	34	790
Sheet 25		114	85	95	109	51	60	25	25	18	582
Sheet 10		102	224	192	157	125	130	40	40	35	1045
Sheet 18			92	73	95	50	66	45	32	21	474
Sheet 20			249	86	146	100	92	38	50	38	799
Sheet 22			156	46	103	57	81	38	28	19	528
Sheet 7				211	113	121	75	41	37	34	632
Sheet 8				112	88	48	48	40	46	23	405
Sheet 21				71	144	81	83	33	31	20	463
Sheet 1				2	241	106	110	71	54	23	607
Sheet 17						108	76	46	33	39	302
Sheet 13**						14	50	75	82	47	268
Sheet 3**						1	159	40	55	55	310
Sheet 12***							21	50	31	17	119
Sheet 24									64	28	92
Sheet 11***									11	18	29
Sheet 14***										25	25
Sheet 15***										12	12
Totals	66	634	1040	1187	1588	1233	1375	799	790	558	9270

* figures not available for 1993
**map only 1999
***map only up to 2003

Sales of individual 1:100,000 scale Bedrock map sheets in the period 1994-2003.

GSI DATABASE

The following is a list of GSI datasets for which there are metadata. Each dataset has a single page-table giving a concise description with all the per
information. The Datasets listed on the Document Management System (DMS) are available from the GSI Customer Centre. All others are availa
from the Section listed or through Information Management Programme (IMP).

GSI Digital Datasets, December 2003			
A. Maps			
Map	**Area**	**Format**	**Available from**
1:750,000 National	Pub'd 1964	Raster only	Document Management System
1:100,000	All Ireland, Bedrock geology 21 sheets with accompanying booklets	Vector, Raster and Seamless GIS	Document Management System, Bedorck Section
1:50,000 Regional	Quaternary Geology c. 50% of Country	Vector/GIS	Quaternary Section
Groundwater Protection Maps	60% of Country	In GIS format	Groundwater Section
Huntings Aeromagnetics	National	Geosoft Db	Marine Geophysics
Heliborne Birr/ Navan	Two survey areas	Geosoft Db	Marine Geophysics
B. Databases			
Database			
Minlocs Index	National (7,624 records)	Access Database & Raster	Document Management System, Minerals Section
OpenFile Catalogue	National (7,543 borehole records)	Access Database & Raster	Document Management System, Minerals Section
Stream Sediment Geochem.	Leinster, Inishowen & Longford-Down (1,844 records)	Excel Spreadsheets	Minerals Section
Lithogeochem. Hydrocarbon	Carboniferous area	Excel Spreadsheets	Document Management System, Minerals Section
Minerals References	National	Excel Spreadsheets	Minerals Section
National Geotechnical Database	Urban Areas, Reports, Site Plans & Investigations (46,033 records)	Paper, Raster & GIS	Document Management System, Geotechnical Section
Bedrock Boreholes	National (90,153 records)	Spreadsheet/GIS	Bedrock Section
Core Store Catalogue	National (7,540 records)	Spreadsheet/GIS	Bedrock Section
References Catalogue	National		Bedrock Section
Palaeontology Catalogue	National (24,167 records)		Bedrock Section
Groundwater Well Records	National (3,766 records)	Digital/Paper records	Document Management System, Groundwater Section
Karst Features	National (3,257 records)	Digital	Groundwater Section
Marine and Geophysics			
Physical Properties		Excel sheets	Marine Geophysics
Sediment Samples	213 records	Excel sheets	Marine Geophysics
National Seabed Survey Data	8,692 records		Document Management System, Marine Geophysics

Geological Survey of Finland, GTK

The Geological Survey of Finland, GTK, was visited December 8th and 9th for benchmarking. From Geological Survey of Sweden, SGU, Lars Persson, Naz Ahmed Shaikh and Jacob Johnson took part and from GTK among others: Director General Elias Ekdahl, Directors Runar Blomqvist, Jarmo Kohonen, Keijo Nenonen, Pekka Nurmi, Reijo Salminen, Karita Åker, Senior Scientist Ilmo Kukkonen, Branch Manager Lars-Martin Westerberg, Assistant Director Pentti Noras, Manager Olli Breilin and Director of administrative unit Pekka Suomela.

Foto: Lars Persson

Systematic geological surveys were first carried out in Finland by the Geological Bureau of the Administration for Mines during the years 1865 to 1885. In 1885 the Geological Bureau became an independent government agency under the jurisdiction of the Administration for Industry. The new agency took over the responsibilities of the former Geological Bureau, and has become the present Geologian tutkimuskeskus ("Research Centre of Geology"). By convention "Geological Survey of Finland" is the unofficial name.

The tasks specified for the agency in 1885 were to carry out economic geological research with focus on the mining industry and other branches of the economy of the country according to the standards of science and good practice, and to provide information through maps and information on the general geology of the country. Some effort had also been put into exploration and other practical applications of geology. For example, the Outokumpu copper deposit was discovered in 1910 and the Petsamo nickel deposit in 1921. Industrial minerals and dimension stone resources were also investigated, as well as the physical and chemical properties of soils and ground water were studied for their industrial or agrological potential. A general geological mapping was completed during the 1930's whereby more effort could be put into prospecting and exploration. The number of personnel was increased to about 30. Some targets were identified, e.g. the Otanmäki iron-titanium-vanadium deposit in 1938, but the promising start was cut short by the outbreak of the war in 1939. Activities got off to a fresh start in 1945 and departments for bedrock, Quaternary deposits, exploration and chemistry were established.

In 1956 the Survey moved from Helsinki to a new building in Otaniemi, Espoo. The new premises provided the opportunity to equip, modernise and enlarge a number of new laboratories. Research was intensified, and in 1960 the number of personnel was nearly 200. Regional offices were established at Kuopio and Rovaniemi, partly in connection with a national decentralisation programme. In 1979 the Survey was organised into two divisions headed by research directors: one for the Petrology and the Quaternary departments, and one for the Exploration, the Geophysics and the Geochemistry departments. The 1980's started with intensified efforts to search for and assess the country's natural resources. In 1982 125 persons, who had been employed through special employment funds, were transferred to the Survey's budget, mostly in the regional offices. In 1983 the Finnish name of the Survey was changed from Geologinen tutkimuslaitos (=Geological Research Institute) to Geologian tutkimuskeskus (=Research Centre of Geology).

A new organisation was introduced in 1990. The activities were separated into two main divisions headed by research directors: one for scientific research and co-operation and mapping strategies, and one for the management of regional activities and customer relations. Within the new organisation, the regional offices are responsible for operational activities, such as mapping and exploration, while the research departments are responsible for scientific research and co-ordination.

Foto: Lars Persson

Website: www.gtk.fi

SGU´s questionnaire

General questions

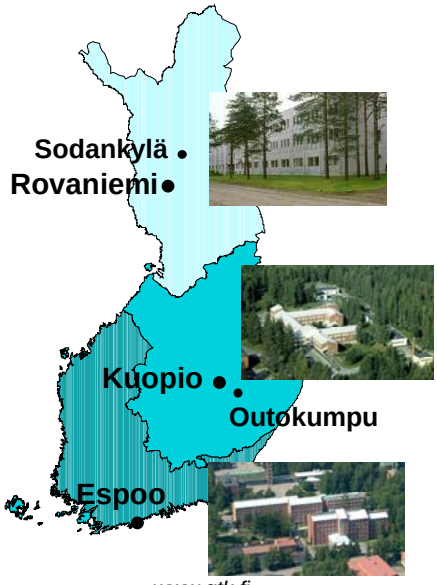
- Mission of the Survey
  GTK maps and investigates the Earth's crust and its natural resources, is responsible for national geoscience information services and expertise, provides quality services to clients and participates actively in international projects
- Vision
  Geology as a basis for sustainable growth and welfare
- Values
  Research - Reliability - Responsibility - Cooperation
- To which Ministry it is allocated
  Trade and Industry

GTK´s operational areas and staff

- Established in 1886
- Authorized by the Ministry of Trade and Industry
- Annual expenditure € 49 million, income € 10 million

Staff

Espoo	423
Kuopio	205
Rovaniemi	162
Outokumpu	39
Sodankylä	18
Total	**847**



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13.9.2004 / Strategy team
2

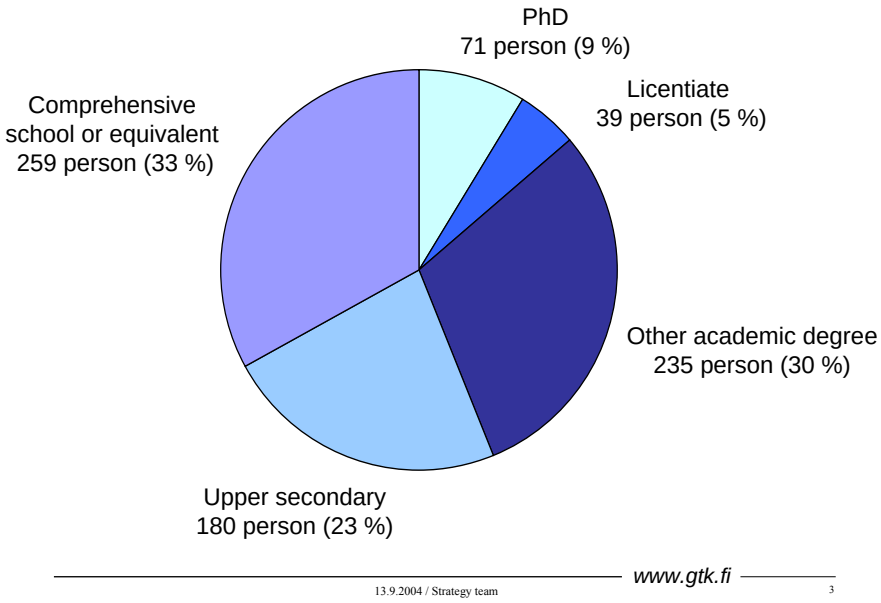
Number of employees
The proportion on geoscientists in 2003 (%): Geoscientists 40.5%; others 59.5%

- Number of employees, development the latest 5 years
- Geoscientists, others

Number of employees, development in the latest 5 years

	Geoscient.	Others	Total
2003	317	467	784
2002	308	498	806
2001	319	494	813
2000	303	495	798
1999	306	499	805

Staff by education in 2003

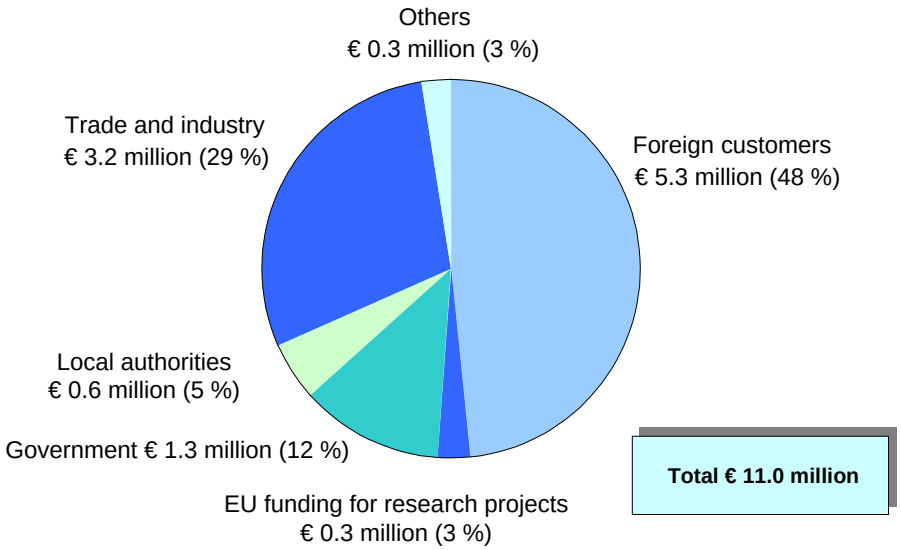


- Financing
  - Total budget, Euro, %
  - State budget, Euro, %
  - Other sources, Euro, % (name the three most important)
  - Development latest 5 years, Euro, %
- Total
- State budget
- Other sources

Financing (1000€)

	2003	2002	2001	2000	1999
Total budget (Euro)	50 969	47 178	47 660	43 578	43 696
State budget					
(Euro)	40 020	39 162	39 815	36 554	36 652
(%)	78.5 %	83.0 %	83.5 %	83.9 %	83.9 %
Other sources					
(Euro)	10 949	8 016	7 845	7 024	7 044
(%)	21.5 %	17.0 %	16.5 %	16.1 %	16.1 %

Income by customer group in 2003



Who initiates/determines the program of the Survey?

- The Ministry
- External Board
- The DG

Director general determines the GTK´s programs

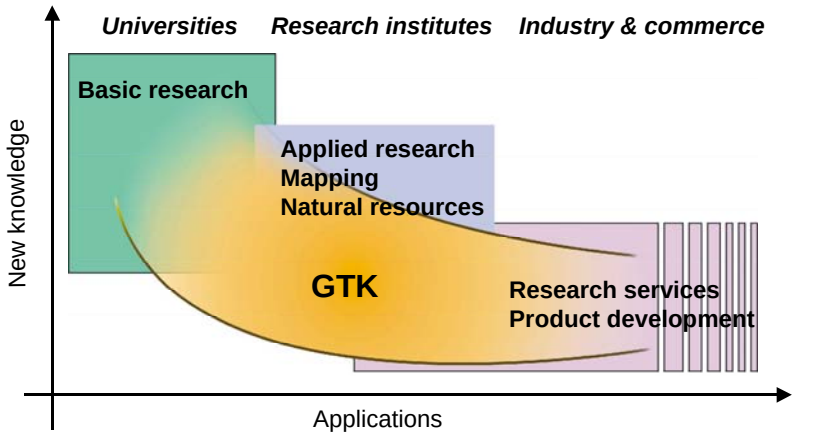
- Others (please explain):

The strategic board of directors and the aerial units initiates the programs

- Is your Survey considered as a center of excellence?

Yes in Finland

GTK's role in the national R&D field



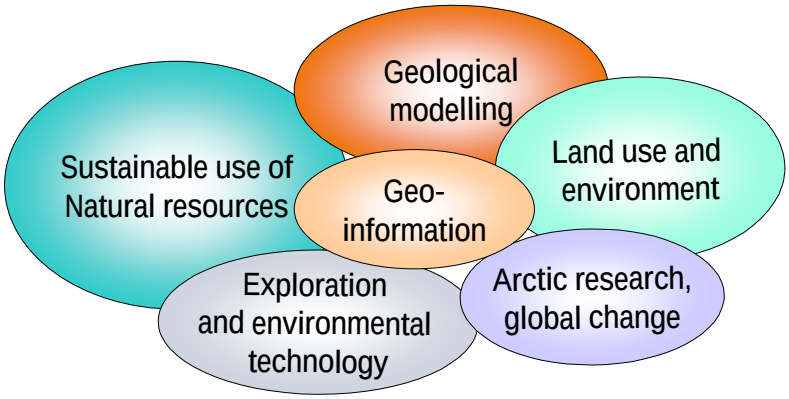
- % of the total yearly budget spent on research and development
  - Development the latest 5 years, Euro, %

16–20%

Research & development

Reliable information is the basis for sustainable development of society. New applications, innovations and solutions for industry and commerce.

Research programmes



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13.9.2004 / Strategy team 24

- % of the total yearly budget spent on marketing
  - Development the latest 5 years, Euro

  Around 2 %
- Please describe briefly your fields of international co-operation

Geological mapping, environmental geology, capacity building, airborne geophysics

- Describe your involvement in various EU-financed projects, their type, size, extent and partners for the last 3 years and Please future outlook.

Project Acronym	Project's goal and purpose	GTK's motive
Ongoing		
RAMAS: Risk assessment and risk management procedure for arsenic in the Tampere region	Ramas aims to increase the awareness of the arsenic problem and support the decission-making of the local authorities in the Tampere region (land use, health, environment, etc.) '- by providing a comprehensive and extensive review of the occurance of arsenic in the Tampere region '- by evaluating the potential health and/or environmental risks '- by presenting recommendations how to prevent the realisation of these risks or how to fix already exsisting problems	As in groundwater is a big domestic problem. To enhance domestic co-operation between authorities and research organisations
BIOSHALE Search for sustainable way of exploiting blackshale ores using biotechnologies	• Evaluation of biotechnologies for the safe, clean and viable benefication of blackshale ores • Designing of an innovative model for the development of the mining activities • Evaluation of the environmental impacts at all steps	To improve leaching technology using biometho in ore processing

ARMONIA: Applied Multi Risk Mapping of Natural Hazards for Impact Assessment	Provide the EU with a set of harmonised methodologies for producing integrated risk maps to achieve more effective spatial planning procedures in areas prone to natural disasters in Europe.	Development of a glossary on natural hazards, presentation and communication for producing multi-risk maps.
NARVA GMP: Narva Groundwater Management Plan.	Building environmental capacity of the Russian administration, reinforcing information analyse capacities, creating a pool of well-trained Russian specialists able to reapply project approach.	Risks assessment has been considered in sever research and commercial projects undertakings GTK.
DEMO-MNA: Demonstration of the use of Monitored Natural Attenuation (MNA) as a Remediation Technology.(3607002)	The project will demonstrate a Monitored Natural Attenuation (MNA) remediation concept, which includes site characterization, monitoring, risk assessment and evaluation of the disappearance of contaminants.	Monitoring of ground waters, construction 3D models of a terrestrial surface, environment geophysics and research of the polluted sites wi use of methods of modeling
NuPulse: A non-destructive Pulse Neutron Multiple Detector Tool for use in environmental, hydrocarbon and mineral exploration work	To develop a non-destructive quantitative analytical device based on neutron technology for use in environmental monitoring and assessment, as well as in hydrocarbon, mineral and metal exploration and processing.	To develop a modern analytical device that can economically exploited. To further develop the know-how aquired in developing the 3D down-h EM (SlimBORIS) equipment. Coordinator GTK's tasks: Project coordination, participation in device development, assembly o prototypes, field testing of prototypesGTK's task
EUROSEISMIC: European Marine Seismic Metadata and Information Centre	Seismic & acoustic metadata collection	Data inventory, networking
WATERTOOL: An innovative tool for multi-element analysis of ground and surface water(3602001)	To design and construct 3 prototypes of a groundwater analysis and monitoring device capable of analysing 15 parameters simultaneously in the water for environmental purposes, to integrate the data generated by the device into larger water quality and environmental assessment studies carried out by the project end-users	Design and laboratory testing, database and GIS laboratory validation and testing, choice of configuration, field trials and surveys, detailed evaluation of the test sites-propose remediation measures, optimization-evaluation of the monitoring network
SEAREG: Sea Level Affecting the Spatial Development in the Baltic Region	To develop a tool in cooperation with spatial planners how to forecast sea level changes and their impact on the socio econmic and environmental development of the Baltic Sea Region.	To widen GTK's field of operation towards mode societal demands such as regional planning on a European level
GEONAT	Enables new geological surveys in the marine and land areas, which produce more detailed and more reliable information from the project area.	The GTK purpose is mapping an environment of the cities of Merenkurku and Vaasa. Compiled maps, scale 1:250 000 or 1:100 000.
NaNet: Network to review natural analogue studies and their application to repository safety assessment and public communication	Network to review natural analogues studies and their application to repository safety assessment and public communication Application of natural analogues	Safety assessment
ESPON Hazards: ESPON Programme, Action 1.3.1 The spatial effects and management of natural and technological hazards in general and in relation to climate change	To collect and develop indicators on natural and environmental hazards on European level for spatial planning purposes. To focus comparability among European Regions and to develop databases and maps	To participate in environmental aspects of spatia planning on a European level

ENVRISK: Strategy development for long term pollution control in regions of extreme environmental risk	To evaluate the scale of environmental damage, including health data, to Implement neutron logging based monitoring stations, to develop GIS-based vulnerability maps for the regions of extreme pollution,to increase public awareness in matters of pollution prevention and control.	Pollution control in four areas where extreme pollution has been proven, using a neutron loggi and monitoring tool, as well as other analytical data, modelled on a GIS platform.
ETC/TE: European Topic Centre on Terrestrial Environment	The European Topic Centre on Terrestrial Environment (ETC-TE) is one of five Topic Centres designated by the European Environment Agency (EEA) for the period 2001 - 2006 to assist in its work of collecting, analysing, evaluating and summarising information relevant to national and international policies for the environment and sustainable development.	Data collection, evaluation, integration, assessment. Indicator development and indicato fact sheet updates. Expertise in EU Technical working groups related to the development of EU Soil Strategy. Taking part preparation of the EEA reports on soil and coastal issues.
Mineo: Assessing and monitoring the environmental impact of mining activities in Europe using advanced Earth Observation Techniques	Improving of the Hyperspectra technique to practical monitoring of environmental aspects of mining industry	
Training virtual system of Geo-information Centre	East - Finnish innovation the program	Juuan stone museum (applicant)
OSNET Thematic Network on Ornamental Stones	The new types of natural stones quality and methods of extraction estimation, development of cooperation between the enterprises	Kuhmo city (applicant)

- How needs of societal geoinformation are taken into account

Very important in the strategy!

- Through permanent advisory boards with user representatives

In connection with peat surveys

- By regular meetings with user organisations and decision makers at various level

Partly

- Surveillance by the survey itself

Partly

- By complimentary directives from the Ministry

Partly

- Who makes the priority among the various societal demands and how?

GTK itself but listening the ministry

- How the performance of the survey is evaluated/measured

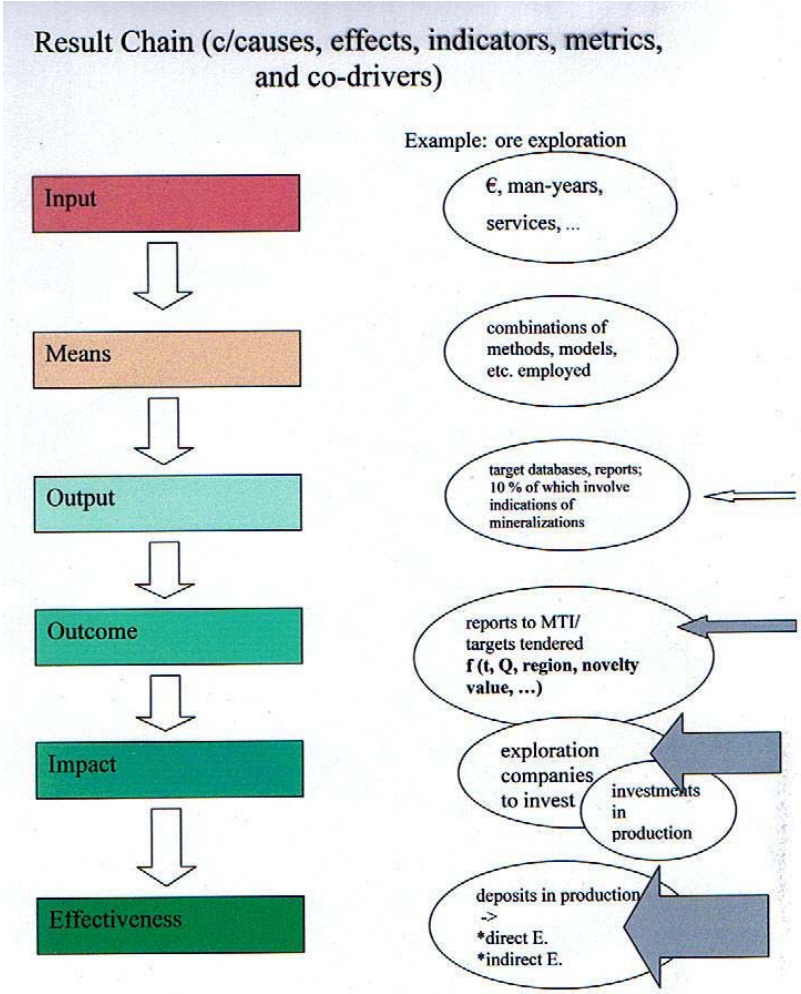
Annual agreements of the key results of GTK by the ministry. Negotiations are held twice during the budget year.

- Regular external evaluation

Yes. The most recent geoscientific evaluation was held in 2003

- Showing performance indicators in the Annual Report

Yes - several performance indicators (the annual report of activities). In the near future, GTK gets a set of new performance indicators, especially designed to measure the societal impact and metal capital



- Do you have quality management ISO 9001

Yes, process in progress

- What is your prime objective in communicating?
- To receive more funding

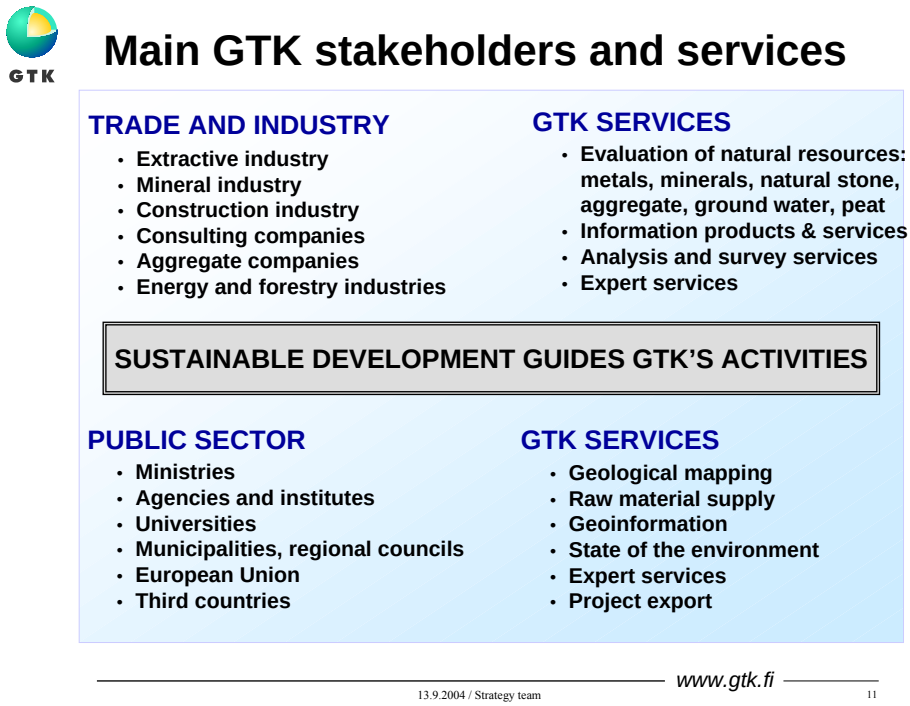
Not primarily, it is rather to create societal impact

- To market the geoinformation you have in an understandable way

Yes and mostly free access through the web

- Please describe your main customers or users of your information and services

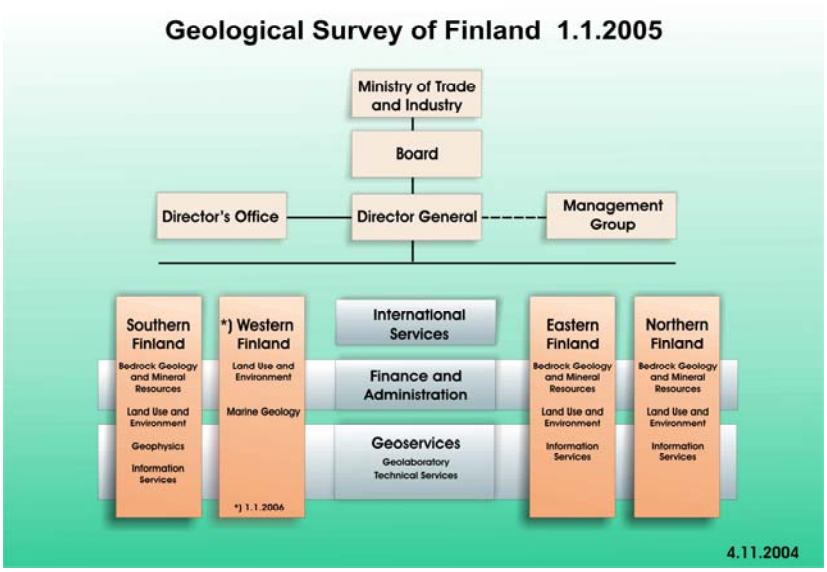
Society, mineral industry, energy- and other industry sectors, education, EU, private citizens, governmental authorities and other research organizations.



- Please describe the main societal sector where your products and information is used today:
  Land use and planning, mining of minerals, water supply, construction and building, environmental management, nature conservation and education
- Do you have a policy for the pricing of your products?
  Yes, mostly for free by open domains on the web while primary data is delivered by copy costs

Organisational structure

- What organisation type has the Survey?
  - Hierarchic
  - Matrix (programs and projects), mainly
- Please provide an organisation chart



- Do you consider your Survey as
  - A demand oriented organization

    Yes
  - A traditional geoinformation producer organization

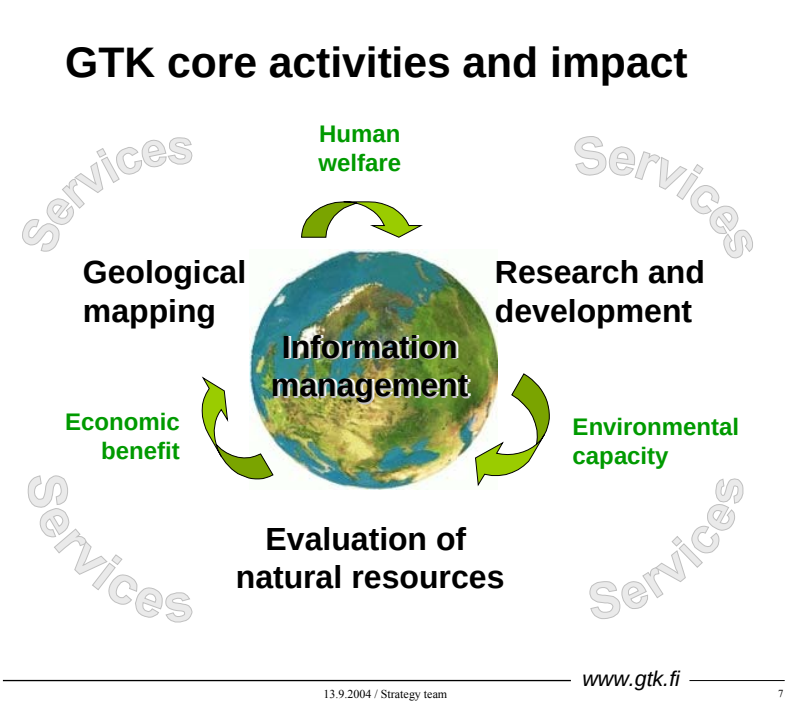
    Yes
- If you are demand oriented, what changes were necessary to adapt to this role

We had to focus on problem solving oriented strategic research rather than curiosity and academic merit driven fundamental basic research

- How much of the project work is outsourced ((in house/out-house activities, % of the total amount spent in the last 3 years)

Only 50% of the drilling program and some geophysical field services and leasing of vehicles is outsourced

Activities



- How much of the land area (%) and continental shelf area is covered by modern (not older than 30 years) geological maps in various disciplines

Bedrock 1:100 000 about 65 %, Quaternary geology 1: 20 000 c. 40 %, Geophysical maps low altitude c. 90 %, marine geology c. 35 %

- Resources provided in the last 3 to 5 years to various core projects respective disciplinary projects:

Administration and laboratory, plus field services makes up for c. 33 % of the total working time of GTK, mapping and natural resources c. 34 %, R&D between 16 –25 % and data management c. 15%

- Is both primary and synthesized information in digital form and available in databases?

Yes, at the present nearly 90 %

- Is geological data accessible for users/customers on line?

Yes, most of the data through the WWW

- Is it possible for users to download information from your databases on line?

Yes most of the recent publications and maps

- If so, how is that financed and what are the terms of usage?

Open domain free of charge

- What is your linkage with other players in the innovation system?

Network to the main delivers of digital data

- What is the general length of a project?
  - Core projects (need for society, e.g. geological mapping)

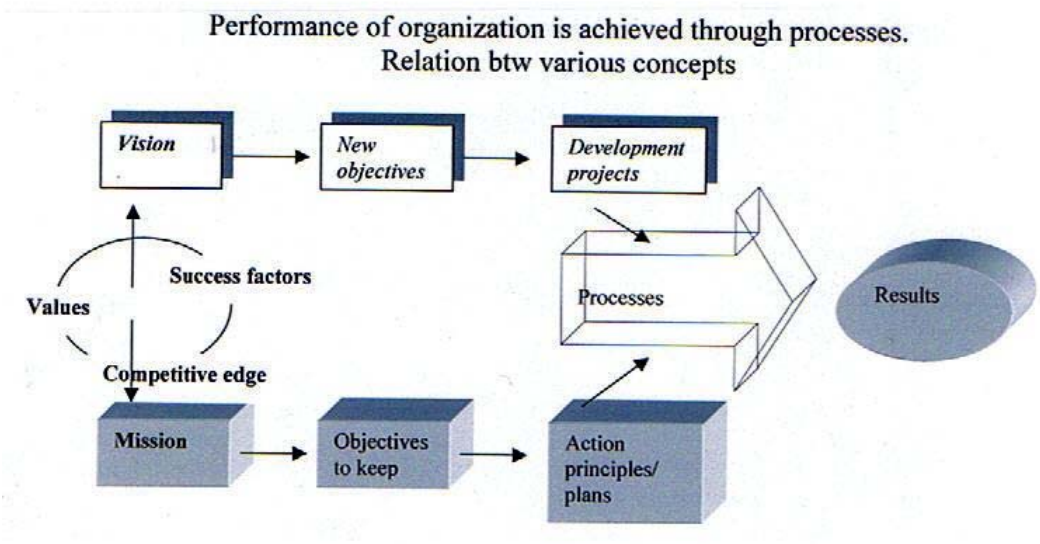
  More than ten years
  - Co-operation and research projects (not 100% funded but partially subsidized. These projects also include bilateral projects

  Usually no longer than three years

- The activities are grouped in disciplines

We have collected the geological knowledge to broader multidisciplinary programs to avoid the separatism with geodisciplines and too small research units. For the customer and taxpayer geology is one discipline and they do not record a greater difference between various fields within geosciences but can easily specify the various products

- Geological mapping
- Natural recourses
- Research and development
- Information management



Commercial activities

- Turnover, Euro
  - Development the latest 5 years

  See chart below
- National (name the three most important sectors)
  - Development the latest 5 years

  National sector c. 60 – 70 % of the income
- International (name the three most important sectors)
  - Development the latest 5 years

  Project sales abroad and international customers c. 30-40 % of the income
- Is external income demanded? If yes what limit is given?

Yes, approximately 20-25 %

- Is the pricing of services/products standardized?

Yes e.g. laboratory services, manpower, data products

- How high and of what type are the overheads?

See below

- Are there any especially designed profit centers?

No

- What is done with the profit gained?

The profit gained is used to finance GTK's basic functions and the development of activities

Commercial activities						
	2003	2002	2001	2000	1999	
Turnover *(1 000 Euro)*	10 949	8 016	7 845	7 024	7 044	
% of total	21.5	17.0	16.5	16.1	16.1	

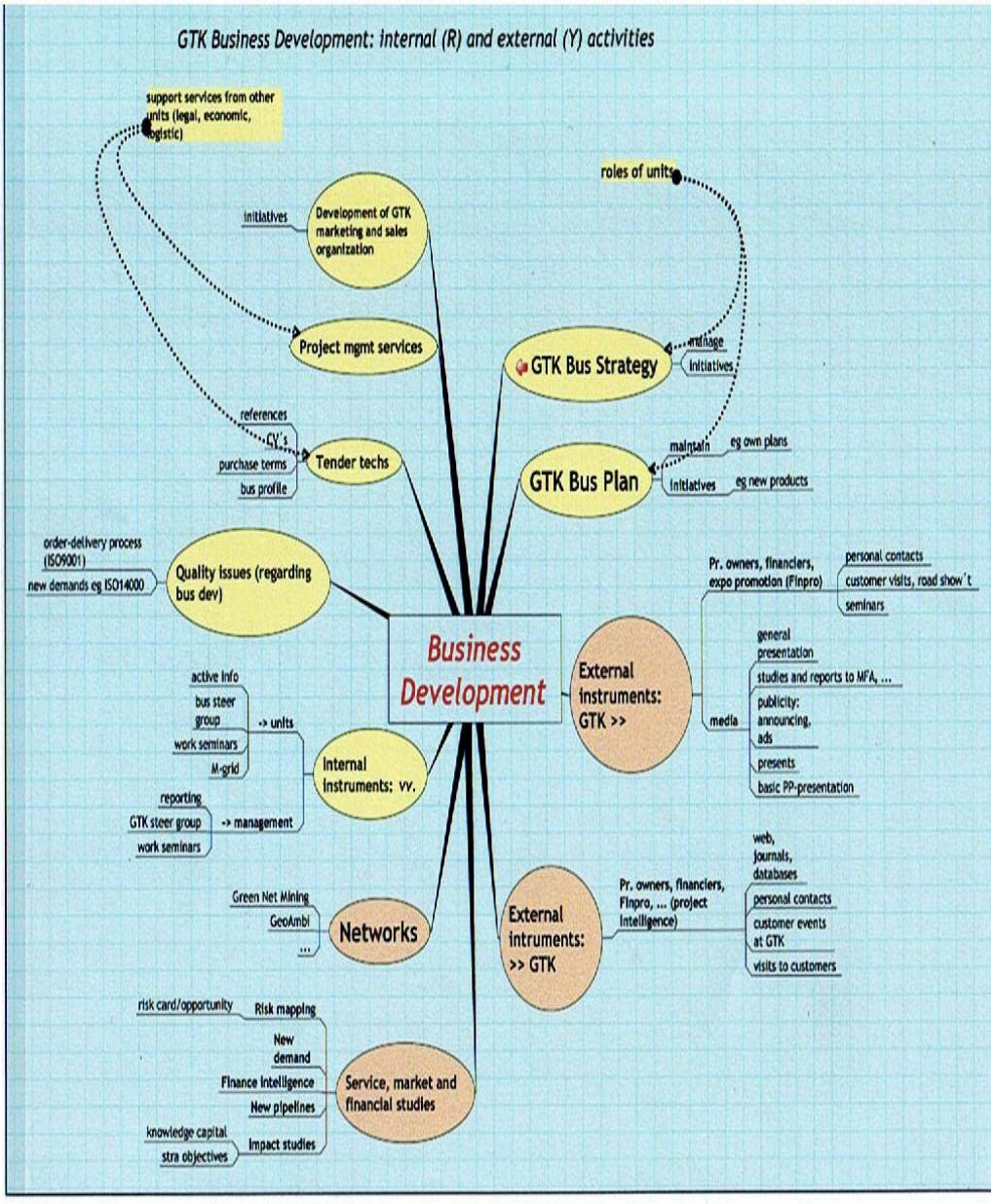
We use approximately coefficient 3.0 in pricing the manpower wages

- Especially designed profit centres?

There are no special profit centres

- Profit?

The profit gained is used to finance GTK´s basic functions and the development of activities



Future outlooks

- Does your Survey have a strategic plan for the next 5-10 years?

Yes (see the power point version of our strategy presented below)

- Tendencies for the future budgets (ratio of state's budget and external income)

Stable at around 50 million €

- How the various EU directives affect your present and future activities

In many ways. For example the water directive, INSPIRE directive, Mining waste directive, NATURA 2000 etc.

- Tendencies for commissions, volume and trends commissions

Will be around 25 % of our budget

- Investments in the future (please describe in which fields)

Strategic investments in order of 1 – 3 million € annually; mostly to geolaboratory and geophysical equipment

- Do you think that geological mapping will still be an activity in the next decade and be your core activity?

Yes, but mapping procedures are rather changed towards spatial data collecting. Databases are more or less updated on line simultaneously with the fieldwork by wireless communication to the central computer and database

- How you listen to decision-makers to identify important future issues

We are trying to get more involved in the county decision making system as well as close relations to the ministries

- How do you respond to the expectations of society?

By reinforcing aerial attendance and impact, but also by networking with other governmental research organisations, universities, education units and authorities. Most important is excellent research and objective survey attitude giving independent and impartial results to decision makers

- How you influence public perception of your work?

GTK is a public organisation and our work should be as transparent as possible. We serve private taxpayers as well as global companies or authorities

- What services are likely to be abandoned in the future?

Routine drillings and geophysical measurements partly, maybe some routine office work and data work. In field services though some own production is necessary to ensure critical functions of the survey

- What services are going to be extended?

Core functions, especially 3-4 dimensional geology and geophysics plus modeling

- Are any new services planned, if yes which?

Mineral processing services for mining and extracting industry at the new GTK MINTEK laboratory at Outokumpu including environmental cleaning techniques for polluted soils and mining wastes

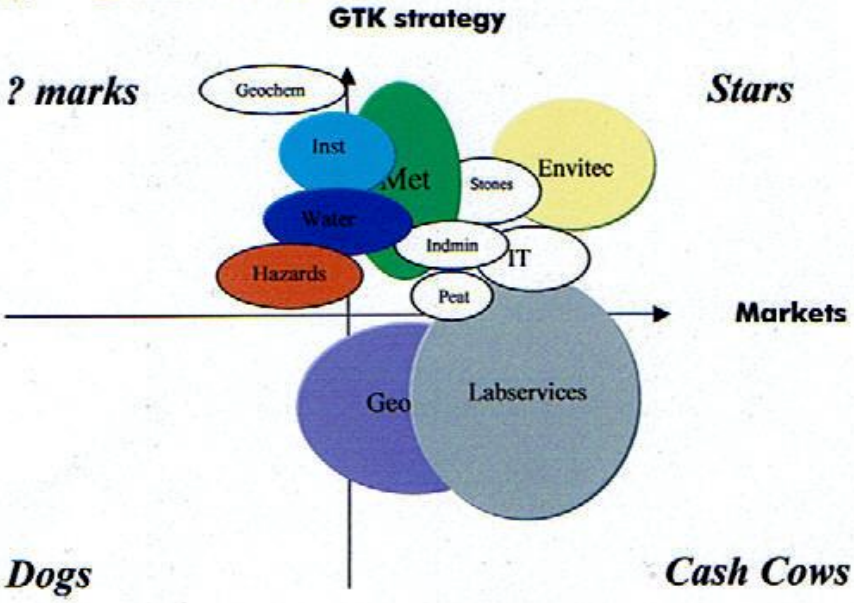
GTK

Indicators of GTK

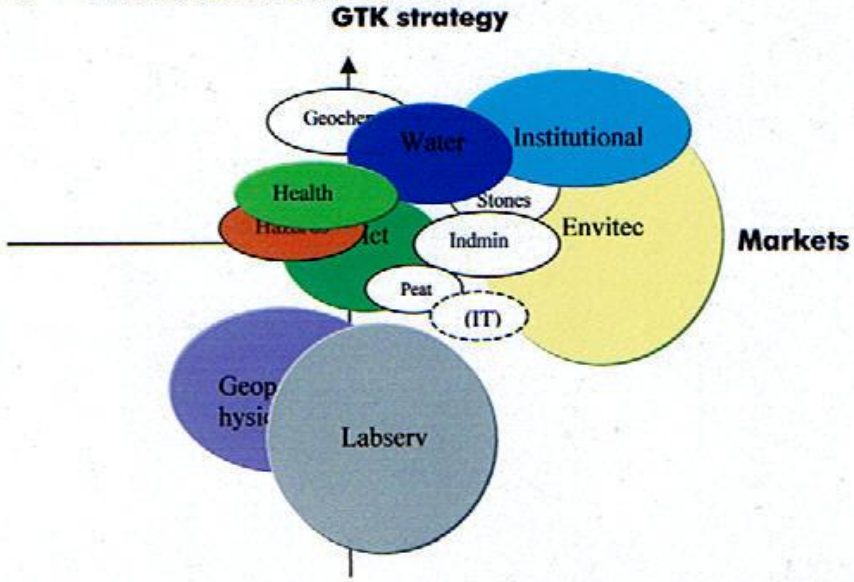
- Number of deposits of natural resources reported by GTK
- Amount of new peat resources suitable for industrial use
- Extend and structure of comissioned work
- Use of GTK's Internet services
- Number of joint projects
- Participation in international and domestic networks
- Amount and quality of publications
- Use of GTK's knowhow in decission making

GTK´s product group analysis by means of the Boston Consulting Group (BCG) classification

A: CURRENT STATUS



B: PROGNOSTIC STATUS 2006



MUTUAL POSITIONS AND SALES VOLUMES OF GTK PRODUCTS IN RELATION TO THEIR STRATEGIC SIGNIFICANCE AND MARKET DEMAND IN 2001 AND 2006. A FICTIVE PRESENTATION FOR DISCUSSION.

Newly designed in April 2002 from the presentation in GTK´s Business Plan, Part 1, July 1999, by P. Noras, S. Lamminen and P. Schmidt-Thomé of GTK´s M-Group.

Appendix:

A. Strategies

Changes in the operating environment

Strategy 2009

The social and regional impact of GTK activities will be increased. The objective is to secure preconditions for trade and industry and to promote international competitiveness of regions.

- GTK will evolve into a European centre of excellence for delineating earth resources and promoting their sustainable use.
- GTK is the national centre of excellence for geoscience data management and analysis, ensuring effective public access and utilization of geological information
- GTK' s regional activities will be profiled to coordinate with regional development plans, strengths and challenges.
- The implementation of strategic targets will be supported by developing new forms and networks for jointly financed activities.
- The optimal target level of contract services will be attained, and activities will be focussed towards those services that best promote GTK's impact.

Strategy 2009 (cont.)

The objective is to be productive, quality-conscious and service oriented at all levels of operations.

- GTK's strategic direction and planning processes will be strengthened.
- GTK's competitiveness will be improved through high-level know-how, active networking and international operations.
- The effectiveness of services will be improved through enhanced management and quality assurance procedures.
- GTK's internal service processes will be developed on a client/producer basis, the object being competitive services.
- The proportion of externally sourced services will be increased.

Strategy 2009 (cont.)

The objective is a good working environment with innovative and motivated staff and a strong sense of community.

- A strategy for the management and development of human resources will be implemented and staff well-being will be promoted through active personnel policy
- Interactive operations and flow of information will be improved at all levels.
- Maintenance, enhancement and updating of organizational know-how will be ensured by supporting professional development, opportunities for exchanging duties, and voluntary education.
- Recruiting is targeted at enhancing essential areas of activity and in promoting effective international liaison.
- GTK secures opportunities for young researchers for challenging careers in an international research environment.

B. Mapping strategies

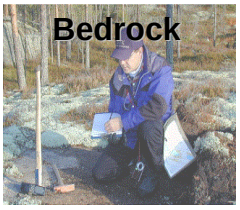
Strategic objectives 2009

- Mapping programmes based on map sheet divisions will be replaced by customer driven data collecting and product development.
- Mapping data will be unified and updated in accordance with the new Euref-FIN- coordinate system to form general scale seamless map data bases covering the whole country.
- Resources for mapping will be strengthened and focus will be transferred to the mapping of centres of population growth and of potential areas for natural resources.
- Urban geological mapping will be carried out in cooperation with relevant municipalities.
- The airborne survey programme will be completed.

Geological mapping

Basic information for the needs of the extractive industry, land use planning, construction and environmental protection.

Mapping programmes

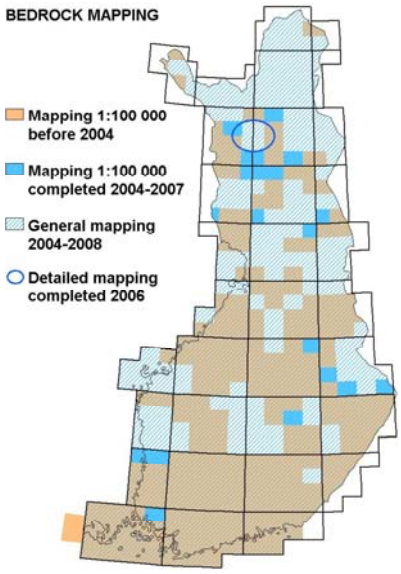


Quaternary mapping

- The basic mapping of priority areas and the 1st version of the general map data base will be completed.

Bedrock mapping

- The 1st version of the general map data base will be completed, with more detailed mapping focused on prospective terrain.



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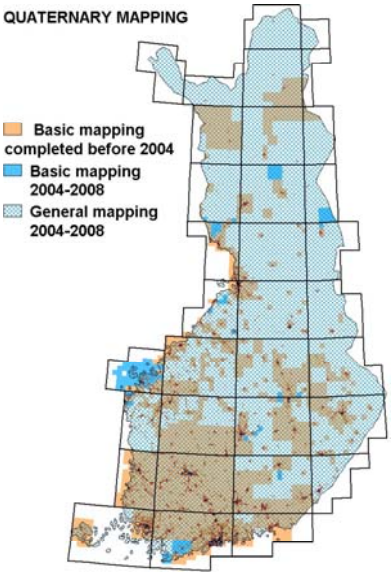

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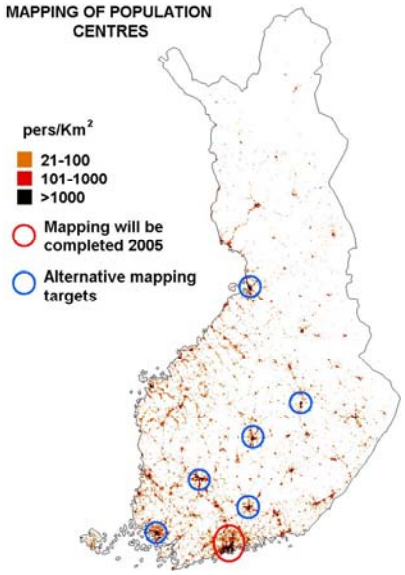
Mapping of population centres

- Mapping is focused on centres of population growth according to need



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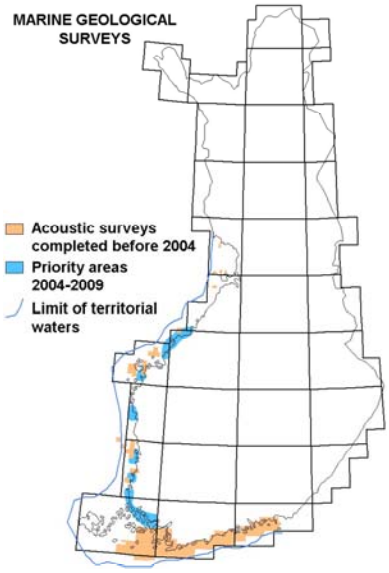
Marine geological surveys

- 70 % of coastal areas will be surveyed, essential data distributed through the web



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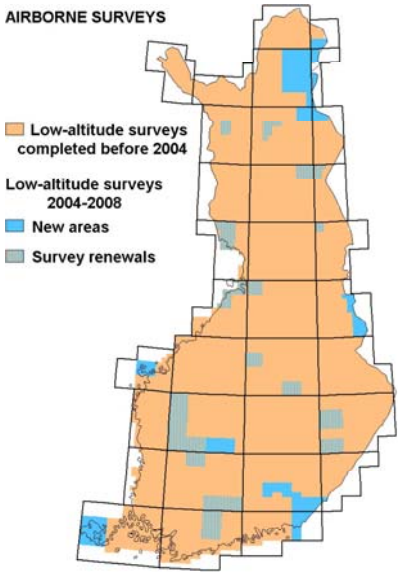
Airborne surveys

- Survey programme completed in 2008



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Mapping of population centres

- Mapping is focused on centres of population growth according to need

Marine geological surveys

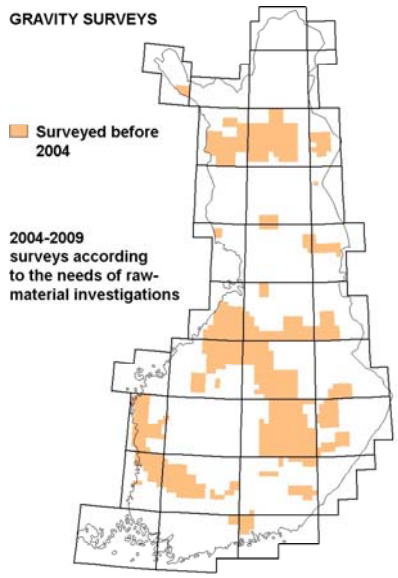
- 70 % of coastal areas will be surveyed, essential data distributed through the web

Airborne surveys

- Survey programme completed in 2008

Regional gravity surveys

- focusing on areas with raw material potential



C. Strategic targets

GTK Strategic targets 2009

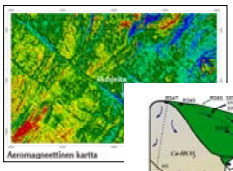
- GTK will be a European centre of excellence in the study of the natural earth resources and their utilization, as well as in the development of exploration and beneficiation technologies.
- Special areas of development are environmental research relating to the sustainable management of natural resources, research related to noble metals (Au, PGE) and natural stone deposits, and arctic research.
- Technological and analytical development focuses on applied mineralogy, environmental geochemistry and geophysics.
- Increase in multidisciplinary research activities, with enhanced national and international networking.

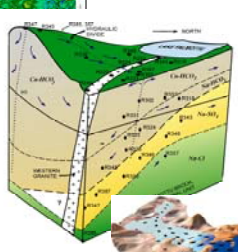
GTK

Sustainable use of natural resources

- Sufficiency of natural resources
- Economics of exploitation
- Environmental impact and life cycle analysis
- Applied mineralogy and mineral dressing
- Utilization of minerals, natural stone and peat
- Utilization of by-products and waste, and new materials

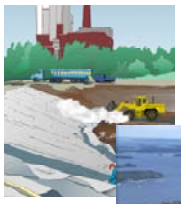
Geological modelling

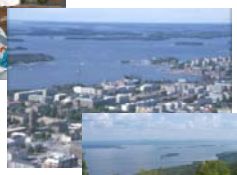


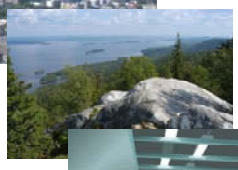


- 3D-modelling and interpretation
- Crustal development, evolution and metallogeny
- Origin and structure of Quaternary deposits
- Geochemical cycle and processes
- Modelling of ore, mineral, peat and groundwater deposits
- Noble metal research

Land use and environment





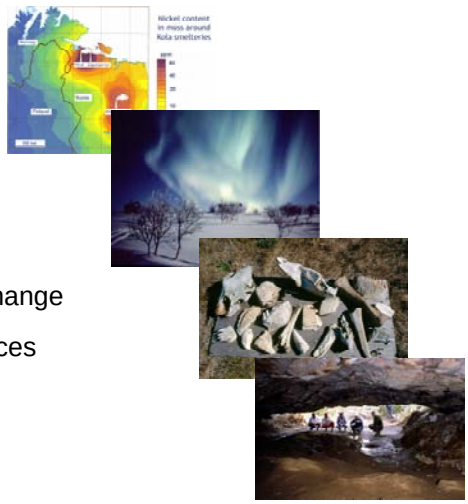


- Environmental impact of land use
- Urban and engineering geology
- Geodiversity and geological values
- Nuclear waste deposit studies
- Geological environmental and health risks
- Contamination

Exploration and environmental technology

- Depth penetration methods, borehole measurements
- Environmental geophysics, geochemistry and monitoring
- Measuring accuracy, 3D and interpretation
- Remediation technology
- In-situ -analyses
- Heavy mineral technology

Arctic research, global change



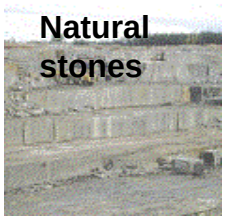
- Arctic processes
- Paleoenvironment and global change
- Arctic region and natural resources

D. Further strategic targets

Natural resources

Discovery, delineation and evaluation

Information about natural resources and their usability as a basis for sustainable development

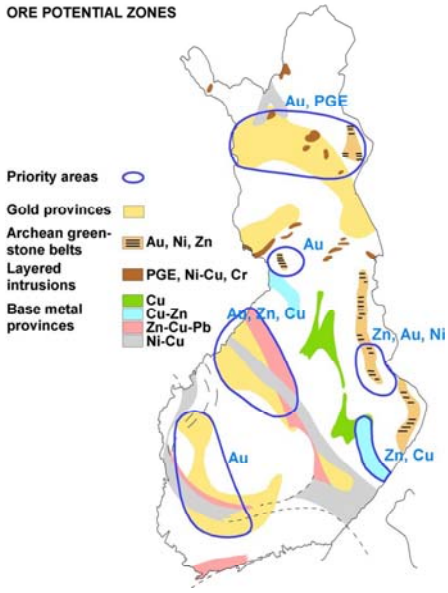


Strategic targets 2009

- GTK aims to find new deposits of geological resources, produce basic information for the extractive industry, and influence the positive development of the minerals, energy and mining sectors through active action.
- Exploration and evaluation of raw materials is based on comprehensive research and the use of latest technologies.
- GTK emphasizes environmental considerations throughout its mapping, exploration and research activities
- All environmental issues are considered in the evaluation of deposits.
- GTK is proactive in publicizing the significance of natural resources and their responsible utilization.

Metals

Focus on noble metals

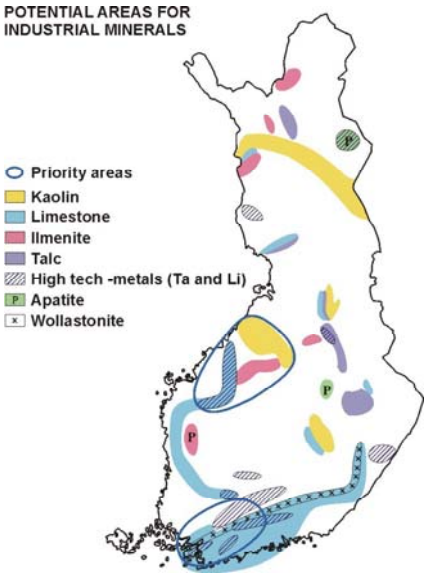


Metals

Focus on noble metals

Industrial minerals

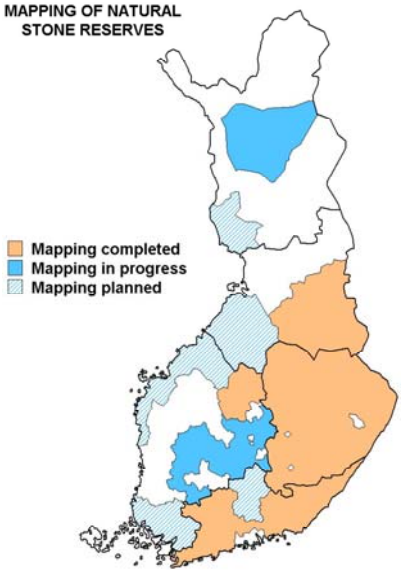
- Focus on pigment minerals



Metals
- Focus on noble metals

Industrial minerals
- Focus on pigment minerals

Natural stones
- Identification of new deposits and rock types suitable for production



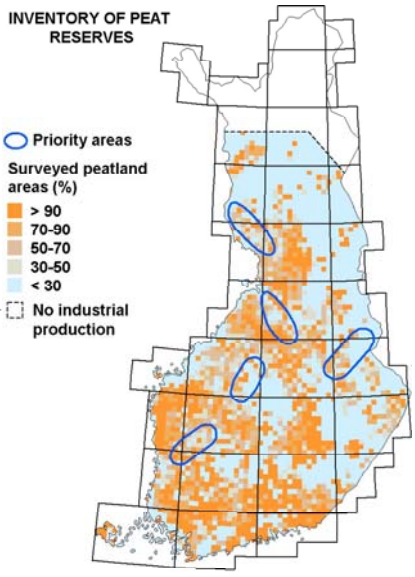
Metals
- Focus on noble metals

Industrial minerals
- Focus on pigment minerals

Natural stones
- Identification of new deposits and rock types suitable for production

Aggregates
- Inventory will be completed in areas where demand and consumption are greatest

Peat
- Evaluation of reserves suitable for production covering 300 sq. km of peat land per year



Metals
- Focus on noble metals

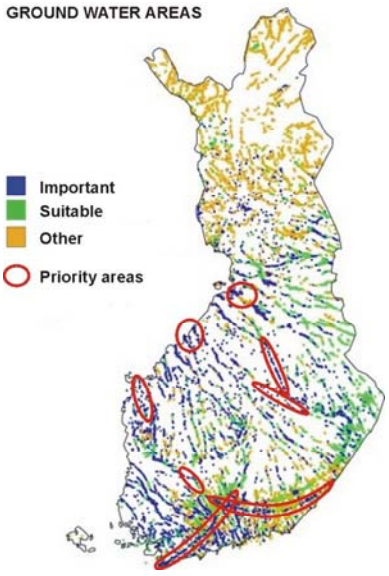
Industrial minerals
- Focus on pigment minerals

Natural stones
- Identification of new deposits and rock types suitable for production

Aggregates
- Inventory will be completed in areas where demand and consumption are greatest

Peat
- Evaluation of reserves suitable for production covering 300 sq. km of peat land per year

Ground water
- Geological modelling of selected groundwater reserves in priority areas



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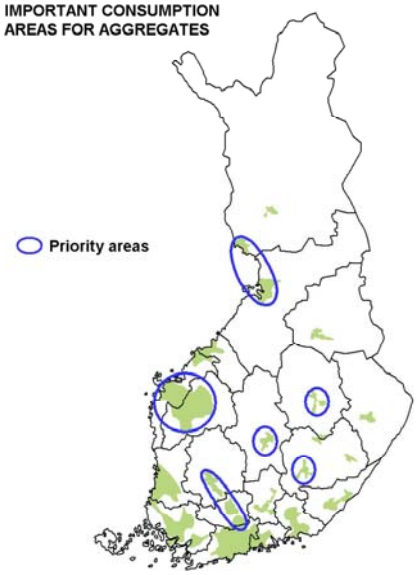
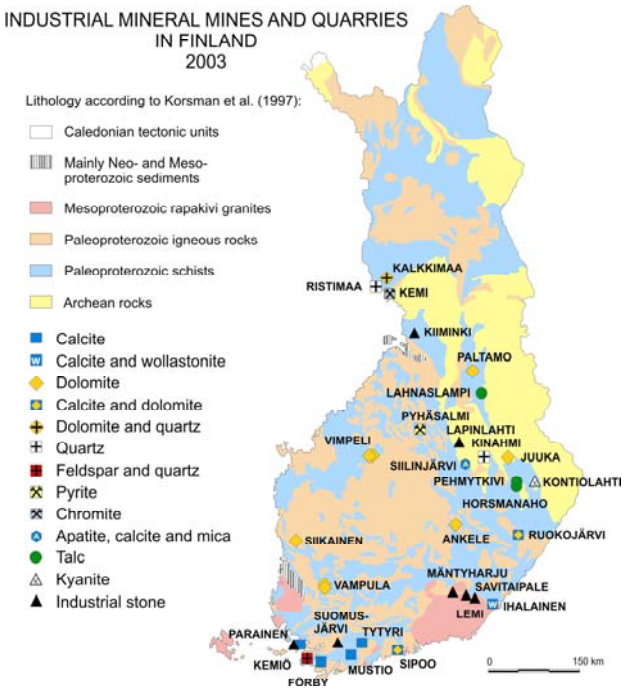


E. Other objectives



GTK

GTK

PROJECT THEMES, external financed projects

- **NATURAL STONE PROJECTS**
- **AGGREGATE MAPPING AND ASSESSMENT (Sand and gravel & rock aggregates)**
- **IDENTIFICATION OF GEOLOGICAL NATURE VALUES**
- **SUB SURFACE MAPPING OF IMPORTANT AQUIFERS**
- **DEVELOPMENT OF COOPERATION AND NETWORKING**

Olli Breilin, Hannu Luodes and Jouni Pihlaja
Geological Survey of Finland, GTK

December 2004

GEOLABORATORY IN SHORT

- Service network: Espoo, Kuopio, Rovaniemi and Sodankylä, 3800 m² laboratory facilities
- 87 manpower years
- Modern equipment, 3 milj. €
  - 3 ICP-MS
  - 6 ICP-AES
  - WD-XRF
  - 9 GAAS/FAAS (3 kpl simultaneous)
  - IC, HPLC, GC
  - 2 Hg-analysers
  - 3 calorimeters
  - 2 Sedigraph-grain size testers
  - pretreatment ,. robotised
- Accredited since 1994 (Finas T025)
- 100 000 samples / yearly
- Laboratory production 4.8 M€/a, about 40 % for outside clients

The Geological Survey of the United States, USGS

US Geological Survey (USGS) in Reston, Virginia, USA was visited October 18th – 19th for benchmarking. From Geological Survey of Sweden (SGU) Lars Persson, Naz Ahmed Shaikh and Jacob Johnson, took part and from USGS among others: General Director Chip Groat, Geologist Curtis Larsen, Senior Staff Scientist Rama Kotra, Eastern Regional Geologist David Russ, Chief, Office of Budget Carla Burzyk, Liaison for Satellite Missions Raymond Byrnes, Associate Program Coordinator, Natonal Cooperative Geologic Mapping, Randall Orndorff, Chief International Programs Richard Calnan and Botanist Martha Power.

General overview

US Geological Survey (USGS) is a bureau of the Department of Interior (DOI). A Director appointed by the President leads USGS but the role is apolitical. USGS is 125 years old and it is responsible for fulfilling the Nation´s needs for reliable, impartial scientific information to describe and understand the Earth. This information is used to minimize loss of life and property from natural disasters; manage water, biological, energy and mineral resources; enhance and protect the quality of life; and contribute to wise economic and physical development. The USGS is the Federal Government's principal civilian map making agency and it is the primary source of its data on the quality and quantity of water resources, the Nation's primary provider of earth-science information on natural hazards, mineral and energy resources, and the environment, and a major partner in developing the Nation's understanding of the status and trends of biological resources and the ecological factors affecting living resources.

45 000 stations that monitor the amount and quality of surface- and groundwater**.**
USGS publishes approx. 3 000 new or updated reports and maps every year and maintains a stock of 88 500 different maps. Some 54 000 maps have a working scale of 1:24,000.

Website : www.usgs.gov

SGU´s Questionnaire

The currency used is given in USD but also in Euros according to the exchange rate of 1 USD=7 SKR, I Euro=9 SKR

General questions

- Mission of the Survey

To serve the Nation by providing reliable scientific information to:

- Describe and understand the Earth
- Minimize loss of life and property from natural disasters
- Assess water, mineral, biological and energy resources
- Enhance and protect our quality of life

- Vision

"Serve the nation by providing reliable scientific information"

- To which Ministry it is allocated.

Department of Interior (DOI). Recent emphasis on support to other DOI bureaus (NPS, F&WS, etc.).
USGS is Geological in name and tradition, now Natural Science with Biology, hydrology, geography, geology and information

- Number of employees

9 500 (Men/women 60/40 in Science, 50/50 in executive)

- Geoscientists (all Science categories)

6 750

- Others

2 740

- Number of employees, development the latest 5 years

Not relevant owing to reorganisation of the Survey

- Geoscientists
- Others

Employment statistics

Discipline	Nonscientists	Geoscientists	Other scientists	All Employees
Biology	399	69	1 167	1 635
Director´s office *	271	303	180	754
Geographic information	179	18	10	207
Geology	343	1 059	130	1 532
Geography	305	514	115	934
Water	764	2 960	223	3 947
All Employees	2 742	4 923	1 833	9 498
* includes 2 Interdisciplinary Science Centers				

Fiscal Year	Nonscientists	Geoscientists	Other scientists	All Employees
FY 2004	2 742	4 923	1 833	9 498
FY 2003	2 836	5 229	1 795	9 860
FY 2002	2 944	5 454	2 043	10 441
FY 2001	2 948	5 420	1 911	10 279
FY 2000	2 928	5 435	1 771	10 132

- Financing
    - Total budget, USD

      1180 – 1280 million (separate federal and nonfederal budgets). Corresponds to approx. 920 – 995 mill Euros
    - US Federal State budget, USD, %,

      980 million, 77 – 83% (approx. 765 mill Euros)
    - Other sources, USD, % (name the three most important)

      Not relevant
    - Development latest 5 years, USD, %

      Not relevant
        - Total
        - State budget
        - Other sources
- Who initiates/determines the programme of the Survey?
    - The Ministry
    - External Board
    - The DG
    - Others (please explain)

      The Congress structures the funding. The President through his administration proposes a budget annually. The Congress validates and modifies the budget and return it to the President for acceptance or veto. There are 28 program lines and a 5 years´ planning process
- Is your Survey considered as a center of excellence?

  Yes
- % of the total yearly budget spent on research and development

  Venture Capital Fund - 2 mill USD, 0.2% (Geology 250 – 300 000 dollars). No salaries paid. Approx. 1.5 mill Euros. The % of the total yearly budget spent on R&D is much larger. There are about 500 research scientists in geology.
- Development the latest 5 years, USD, %
    - % of the total yearly budget spent on marketing
- Development the latest 5 years, USD, %

- Please describe briefly your fields of international co-operation

  1.6 million USD (approx. 1.2 mill Euros) occupies 19 people. The actual posting of USGS employees is decreasing (e.g. closing of mission in Saudi Arabia). Increase in international work; Overseas personnel is 5 employees (1 000 trips a year). 5 mill. USD (approx. 3.9 mill Euros) co-operation mapping program in Madagascar with British Geological Survey as lead partner. Some funding from World Bank. Activities in e.g. Afghanistan (oil, gas, coal, infrastructure) + capacity building. A funding guarantee exists for people going abroad when coming back to the survey. Letters of agreement for exchange of scientists occur

- Please describe your involvement in various EU-financed projects, their type, size, extent and partners for the last 3 years and future outlook

Not relevant

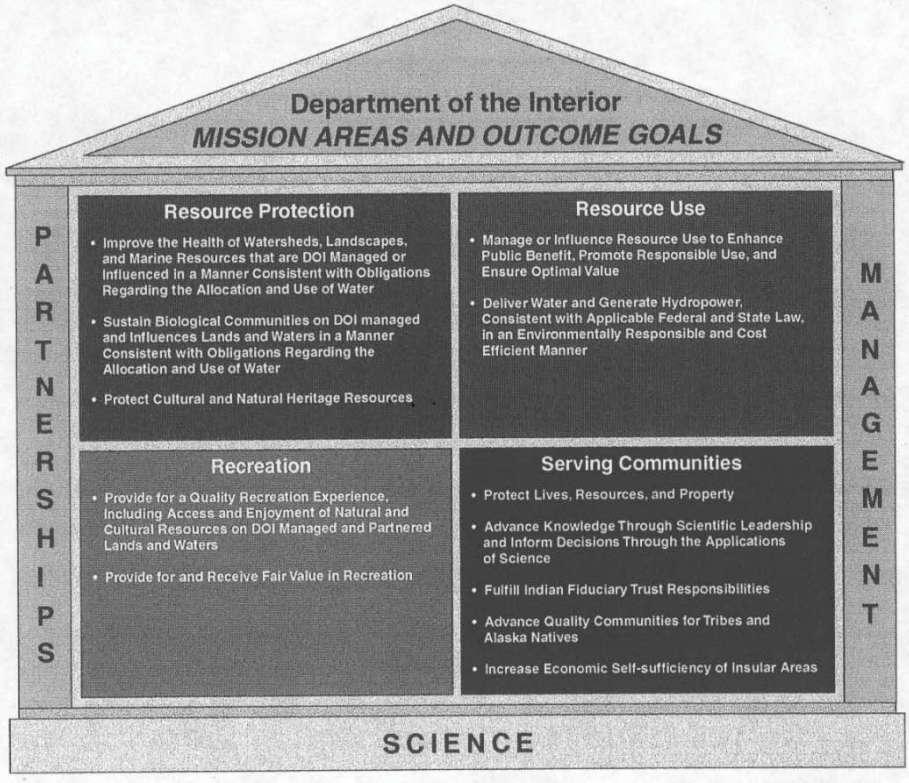
- How needs of societal geoinformation are taken into account
  - Through permanent advisory boards with user representatives
  - By regular meetings with user organisations and decision makers at various level
  - Surveillance by the survey itself
  - By complimentary directives from the Ministry

  All respects.

  The program planning, budget and performance integration is Customer, Science, Administration and Congress driven

- How and who makes the priority among the various societal demands?

See the figures below



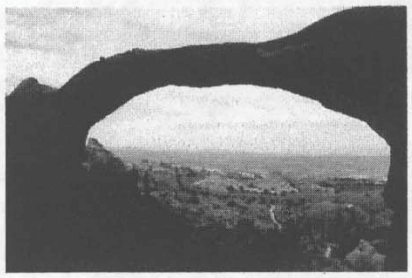
This structure depicts the four mission areas of the Department of the Interior and the supporting pillars of partnerships and management. Science is presented as the foundation for informed resource management decisions.

DOI by the Numbers

Why has the Department of the Interior been called the Department of Everything Else? A quick look at some statistics related to Interior's diverse mission and responsibilities sheds some light on this label.

The Lands and Water Interior Manages

- 507 million acres of surface lands
- 1/5 of the Nation's public lands
- 700 million acres of mineral estate underlying Federal lands or supervised by Interior through leasing and operations
- 1.76 billion acres of the Outer Continental Shelf
- 52.4 percent of the Nation's Wild and Scenic Rivers
- 69 million acres in the Nation's Wilderness Preservation System



Interior's Recreation Sites

- 388 units in the National Park System including:
  - 56 National Parks
  - 10 National Seashores
  - 24 National Battlefields or Military Sites
  - 118 National Historic Parks and Historic Sites
- 180 Other recreation sites
- 542 National Wildlife Refuges
- 70 National Fish Hatcheries
- 90 National Monuments
- 45 National Natural Landmarks
- 308 Recreational lakes and reservoirs

People We Serve

- 1.5 million American Indians and Alaska Natives
- 47,909 students in Bureau of Indian Affairs schools
- 223 Alaska Village Groups
- 500 million estimated visits to Interior recreation sites annually
- 31 million people who rely upon DOI for their source of water

Physical Infrastructure Maintained by Interior

More than:

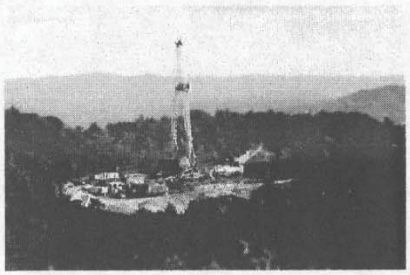
- 4,200 bridges and tunnels
- 39,000 buildings (historic, employee housing, and other)
- 1,600 campgrounds
- 2,500 dams
- 3,000 dikes
- 340 reservoirs
- 126,000 miles of highways and roads
- 25 tribally-controlled colleges
- 184 elementary and secondary schools and dorms

DOI's Contributions to the Nation's Energy Supplies

28 percent of the Nation's energy comes from DOI managed lands and offshore areas.

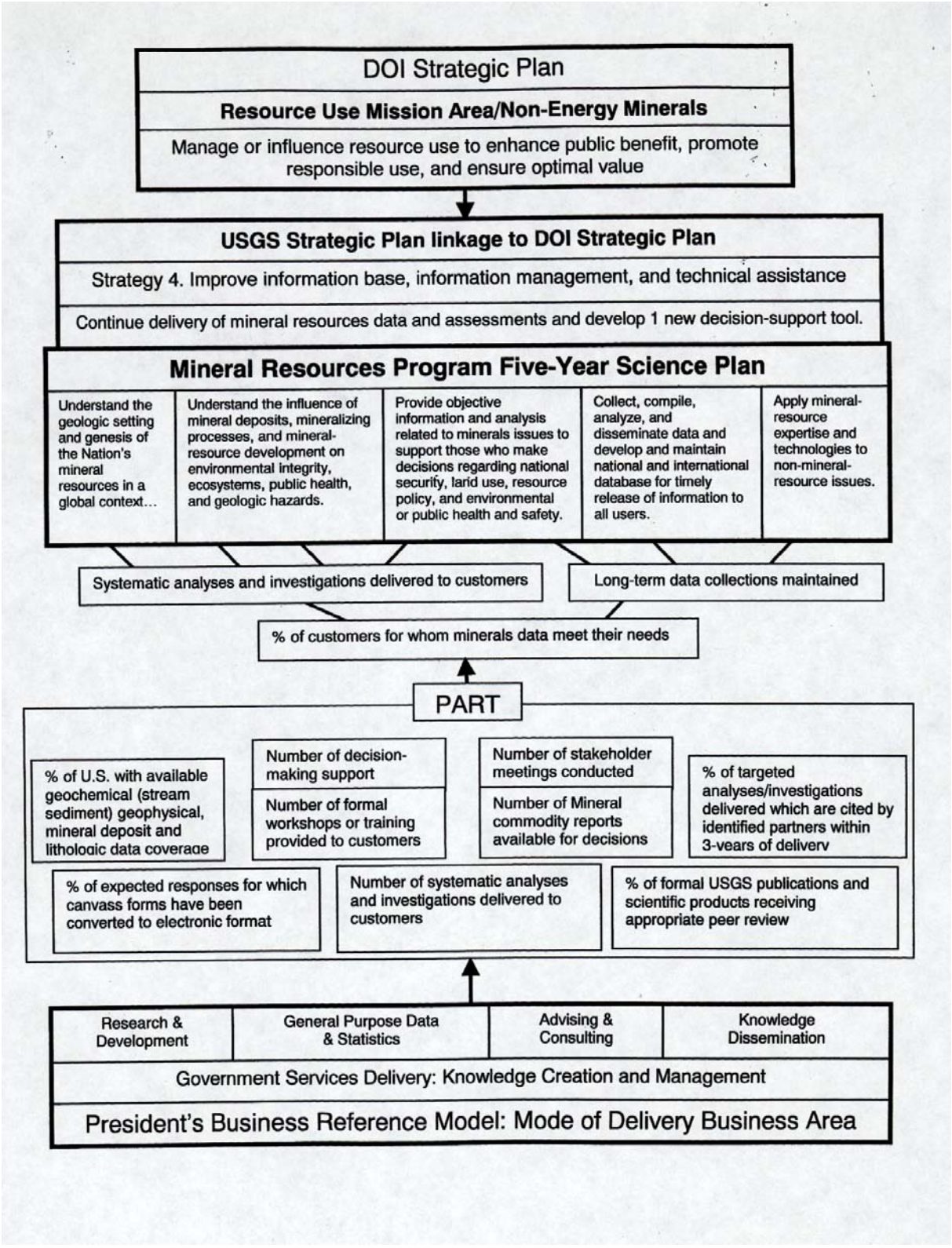
Within this 28 percent, DOI produces:

- 35 percent of the Nation's domestic coal
- 48 percent of the Nation's geothermal power
- 17 percent of the Nation's hydropower
- 34.5 percent of the Nation's natural gas
- 32 percent of the Nation's domestic oil
- 20 percent of the Nation's windpower



How DOI Monitors Hazard-related Activities:

- 43 U.S. volcanoes monitored
- 5 hazard monitoring networks maintained
- 14 geomagnetic observations
- 121 earthquake monitoring global seismographic network stations
- 476 cumulative real-time earthquake sensors installed
- 5,621 real-time stream-gages on the Internet
- 7,000 stream-gages and water quality monitors



- How the performance of the survey is evaluated/measured
    - Regular external evaluation

    Yes
    - Showing performance indicators in the Annual Report

    Yes

- Do you have quality management ISO 9001

No

- What is your prime objective in communicating?
  - To receive more funding

Yes

- To market the geoinformation you have in an understandable way

Yes

- Please describe your main customers or users of your information and services

A wide range or broad spectrum of customers – other governmental agencies at Federal State, and local levels; industry; academia; and the general public

- Please describe the main societal sector where your products and information is used today
- Do you have a policy for the pricing of your products?

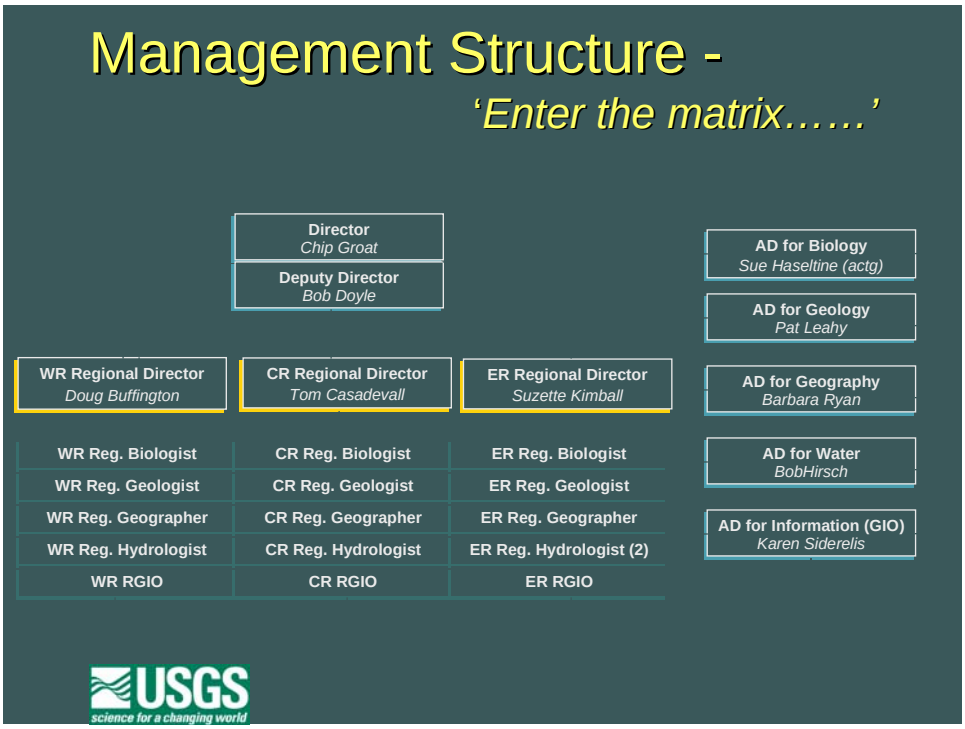
To cover delivery costs

Organizational structure

- What organization type has the Survey?
  - Hierarchic
  - Matrix (programs and projects)

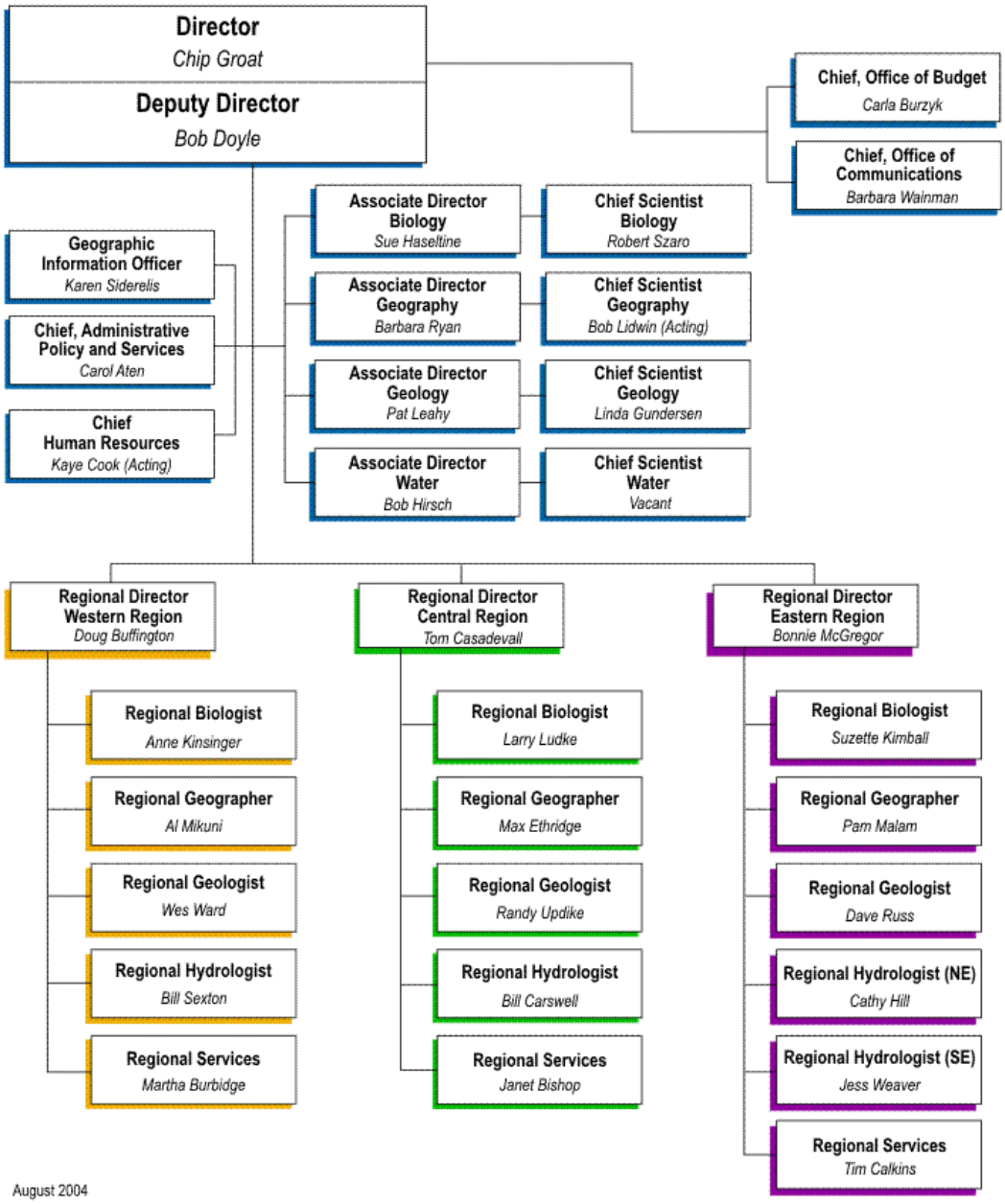
Yes, since 5 years. Historically organized along discipline lines, now working to reduce Business Practice Differences to facilitate interdisciplinary work

- Please provide an organization chart



USGS
science for a changing world

U.S. Geological Survey



- Do you consider your Survey as
  - A demand oriented organization

    Yes
  - A traditional geoinformation producer organization
- If you are demand oriented, what changes were necessary to adapt to this role

  New employed people imply a multidisciplinary way of working; traditional mapping has become more scientific, microbiology important; qualified data

handling and management important; topographic mapping is not conducted at the same level as in the past. Topo maps are gradually being updated

- How much of the project work is outsourced ((in house/out-house activities, % of the total amount spent in the last 3 years)

Activities

- How much of the land area (%) and continental shelf area is covered by modern (not older than 30 years) geological maps in various disciplines

20% in 1:100,000 or larger scale, usually 1:24,000

- Resources provided in last 3 to 5 years to various core projects respective disciplinary projects
- Is both primary and synthesized information in digital form and available in databases?
  Yes
- Is geological data accessible for users/customers on line?
  Yes, in part

- Is it possible for users to download information from your databases on line?
  Yes
  - If so how is that financed and what are the terms of usage?
  - What is your linkage with other players in the innovation system?
  - What is the general length of a project?
    3–5 year
    - Core projects (need for society, e.g. geological mapping)
    - Co-operation and research projects (not 100% funded but partially subsidized. These projects also include bilateral projects
    - The activities are grouped in disciplines
      - Bedrock geology
      - Quaternary geology
      - Mineral resource assessments
      - Hydrogeology
      - Geophysics
      - Geochemistry
      - Marine geology
      - Environmental geology
      - Medical geology
      - Engineering geology, geotechnics
      - Applied geology

      All involved

The Science programs are shown in Appendix 4.

Commercial activities

The activities are limited to satellite image interpretation in co-operation with NASA. Concern EROS data center and Landsat

- Turnover, USD
  21 mill USD for operational costs (approx. 16 mill Euros)
    - Development the latest 5 years
- National (name the three most important sectors)
  Three commercial satellites companies in USA. Difficult to make profit without state subsidiary. Commercial market for high resolution images is limited

- Development the latest 5 years

  New technique

  Agriculture mapping (global, military), landuse and land management, governmental agencies, forestry (fires), irrigation permit (State of Nebraska) and co-operation with insurance companies

- International (name the three most important sectors)
  - Development the latest 5 years

    Is external income demanded? If yes what limit is given?

    Yes. The costs are tried to be covered (hopefully); no profit ; small market
- Is the pricing of services/products standardized?
  Yes. Fore example 8 mill USD to operate two satellites, 600 dollar per scene (approx. 6.2 mill Euros respectively 470 Euros)
- How high and what type are the overheads?
  For USGS in general the interior service costs are 15%, discipline work 12%, all together 25-35% then covering all costs (facilities, electricity, equipment etc.). The personnel cost is the most heavy; 90% of budget
- Are there any especially designed profit centers?
  No
- What is done with the profit gained?
  To cover costs. (USGS was never set up to make profit; in reality USGS has no commercial activities)

Future outlooks

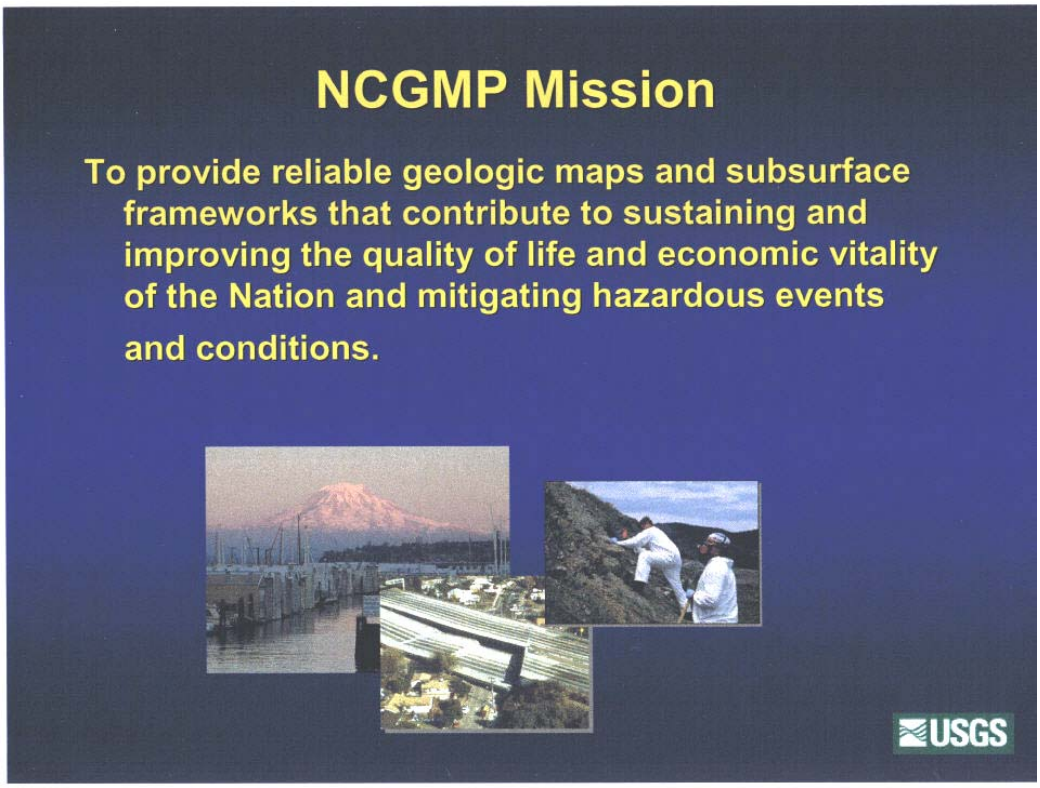
- Does your Survey have a strategic plan for the next 5-10 years?
  Yes. It is a 5 years planning process done by people inside and outside the organization. DOI, federal agencies, people in the private sector are asked both with long-term and short-term priority. Once a year people are invited to give input
- Tendencies for the future budgets (ratio of state's budget and external income)
  Similar as now
- How the various EU directives affect your present and future activities
  Not relevant
- Tendencies for commissions, volume and trends
  Similar current situation
- Investments in the future (please describe in which fields),
- Do you think that geological mapping will be still an activity in the next decade and be your core activity?
  Yes, without doubt. A small part of the country is covered and there are possibilities for interdisciplinary aspects. An updating is also necessary, e.g. joints and faults. There are 3 types: EDMAP, FEDMAP and STATEMAP. STATEMAP (41 projects) shall be financed to 50% by State funding but is currently about 70%. EDMAP is performed by about 500 students. E.g. Kentucky is currently mapped; bedrock and now surficially. A concentration is made to coal occurrences. Further details about the mapping is given in Appendix 1.
- How you listen to decision-makers to identify important future issues
  See appendices 2 and 3 and figures
- How do you respond to the expectations of society?
  See appendices 2 and 3 and figures
- How you influence public perception of your work?
- What services are likely to be abandoned in the future?
  Not relevant
- Are any new services planned, if yes which?
  Mentioned in the mapping program: geoparks and preservation areas, urban expansion-material resources, mineral resources, skill assessment, active post-doc program, foreign

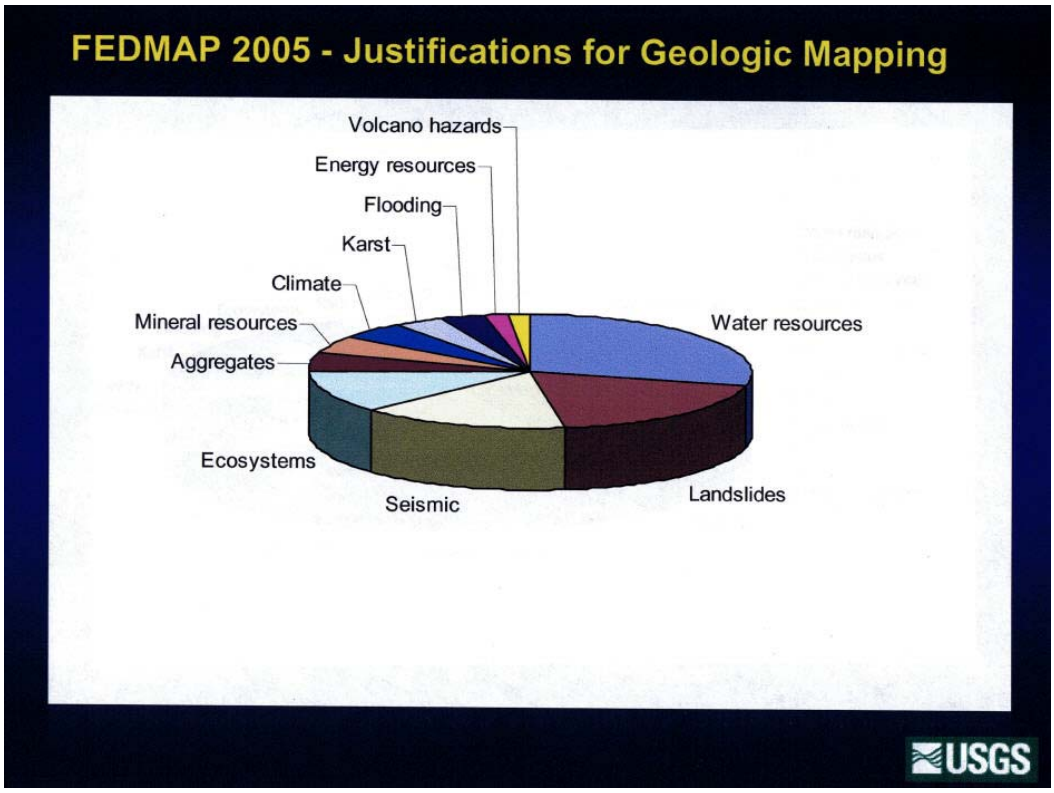
languages, improved personal development, high-level radioactive waste, waste in a wide sense, waste disposal, remediation, coastal areas, estuaries, water-level changes, sea-level rise, salt water intrusions, subsurface geology, 3-4D, seismic reflection-modeling, education, climate change, carbon sequestration, geothermal energy (oil, gas, shales)

Appendix 1.

The Program Goals of the National Cooperative Geologic Mapping Program, NCGMP:

- Produce high-quality, multi-purpose geologic maps to solve a diversity of land-use issues
- Develop 3-D geologic frameworks for predictive process modelling (e.g. ground-water flow, seismic shaking, landslide probabilities; Iandscape change; ecosystem health)
- Make geologic map information more accessible to the public
- Help ensure that geologic mapping capabilities/workforce is adequate to meet the Nation's needs.





NCGMP in the Parks

- 10–14% of the NCGMP budget is directed toward geologic mapping efforts in the national park system
- NCGMP has worked in over 50 national parks, monuments, preserves, and recreation areas
- NCGMP has also worked in many national forests and wildlife refuges

EDMAP

- On yearly average, funds 65 students from 40 Universities
- Since 1995, funded over 550 students from 118 Universities
- Maximum funding per graduate student – $15,000.00
- Maximum funding per undergraduate student – $7500.00

EDMAP objectives

- Provide for broad education in geologic mapping and field analysis through the support of field studies, and to develop academic programs that teach students of earth science the fundamental principles of geologic mapping and field analysis
- Train the next generation of geologic mappers
- Match every Federal dollar with university dollar
- Competitive grants process
- Integrated with Federal and State components of Program

STATEMAP Objectives

- Establish the geologic framework of areas determined to be vital to the economic, social, environmental, or scientific welfare of individual States
- Responsibilities vary from State to State
- Match every Federal dollar with State dollar
- Competitive grants progress

- Provide geologic information for State governments
    - for regulators
    - Water resources
    - Mineral and energy resources
    - Land-use planning

Roles of the USGS in STATEMAP

- Administer Program
- Track geologic map deliverables (Mapping in progress database)
- Clearinghouse of geologic map Information through National Geologic Map Database

Appendix 2.

Future roles and opportunities for the US Geological Survey by the National Research Council

Conclusions and Recommendations

The U.S. Geological Survey (USGS) has adapted to the changing political, economic, and technical state of the nation and the world since it was established in the late nineteenth century. Over a period of more than 120 years, the USGS has evolved from a small group of scientists who collected data and provided guidance on how to parcel, manage, and use the public lands of the West to an agency comprised of thousands of scientists who conduct research and assessment activities on complex scientific issues at scales ranging from the local to the global. The USGS will no doubt continue to evolve and adapt to meet changing national needs. In fact, the recent integration of the National Biological Service and parts of the U.S. Bureau of Mines into the USGS presents an ideal opportunity to examine the agency's vision, mission, role, and scientific opportunities as the organization begins the early years of the twenty-first century.

The USGS recognized the need to adapt to changing demands when it asked the National Research Council (NRC) to undertake this study. The NRC formed a multidisciplinary committee of 16 experts (see Appendix A for biographical information on committee members) to address the following issues related to the future roles, challenges, and opportunities of the agency:

- major social needs that the USGS should address;
- significant emerging scientific and technical issues that appear especially important in terms of their relevance to the mission of the USGS;
- opportunities for improving partnerships and other cooperative arrangements with federal agencies, state agencies, universities, and the private sector;
- appropriate international functions of the USGS; and
- the balance of activities such as data acquisition and management, regional studies, and fundamental research.

A NATURAL SCIENCE AND INFORMATION AGENCY

Over time, the USGS has evolved and built a solid foundation on which to plan its future. At present, senior management is attempting to modify the agency's culture from a cluster of loosely linked organizational units to a tightly interactive community. The recent integration of the BRD into the USGS is an organizational change that provides an opportunity for the agency to respond to questions beyond the geological, hydrological, and geographical sciences. When the BRD merged with the USGS, it prompted slight changes in wording, but no fundamental changes to the formal mission statement of the agency. The mission of the agency is to supply information that contributes to the wise management of natural resources and that promotes the health, safety, and well-being of the nation's citizens. The information in the form of maps, databases, and analyses provides managers and

policy makers with timely, unbiased, and reliable information on water, energy and minerals, biota, and land resources. This mission is fully appropriate for a federal science agency. Furthermore, the role of the USGS is well defined with respect to other federal agencies. The USGS provides technical expertise and information not available elsewhere to a variety of federal agencies and other customers.

The USGS is a vitally important provider and coordinator of information related to critical issues in the natural sciences. As a result of changes in its external and internal environments, the USGS is evolving from an agency that was organized primarily to discover what is out there, to one that tries to understand what is out there, to one that tries to understand how what is out there works (i.e., process understanding). Although all three approaches are present in the work of the USGS today, the questions posed to the agency by society increasingly call for multifaceted, analytical, and integrative investigations of complex processes and systems. By evolving into a natural science and information agency, the USGS will be able to play a leadership role in the elucidation of the geological, hydrological, geographical, and biological processes that are important to the nation and in the use of modern technology for the effective and efficient dissemination of this information.
In upcoming decades, many of the relevant social needs and emerging scientific opportunities that the USGS should address will involve interactions among the natural environment, its biota, and people. The USGS is well positioned, in terms of its information resources, technological capabilities, and range of professional expertise, to provide well-coordinated, comprehensive responses to priorities of society and science. Interactions between the environment, its biota and people are highly complex and unpredictable, and in many cases, the solutions require integrative approaches.

Integrative science focuses on issues that cross disciplinary boundaries and is more than multidisciplinary collaboration. It involves individuals sharing different perspectives, methodologies, and conceptual models in a manner that changes each person's approach to the problem at hand. An integrative approach to science entails a focus on problems in all of their complexity, and the creation of teams with the skills and resources necessary to provide the entire suite of knowledge required for solutions or at least for well-informed responses. Developing interdisciplinary teams requires more of management than drawing a committee of scientists from each of the existing USGS divisions to attack a problem. It requires management to foster the integrative habit of inquiry by knowledgeable individuals.

A determination to commit the USGS to integrative scientific investigations is not an easy step to undertake. Not only are the objects of study -and therefore the vocabularies - different among disciplines, but the traditional spatial and temporal scales of phenomena to be studied and the nature of acceptable explanations are different too. Integrative work relevant to policy often requires that new perspectives are forged, new applications of methods are developed, and greater emphasis is given to the definition of conceptual system models. Both the difficulties and the rewards imply that in a large, multifaceted agency such as the USGS, senior management has to take the lead in promoting such integration because they are the only personnel with knowledge of all the agency's resources and they alone are charged with the strategic application of these resources in the overall national interest.

The USGS was founded around disciplinary skills and experience, and it continues to embrace a discipline-specific organizational structure.

Despite this constraint, the agency recognizes the value of interdisciplinary teams and studies and has demonstrated the importance of those efforts many times. However, the agency has not yet created an interdisciplinary environment to confront the complexity of the issues at hand. The USGS has the capability and the opportunity to advance understanding of how the complex air-water-human-land system works with integrated research teams crossing traditional disciplinary boundaries.

The USGS should place more emphasis on multiscale, multidisciplinary, integrative projects that address priorities of national scale. The committee recognizes that integration is difficult to achieve, especially in cases that require integration of natural and social sciences. However, the failure to integrate will inhibit understanding of many natural science problems. Nevertheless, not all

complex science problems require a broad integrative multidisciplinary research framework; therefore, the choice of research framework must fit the specific research problem. Problems that do not require a broad integrative multidisciplinary research framework should not be overlooked.

In the future, the USGS must continue to be first and foremost a scientific agency capable of high-quality assessments and research on relevant natural science issues. However, the nation and the world are entering a new era where economies are global, and information and its management are now a major source of wealth. How effectively the USGS can manage information will be critical to its future performance. For the USGS, information management has two essential aspects. The first is the ability of the USGS to assess the information needs of its customers and partners and to focus its resources on meeting those needs. The second is to deliver and facilitate the use of reliable, high-quality data and information effectively. The revolution in information technologies provides new opportunities for the way in which the USGS collects and disseminates information**. In the future, information management at the USGS should shift from a more passive role of study and analysis to one that seeks to convey information actively in ways that are responsive to the social, political, and economic needs.**

MAJOR RESPONSIBILITIES

Consistent with the mission responsibilities and the technical and analytical capabilities of the participating agencies, it is desirable that the USGS provide national leadership and coordination in the specific programmatic areas for which it is responsible. **The USGS should provide national leadership and coordination in (1) monitoring, reporting, and where possible, forecasting critical phenomena, including seismicity, volcanic activity, streamflow, and ecological indicators; (2) assessing resources, including oil and natural gas (domestic and foreign), minerals, water, and biota; and (3) providing geospatial information.**

These activities include the following overlapping categories: surveys, monitoring, data analysis, research, information dissemination, and product generation. **Subject to the overriding requirement that the USGS fulfill its primary and high priority mission responsibilities, the committee believes that the USGS should continue to conduct each of these activities, but that the balance of activities should shift toward the value-added activities of data analysis, problem solving, and information dissemination**. A shift of balance does not mean that the USGS should reduce data gathering or long-term data collections, but that it should do more to interpret what the data mean and to make the data useful and accessible.

Monitoring, Reporting, and Forecasting

The value of the USGS's high-quality, longitudinal databases will increase as they become longer and include a wider range of environmental variability and human influences. When surveys are repeated, they constitute a form of monitoring that can be used to detect or quantify natural change or human influence. The use of automated gauging and other remote monitoring devices, especially at remote sites, makes long-term monitoring more reliable and cost-effective. *Long-term databases are one of the USGS´s most important contributions to the nation, and care must be taken not to disrupt them.*

Long-term monitoring is expensive and time consuming, and it has to be conducted carefully to provide the greatest amount of information return per dollar or time expended. In order to provide the maximum value to society, monitoring programs must be maintained indefinitely into the future so as to obtain the data necessary for understanding the natural cycles and fluctuations of earth systems as well as the impact of human activity on them.

The USGS can realize efficiencies in program areas in which the agency invested heavily in the past. Efficiencies can be realized by employing methods, such as remote sensing, in national resource surveys and reviewing national resource surveys for their relevance to the agency's mission. The USGS could also enhance monitoring and data analysis with the use of conceptual and mathematical modelling. Research into processes and relationships could be enhanced by regular internal and

external reviews and articulation of the kinds of research that are considered necessary and useful for public policy. Finally, the USGS should place less emphasis on the design and development of new products and more emphasis on the update, maintenance, ease of availability, and security of quality data stores that are amenable to the rapid generation of value-added products. This emphasis could leverage the capability of value-added industry to produce tailored products on demand for USGS investigations and studies, using the most current and reliable software and hardware.

For many years, the USGS has provided national leadership in communicating natural hazards information in a timely and understandable manner to multiple and diverse client groups. This information assists in protecting lives and property. The USGS is encouraged to play a stronger role in the disaster information community because the cost of natural disasters is increasing rapidly. Planning to minimize or avoid impacts is critical to reducing cost and human suffering. The USGS has responsibility to monitor and issue warnings for earthquakes, volcanic eruptions, and landslides, as well as to monitor floods and water quality. It also has responsibility to make disaster-related information available to disaster managers. Although disaster managers are finding it easier to obtain and share relevant information than in the past because of the Internet, data formats and reliability as well as accessibility remain problematic**. It is critical that the USGS continue to exercise national leadership in hazards research and risk communication.**

The USGS should emphasize system modelling as a powerful tool for integrative science. System modelling would enable the USGS, in coordination with other agencies and partners, to develop a greater understanding of complex science problems that involve natural and human systems. The USGS has the capability, within one agency, to gather geologic, hydrologic, and biological information about land use issues. By using the NMD appropriately, it can represent the information geographically. The challenges are (1) to recognize the types of information to solve a particular problem, and (2) to integrate different types of information in meaningful ways. Understanding of large, complex systems can be improved through the use of integrative system models. Moreover, effective application of such models to real-world problems requires a comprehensive understanding of social, as well as geological, contexts.

The committee believes that the development of an enhanced capability in integrative system modelling can contribute to the future effectiveness of the USGS. Modelling and integration capabilities need to operate across divisions and feed into the administration of research programs, especially for helping to establish research priorities and identifying where multidisciplinary or interdisciplinary research is needed. Modelling and integration efforts would also benefit from the establishment of a coordination committee involving related federal agencies and from the development of strong ties with other partners. Developing this modelling and integration capability would require hiring new scientists with appropriate background skills and developing new partnerships.

Assessing resources

The USGS has a national reputation for its work in the area of assessing energy, mineral, water, and more recently, biological resources. These assessments are critical for the well-being of the United States. As the United States progresses into the twenty-first century, natural resources essential to the economic and strategic security of the nation will be subject to much greater pressures than in the past. **The USGS should provide national leadership in the provision of natural resource information.** By doing this the USGS will help the United States understand its future natural resource needs.

Providing Geospatial Information

The USGS is well positioned to provide the framework for a geospatial information depository and portal for the DOJ and other federal departments, providing access to a wide range of natural resource information and derivative products that can support effective decision making. In this role, the agency would be responsible for integrating and making interoperable the nation's disparate geospatial databases, for promoting and coordinating the continued development of the architecture for the

NSDI, and for developing national mapping and product specifications. The USGS would also be responsible for making the geospatial databases available as understandable information products for public use and exchange. Sharing geospatial data is important, because it avoids duplication of expenses associated with generation and maintenance of data.

NATIONAL AND INTERNATIONAL ROLES

As discussed in the previous section, the USGS is expected to address a variety of natural science issues of regional, national, and international importance. A major responsibility of the USGS is to serve as the science and of the Department of the Interior (001). For informed decision-making. DOI's agencies make use of objective, non-advocacy information from the USGS. If this information were not available - for example, to the BIA, BLM, MMS, and NPS - similar expertise would have to be developed within these agencies. **The USGS should ensure that science information is provided to DOI bureaus in an efficient and effective way. In turn, DOI leadership should ensure that USGS personnel and resources are utilized in DOI decision making.**

The USGS also has significant responsibilities that support other government agencies, states and local governments, tribes, industry, academic institutions, and the public. The oil and gas assessments and natural hazard maps are examples of USGS products that are of interest to a wide range of audiences. Interest in and concern about natural processes, resources, and environments are now affecting more segments of the population, and the USGS should encourage this interest. The USGS needs to provide leadership and research on a scale appropriate to the problem. Such a focus will require regional directors to understand the broader national and international context of a problem, and headquarters to appreciate the diversity of regional problems.

The USGS engages in international activities. For many years, the agency has worked internationally to provide the nation with much needed information about sources of essential minerals and fuels. More recently, research in foreign countries has helped USGS scientists to understand and prevent or mitigate environmental threats, and this work has proven to be a wise and necessary investment. Foreign area studies are worthwhile because environmental threats in one place can have significant influences in other places. For example, globalization means that U.S. companies and financial markets are increasingly vulnerable to disruptions caused by natural disasters anywhere on earth. The Kyoto earthquake provided an indication of how a much larger and more devastating earthquake in Tokyo might affect the economic and social fabric of the world.

Because many of the natural science issues within the purview of the USGS are global in nature, there is a compelling argument for the USGS to increase its international work on activities that meet mission objectives. **The USGS should develop international expertise in natural science problems relevant to the USGS mission.** Specifically, the USGS should perform a more vigorous role in pursuing foreign area and global studies that develop relevant natural science information in support of U.S. interests; increase technical assistance to foreign countries that are developing relevant natural science programs; and become more active in international activities to benefit the domestic programs and the international stature of the agency.

IMPROVING EFFECTIVENESS

In the future, the USGS will be asked to do more than in the past, and management of the agency will become increasingly challenging. The most fundamental challenge is one of magnitude: the size of the agency's human and financial resources relative to the demands for its information, services, and products. Yet the agency's management also has to address problems of substance, such as those associated with the need to develop an innovative, strategic, and balanced program of problem-specific and core research.

Priority Setting

The future of the USGS depends on its skill in identifying and setting rational and realistic priorities and its ability to reduce commitments of time and money that do not contribute to these priorities. Priority setting is not unknown at the USGS, which has in recent years prepared several strategic plans that establish broad priorities for the agency. However, there are three areas of concern in the USGS planning process that should be addressed. First, priorities stated in the strategic plans seem to have been developed intemally with few mechanisms for refining them in response to input from customers. Second, in being responsive to its customers, the USGS should resist overpromising or overcommitting resources and, as a result, creating unreasonable expectations among its customers. Third, although responsiveness to customer needs must drive USGS priorities, this responsiveness must be in the context of the agency's national mission.

The USGS should develop a more effective process to assess and prioritize customer needs. A step in the right direction is the DOI "Agreement on USGS Research Support for DOI Resources Management Bureau Needs, " which attempts to establish a process for determining USGS science priorities in support of the management and regulatory missions of other DOI bureaus. The USGS should work to ensure that the spirit and substance of this agreement are met. Similar, formalized approaches should be pursued with other customer groups, such as state geological surveys, environmental protection agencies, and resource management agencies. Thus, the USGS needs to consider mechanisms for prioritizing its activities and seeing that they are consistent with stated mission goals.

An important aspect of priority setting for the USGS is to support and maintain a strong research program. This report emphasizes the need for the USGS to develop objectives for a long-term core research program. One important objective of such a program should be to generate new knowledge on a set of understudied issues of importance to society and science that are central to a deeper understanding of interactions among natural systems and between nature and society.

By "long-term" research is meant a period that is long enough to improve understanding of specific, understudied problems. This period should be of the order of 5 to 10 years. Such a time horizon would provide the opportunity for teams of multidisciplinary teams of researchers to collaborate, apply novel approaches, and produce significant results on critical problems.

ln the past, much USGS research and development focused reactively on short-term and narrowly defined problems, and often failed to anticipate the emergence of critical long-term problems. This approach is unsuitable for dealing with complex natural science problems that are relevant to the USGS mission. The solution to many complex natural science problems requires a research framework based on integrative science—science committed to bridging barriers that separate traditional modes of inquiry.

The USGS should develop and set a research agenda that is balanced appropriately between problem-specific research and core research. Clearly, the USGS needs to undertake both problem-specific and core research to address current and emerging science issues. However, the USGS should give high priority to, and expand considerably, the core research agenda and commit the necessary resources to undertake the priority research. The research agenda should be developed through a formal and continuous strategic science planning process. The USGS should review continually the balance between problem-specific research and core research and determine the appropriate mix of problem-specific and core research efforts.

To focus its efforts, the USGS should consider mechanisms to set a research agenda based on a series of guiding principles. Setting the research agenda will require substantive communication within the USGS and beyond its borders as well. The result should be a portfolio of planned and coordinated core and problem-specific research activities appropriate to USGS expertise with broad support inside and outside the agency.

The principle of calling on external advisory committees to assist in program design and development is weil established. Many federal agencies have strengthened their programs through the extensive use of such committees. As a major federal science agency, the USGS cannot afford to be without external advisory committees. **The USGS should establish and make extensive use of external advisory committees.** Consideration should be given to the establishment of an agency-level external advisory committee and, where there are none now, external advisory committees at divisional and program levels as well.

A major advantage of external advisory committees is that they have organizational memory, but because they need to have broad expertise, they may not be as well suited to reviewing specific aspects of a program as specially constituted review panels. Therefore, the USGS should continue to request specially constituted review panels to conduct independent reviews and provide answers to specific questions.

Meeting Technical Needs

The scientific credibility and respect attributed to the USGS is primarily the product of an outstanding work force. However, the reservoir of accumulated knowledge is in danger of being lost through forthcoming retirements unless existing staff overlaps with new staff. Without a new generation of talented scientists to replace departing staff the ability of the USGS to answer the questions of the future will be compromised and the morale of the remaining staff will deteriorate.

The USGS should devote substantial efforts to recruiting and retaining excellent staff. The rejuvenation of the work force should take into account the new areas of expertise that will be needed in the future. In identifying new hiring priorities, the USGS has to pay special attention to its long-term core research agenda. Thus, opportunities should be made available to recruit scientists who can work effectively across program boundaries and who can be expected to provide leadership in the integration of science information.

To facilitate integrative science, the issue of personnel location will have to be addressed. In the future, USGS professional staff members will be expected to increase the effectiveness of their multidisciplinary investigations, which can be facilitated by concentrating scientists from different disciplines in centralized facilities. Therefore, consideration should be given to the collocation of scientists from different disciplines in order for them to conduct integrative science projects more efficiently.

ln an environment of fiscal pressures, the agency may not be able to make as many new hires as it may wish. As a result, the USGS has to develop an organizational culture that encourages, values, and rewards flexibility and teamwork. For the agency to undertake multidisciplinary, integrative initiatives, it is of paramount importance that scientists be able to transcend traditional disciplinary boundaries. To retain excellent staff, careful consideration must be given to the reward system. The present reward system favours research over assessment and service activities. Management should seek ways to resolve this nettlesome issue by altering reward structures to encourage, recognize, and reinforce categories of professional activity that are sometimes underrated.

Even if the professional staff of the USGS were to increase substantially in the future, the increase would probably be insufficient for the agency to accomplish its goals solely through in-house activities. As the problems that the USGS addresses become more complex and multidisciplinary, it is unlikely that the existing professional staff, even with major retraining, would be able keep up with all of the new techniques and new knowledge, let alone cover all of the areas of expertise necessary to carry out an ambitious program of integrative science. **To achieve its mission goals, the USGS will have to strengthen coordination and collaboration with other federal agencies, as well as with states, academia, and industry.** At present, the USGS is insufficiently engaged with potential partners, especially related federal agencies, whose work can enhance the ability of the USGS to achieve its mission objectives. Coordination and collaboration increase institutional flexibility in meeting mission goals. They permit the sharing of resources (personnel, equipment, and ideas),

enhance the prospects for new project funding, and can lead to high-quality science. In addition to making a strong commitment to increase external coordination and collaboration, the USGS should strive to improve cooperation between scientists within the agency. The USGS can make greater use of intra-agency transfers that foster cooperation, lessen the "stovepiping" of programs, and could accelerate the development of new integrated entities.

USGS cooperative programs with regional, state, and local governments as well as with other entities are stimulated by requests for scientific knowledge and data. These reimbursable programs can have considerable value: they allow the USGS to exchange employees between programs, they allow the agency to leverage its funds and thereby to expand its range of operations, and they provide a measure of the worth of certain agency products.

The efficacy of engaging in reimbursable work has been a source of debate both within and outside the USGS for many years. Proponents emphasize that reimbursable work enhances USGS programs, expands the work force, and keeps the agency in close contact with customers. Opponents argue that reimbursable programs distort the priorities of the USGS and inevitably lead to problems of conflict of interest or perceived conflict of interest that act against the best long-term interests of the agency. The USGS has a long-standing partnership with state geological surveys and water resources agencies. This partnership is strained because of concern by state surveys that the USGS inappropriately competes with them for local project funds. The concerns, real or perceived, about competition between USGS and state surveys have to be addressed. **The agency should ensure that reimbursable contracts meet mission and strategic goals and that they do not compete unfairly with state or other organizations.**

Clearly, the reimbursable work of the USGS benefits many agencies. However, some of the reimbursable programs cause fiction between the USGS and state and private entities, are viewed as conflicts of interest, and may divert the agency from its mission. Existing guidelines for reimbursable programs appear to be insufficiently clear or inconsistently applied. The USGS is aware of the issues and has taken steps to avoid unfair competition with the private sector. However, the issue of USGS funding through reimbursable work deserves review with regard to its effects on customer relations and with regard to the USGS mission and strategic plan.

The USGS should place more emphasis on whether potential cooperative projects meet mission and strategic plan objectives. Appropriate reimbursable programs are partnerships in which the USGS performs a function that is consistent with its basic mission and that contributes to its strategic objectives without competing unfairly wit organizations that can provide a similar service.

Budget

The agency's budget, which has remained constant for many years, is a matter of concern. Even with an agile, talented work force and a strong commitment to coordinated research efforts with other agencies and partners, it will be difficult for the agency to attain its future gods, especially those associated with a long-term core research program of integrative, multidisciplinary, relatively large research initiatives. In response to priorities of society and science, the USGS is being called upon to confront complex problems that are critical to human and ecosystem survival. Long-term problems such as those associated with natural hazards that pose increased risks to the nation cannot be solved with the current level of program finding**. As the agency's responsibilities continue to increase, its budget should be increased to a level commensurate with the tasks.** The USGS should justify and request additional funds to support the development of a research portfolio in the national interest. With an appropriate level of funding for practical research related to national needs, the USGS will be better able to fulfil its mission.

Future budget requests should contain sufficient flexibility to permit the USGS director to respond rapidly to new research challenges and opportunities. A fraction of the agency's operating costs could be set aside for new initiatives analogous to a research and development budget in the private sector.

Appendix 3
Research Disciplines and Topics in Hydrologic Sciences

For purposes of technical oversight and review, research in NRP is subdivided into six disciplines. Each discipline is represented by research scientists who serve as technical advisors to NRP managers and as a peer resource for research scientists. Chiefs of the Branches of Regional Research located in the Eastern, Central, and Western Regions. The three Chiefs, together with the Assistant Chief Hydrologist for Research at the national level, oversee the entire program. Below is a brief description of the disciplines and a list of current research topics.

Research Disciplines

GROUNDWATER CHEMISTRY

Investigate inorganic, organic, and biochemical reactions that affect water quality in relation to mineralogical, geochemical and hydrologic conditions in the groundwater environment.

- Sedimentary climate records
- Isotopic investigations
- Geochemical evolution of ground water
- Reactions in contaminated aquifers
- Water-rock interactions in sedimentary basins
- Geochemistry of thermal systems
- Mineral-water interactions
- Reaction-transport modelling
- Age-dating of ground water
- Fate and transport of gases in the subsurface

SURFACE-WATER CHEMISTRY

Assess natural and contaminant chemicals in water and sediment, and study fundamental chemical and biochemical processes that affect the movement of organic and inorganic solutes and gases through primarily surface-water systems.

- Radioisotopes in water, sediment and wastes
- Trace-element partitioning
- Partitioning of organic and inorganic solutes
- Biogeochemical cycling
- Chemistry of small watersheds
- Natural organic material in water
- Chemistry of river systems
- Lake ecosystems
- Ultra-trace metals in water

GROUND-WATER HYDROLOGY

Understand and develop tools to analyze processes that control movement and availability of subsurface water, its transport of dissolved substances microbes, particulates and other fluid phases and its interactions with the geological environment.

- Unsaturated-zone hydrology
- Ground-water flow and solute transport
- Numerical model simulations
- Physics and flow of immiscible contaminants
- Hydrology of fractured rocks
- Hydrology of thermal systems
- Hydraulic properties of aquifers
- Flow in low-permeability systems

- Borehole geophysics
- Monitoring network design

SURFACE-WATER HYDROLOGY

Quantify, understand, and model the physical processes that control the distribution and quality of the Nation's surface-water resources.

- Surface-water modelling
- Surface-water flow and transport
- Estuarine hydrodynamics
- Surface water-ground water interactions
- Geochemical interactions in catchments
- Paleoflood hydrology
- Climate variability and surface-water hydrology
- Watershed modelling
- Statistical hydrology

GEOMORPHOLOGY AND SEDIMENT TRANSPORT

Understand stream-channel morphology and erosional processes that govern the source, mobility, and deposition of sediment.

- Sediment transport dynamics
- Sediment transport from disturbed lands
- Climate implications from fluvial systems
- Channel morphology and sediment transport
- Flow and sediment mechanics

ECOLOGY

Investigate biological and microbiological processes that affect and are affected by the quality of water and evaluate environmental factors that determine the ecology and biogeochemistry of surface-water and ground water resources.

- Responses to climate variability
- Aquatic vegetation in rivers and wetlands
- Riparian vegetation and geomorphology
- Dynamics of plankton and benthic organisms
- Transport of solutes in estuarine systems
- Toxic substances and effects on biota
- Microbial biogeochemistry
- Microbial activity and transport in ground water
- Carbon fluxes across interfaces

Appendix 4
Geology for a Changing World. A Science Strategy for the Geologic Division of the U.S. Geological Survey, 2000–2010. Bohlen et al. 1999.

This report presents a science strategy for the Geologic Division of the U.S. Geological Survey (USGS) for the years 2000-2010. The report describes seven science goals conceived to address pressing issues facing the Nation in the next decade. In general, these goals focus on understanding human interaction with the natural environment and build upon long-term USGS investments in basic research on the fundamental geologic processes controlling how the Earth works. These goals are consistent with the USGS's mandated role as a Federal science agency charged with providing long-term monitoring, research, and assessments. Although investigations will typically be at the regional to national scale, more localized studies and demonstration projects will also be conducted, either on Federal lands or in other areas of national interest, to develop principles and methods that can be applied much more broadly. The goals are intentionally ambitious for a Geologic Division of its current size; success will require extensive collaboration with other USGS divisions, other Federal agencies, State geological surveys, and academic colleagues.

The first three goals define future thrusts in traditional areas of national leadership for the Geologic Division-studies of the Nation's geologic hazards and natural resources:

1) Conduct geologic hazard assessments for mitigation planning

2) Provide short-term prediction of geologic disasters and rapidly characterize their effects

3) Advance the understanding of the Nations energy and mineral resources in a global geologic, economic, and environmental context

There are strong links between the first two goals (see Highlight 1). Hazard assessments (Goal 1) integrate knowledge about the potential location, size, and frequency of a geologic hazard with knowledge of a region or site's vulnerability to the effects of such an event. Goal 2 addresses the division's role in providing timely information on both the likely and the actual geologic effects of disasters in the short term before, during, and after a hazardous event.

By embracing a global perspective on natural resource supply and demand in Goal 3, the Geologic Division will enhance its ability to inventory the Nation's earth resources. Such assessments must be backed by fundamental studies of the character and distribution of natural resources, as well as the economic benefits and environmental consequences of their development.

Climate-related studies already represent a significant Geologic Division effort and are expected to be of increasing importance in the next decade. The next goal relates to climate change:

4) Anticipate the environmental impacts of climate variability

This fourth goal defines a leadership role for the USGS within the US. National Global Change Program in carrying out regional- to national-scale syntheses on the following two topics: first, reconstructions of past climates from terrestrial records and, second, assessments of the potential impacts of climate change or variability.
The final three goals address societal issues that the USGS anticipates will be of growing importance in the next decade due to increasing concerns over quality of life:

5) Establish the geologic framework for ecosystem structure and function

6) Interpret the links between human health and geologic processes

7) Determine the geologic controls on ground-water resources and hazardous waste isolation

These goals represent modest Geologic Division efforts at present and are envisioned as largely collaborative or support roles in the future when the USGS will form new partnerships with other agencies and groups. They represent exciting opportunities whereby the Geologic Division can take advantage of the new USGS role as the Nation's earth science and biological science agency.

Highlights:

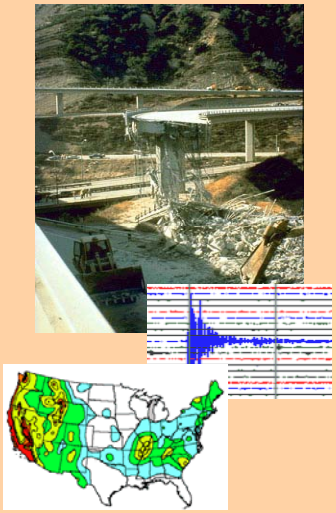
SCIENCE PROGRAMS

- Provide the science needed to support the sound management and conservation of our Nation's biological resources
- Provide objective, reliable earth-science information on geologic hazards and resources and the Nation's geologic framework
- Provide the Nation's basic geospatial data, ensuring access to and advancing the application of these data and other related earth science information for users worldwide
- Provide the hydrologic information and understanding needed by others to achieve the best use and management of the Nation's water resources

Biological Research and Monitoring

- Terrestrial, Freshwater and Marine Ecosystems
- Fisheries and Aquatic Resources
- Invasive Species
- Contaminant Biology
- Status and Trends of Biological Resources
- Wildlife and Terrestrial Resources
- Biological Informatics
- Cooperative Research Units

Earthquake Hazards



- Improve earthquake hazard identification and risk assessment methods and their use
- Maintain and improve comprehensive earthquake monitoring in the United States with focus on "real-time" systems in urban areas
- Improve the understanding of earthquakes occurrence and their effects and consequences

Volcano Hazards

- Assess and monitor potential volcanic hazards
- Provide warning information on volcanic activity and rapid monitoring response to events
- Improve scientific understanding of volcanic processes

Landslide Hazards

- Assess and monitor potential landslide hazards
- Provide warning information on landslide activity and rapid monitoring response to events
- Improve scientific understanding of landslide hazards

Geology science goals

1. Conduct geologic hazard assessments for mitigation planning
2. Provide short-term prediction of geologic disasters and rapidly characterize their effects
3. Advance the understanding of the Nation's energy and mineral resources in a global geologic, economic, and environmental context
4. Anticipate the environmental impacts of climate variability
5. Establish the geologic framework for ecosystem structure and function
6. Interpret the links between human health and geologic processes
7. Determine the geologic controls on ground-water resources and hazardous waste isolation

(*Geology for a Changing World*, USGS Circular 1172)

Geologic hazards, resources, and processes

- Geologic Hazard Assessments
  - Earthquake Hazards
  - Volcano Hazards
  - Landslide Hazards
  - Global Seismic Network
  - Geomagnetism
- Geologic Landscape and Coastal Assessments
  - Earth Surface Dynamics
  - National Cooperative Geologic Mapping
  - Coastal and Marine Geology
- Geologic Resource Assessments
  - Mineral Resources
  - Energy Resources

(DOI budget justifications and performance information, FY04)

Geologic hazards, resources, and processes

- Geologic Hazard Assessments
  - Earthquake Hazards
  - Volcano Hazards
  - Landslide Hazards
  - Global Seismic Network
  - Geomagnetism
- Geologic Landscape and Coastal Assessments
  - Earth Surface Dynamics
  - National Cooperative Geologic Mapping
  - Coastal and Marine Geology
- Geologic Resource Assessments
  - Mineral Resources
  - Energy Resources

(DOI budget justifications and performance information, FY04)

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Geological Survey of Sweden, SGU

The Geological Survey of Sweden, SGU, was founded February 23rd 1858 with the mission to map the bedrock and Quaternary deposits in the country. The main reason as in many countries was to serve the industrial progress and to investigate the natural resources and the possibilities for their exploitation. For the first time in 1950 the number of employees exceeded 100. Ten years later the number was more than 250 people. This year, 1960, the airborne magnetic measurements were started. Major activities at the Survey had so far been carried out from Stockholm but in 1971, the Parliament took the decision to relocate SGU to the cities of Luleå and Uppsala. Part of SGU moved to Luleå 1978 and the Head office to Uppsala1979. In 1982 SGU was divided into two parts and State-owned Company SGAB started its activities principally from Luleå with ore prospecting and airborne geophysical activities etc. After almost exactly 10 years, 1992, SGAB was winded up and the airborne geophysical activities were transferred to SGU in Uppsala. This year the Mineral Information Office was established in Malå.

SGU is a national authority responsible for questions relating to Sweden’s geological character and handling of minerals and a central government authority under the auspices of the Ministry of Industry, Employment and Communications. It deals with issues relating to the country's geological character and the management of its mineral resources.

SGU's tasks include:

1. investigating the bedrock, Quaternary deposits and groundwater of Sweden in order to meet society's needs for geological information, particularly within the fields of environment and health, physical planning, economy and supply of natural resources, agriculture and forestry, and the civil defence
2. working to promote an ecologically and economically balanced exploitation of the country's mineral resources
3. phasing out and ensuring the environmental safety of Sweden's national stockpile of petroleum products
4. dealing with matters in connection with mineral legislation and legislation relating to the continental shelf
5. being responsible for progress towards achievement of the national and environmental quality objective “Good-Quality Groundwater” and partly for “Good Urban Environment “ (Appendix 2)
6. promoting and supporting applied research in earth sciences
7. SGU is also the principal agency for the Mining Inspectorate.

SGU currently employs a staff of 290, most of who work at the head office in Uppsala. The rest work at the local offices in Gothenburg, Lund, Stockholm and Malå.

Photo: Lars Persson

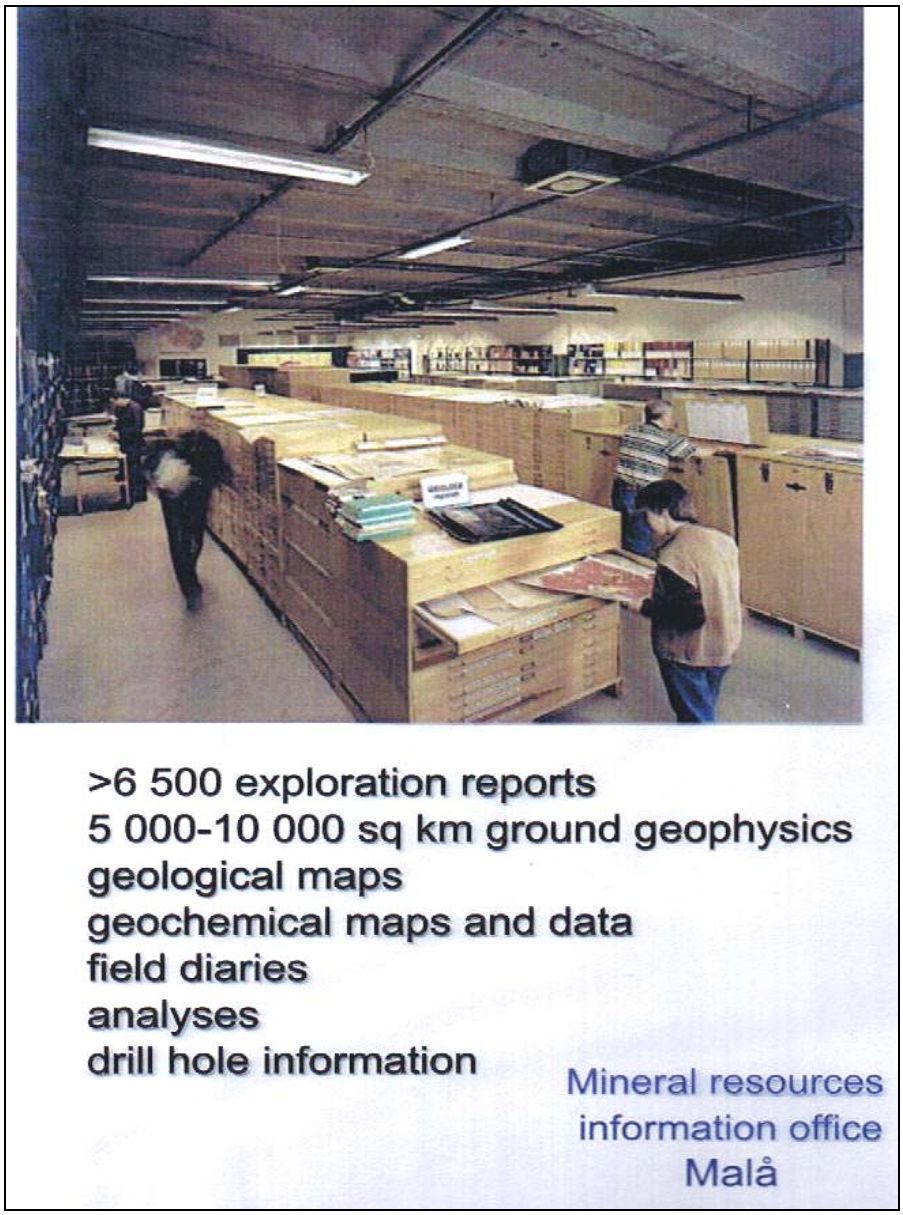
SVERIGES GEOLOGISKA UNDERSÖKNING

Uppsala = Head office, the others branch offices

SGU is the Government´s expert advisory body for analyses and statistics concerning the mineral market. Our task in this connection is to analyse the production data as a basis for decionmaking in both the public and private sectors.

The Mineral Resources Information Office in Malå, northern Sweden

SGU has a supporting role to the mining industry mainly by providing basic exploration data to interested parties. For this purpose it has a regional office located at Malå in northern Sweden. Malå is situated in the western part of the classic Skellefte district (130 km from Skellefteå), with numerous deposits of base metals and gold. The Mineral Resources Information Office (MRIO) primarily serves as a one-stop information office for exploration and mineral resources for all areas of Sweden. At the office, all exploration data collected by previous government-funded activity, as well as private exploration companies, have been merged and stored in archives and databases. The data cover all aspects of modern mineral exploration surveys in areas of glaciated terrain, e.g. airborne low-clearance geophysics, ground geophysics and basal till geochemistry. In addition to digital and hard copy data from exploration, the MRIO is also online with the Head Office in Uppsala, and has immediate and full access to all public data from the regular mapping programmes. Copies of reports and maps are in most cases available for a nominal charge or may be borrowed. The Swedish 'National Drill Core Archive' in Malå is also managed by the SGU and is a vast inventory, with more than 3 500 000 m of drill core in store relating to mineral exploration throughout Sweden. This facility provides a unique possibility to acquire immediate access to drill cores of interest (Exploration activities see Appendix 3).



Website: www.sgu.se

Questionnaire

General questions

- Mission of the Survey

We take responsibility for questions relating to bedrock, superficial deposits and groundwater. We do so by serving as a centre for geological information and an as an expert agency and through the exercise of our powers as a public authority.

- Vision

Our knowledge and information concerning geological conditions and minerals management will as a matter of course be put to use, resulting in well-founded decisions that promote economically, socially and ecologically sustainable development.

Overall objectives:

Our knowledge and information concerning the country's geology and the management of its minerals will meet the needs of society and be objectively based, easily accessible and well known.

Our active influence will help to promote sustainable use of the country's natural resources.

We will contribute to a high level of geoscientific knowledge in Sweden.

We will take a lead in national and international collaboration for the common good of society.

We will have clear corporate goals, competent managers and efficient operations that are continuously improved in terms of quality, health and safety at work, and impacts on the external environment.

We will offer an attractive place of work with a working climate that promotes health – characterised by equal opportunities, diversity and participation – and in which we cooperate with openness and respect for one another and for different skills, roles and tasks.

- To which Ministry it is allocated

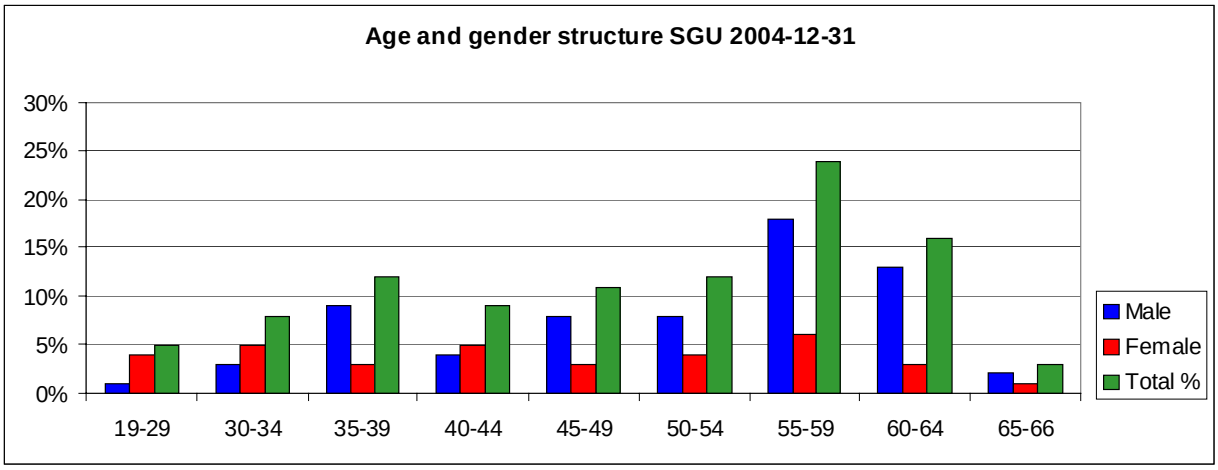
Ministry of Industry, Employment and Communications

- Number of employees
    - Geoscientists, %
    - Others, %

      See below
- Number of employees, development the latest 5 years
    - Geoscientists
    - Others

      See below

Year	Number of employees	Number of geoscientists	Others
2000	286	140	146
2001	269	130	139
2002	284	145	139
2003	288	155	133
2004	291	158	133

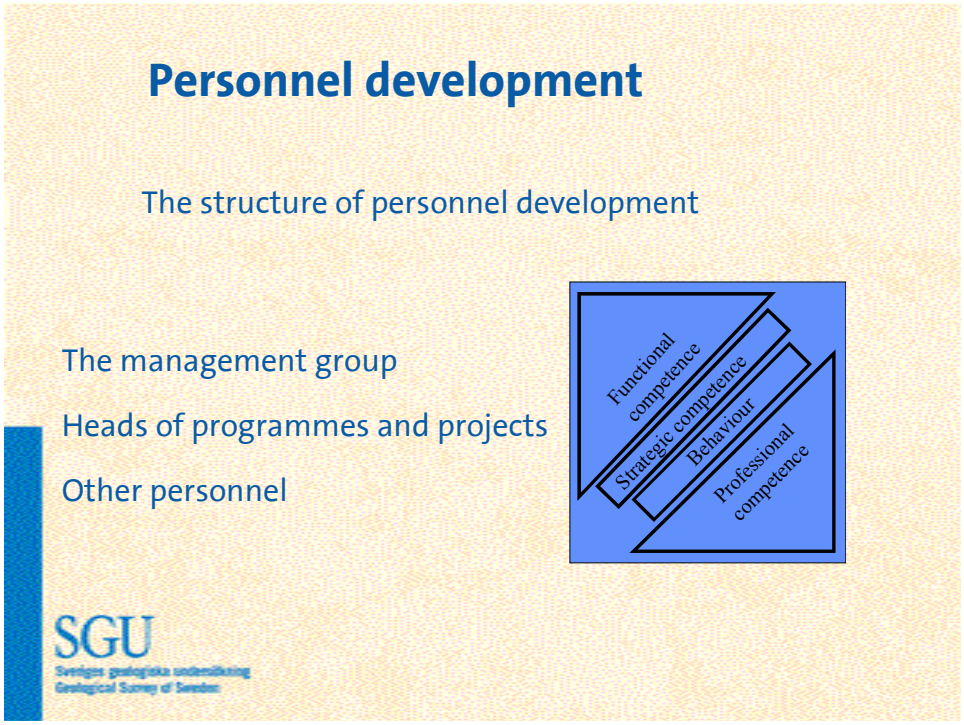


Prerequisites for increased productivity:

- Efficient organization and steering
- Recruitment of new and relevant competence
- Continuous education of staff
- Investments in
  - new methods
  - new equipment
- Research and development

Productivity depends on:

- Composition, competence, age structure etc of staff
- Market contacts



The strategic competence, i.e. knowledge and understanding of the business concept, objectives, organisation, market
and their consequences for the organisation.

The professional competence, i.e. professional knowledge directly related to today's and tomorrow's tasks,
including desirable knowledge beside traditional professional knowledge.

The functional competence, i.e. in different situations to be able to put the professional knowledge into practice, e.g. pedagogic, organisational and cooperative abilities.

Behavior, i.e. ethics, personal qualities, attitudes, service feeling, etc.

The structure of personnel development: The Management group

- Heads of programmes and projects
- Other personnel

- Financing
    - Total budget, Euro
    - State budget, Euro, %
    - Other sources, Euro, % (name the three most important)
    - Development latest 5 years, Euro, %
        - Total
        - State budget
        - Other sources

Year	2004	2003	2002	2001	2000
Total budget KEuro*	27 707	27 627	27 564	25 511	29 410
State	21 463	21 792	23 873	22 318	26 145
Other	6 233	5 835	3 691	3 193	3 265
State, %	77.5	78.9	86.6	87.5	88.9
Other, %	22.5	21.1	13.4	12.5	11.1

*1 Euro = 9 SEK

Income coming from:

- Governmental funding
- From commissioned work
- Subsidiary funding from external organizations
- Sales (maps and databases)
- From renting of equipment
- Who initiates/determines the programme of the Survey?
    - The Ministry
    - External Board
    - The DG
    - Others (please explain)

The Government determines the long-term plan, however after discussions/input from the Survey (DG). Programs are decided by the DG. At an earlier stage the External Advisory Councils and other interested parties are involved

- Is your Survey considered as a center of excellence?

Yes in Sweden by our stakeholders and customers

- % of the total yearly budget spent on research and development
    - Development the latest 5 years, Euro, %

Year	2004	2003	2002	2001	2000	1999
R&D KEuro*	1 373	1 734	1 627	1 346	1 232	676
R&D %	4.2	6.3	5.9	5.3	4.2	2.4
Contribution, Keuro'	582	1025	1407	592	558	706
Total %	7.1	10.0	11.0	7.6	6.1	4.9

*1 Euro = 9 SEK
' Contibution to other organisations

Three main fields of R&D:

1. SGU financed Research and Development
2. Co-financed Research and Development
3. Support for Geoscientific Research.

- % of the total yearly budget spent on marketing commercial activities

≈1.5% marketing of turnover in contract services
≈10% are costs for the direct management of contract services
≈20% are costs for the coverage of indirect administrative support and housing

- Development the latest 5 years, Euro, %

Year	2004	2003	2002	2001	2000	1999
Marketing, Euro*	110 556	108 000	127 889	133 000	121 889	136 444
Marketing %	0.4	0.4	0.5	0.5	0.4	0.5

- 1 Euro = 9 SEK

- Please describe briefly your fields of international co-operation

  As an integrated part of SGU´s R&D activities, SGU actively take part in international co-operation in areas, specially those in minerals, soil, groundwater, geomedicine, conservation of natural heritage, land use and planning, natural hazards and aggregates, development of webservices
  SGU also takes part in EGS (Eurogeosurveys) and FOREGS (Forum of European Geological Surveys)

- Please describe your involvement in various EU-financed projects, their type, size, extent and partners for the last 3 years and future outlook

  During the last 3 years SGU has been engaged in a number of EU-financed projects, the largest being EUROMARSIN (European marine sediment informaltion network), NORISC (Network oriented risk assessment by in situ screening of contaminated sites), EUROSEISMIC (European seismic metadata and information centre), GEONAT (Geological information and nature values for sustainable development of the Kvarken area), PNASTINA (Promotion of natural stone industry in northern areas). The last two are financed under the INTERREG IIIB program. SGU is also involved in EC and the Council activities concerning groundwater and waste from mineral industry.
  Even in the future SGU will strive to take part in various collaborative EU-funded projects and continue to provide experts for the Commission and Council. Commissions initiatives like INSPIRE (Infrastructure for Spatial Information in Europe), GMES (Global Monitoring of Environment and Security), GEOSS (Global Earth observation system of Systems) and Thematic Strategy on the Sustainable use of Natural Resources are of interest for SGU.

  - How needs of societal geoinformation are taken into account
    - Through permanent advisory boards with user representatives

    Yes

Advisory Councils

Appendix 5. Advisory Councils

Exploration Mapping:

Lars Ljung, Chairman	SGU
Naz Ahmed Shaikh, Vice chairman	SGU
Torsten Börjemalm	Alcastone Diamond Exploration AB
Jim Coppard	Anglo American Exploration BV
Wiking Andersson	Boliden Mineral AB
Knut Sörensen	LKAB
Karl-Åke Johansson	Lappland Goldminers AB
Göran Theolin	Länsstyrelsen i Jämtlands län
Eva Johansson	North Atlantic Natural Resources AB
Jan-Ola Larsson	Beowulf Gold
Wolf Schuh	Phelps Dodge Exploration Sweden AB
Dave Cliff	Rio Tinto Mining and Exploration LTD
Michael Nilsson	Scan Mining AB
Fredrik Grensman	Dragon Mining Sweden AB
Peter Juvel	SMA Karbonater AB
Åke Andersson	Mineralgruppen i Jämtlands län
Paul Hammergren	Tricorona Mineral AB
Lars Malmström	Zinkgruvan Mining AB
Tore Vrålstad	Yara International ASA
Malin Sträng, Secretary	SGU

Mineral resources:

Lars Ljung, Chairman	SGU
Sven Arvidsson, Vice chairman	SGU
Erland Lindqvist	Metall
Mati Sallert	Boliden Mineral AB
Knut Sörensen	LKAB
Lennart Widenfalk	Luleå tekniska universitet
Per-Arne Blad	Krisberedskapsmyndigheten
Hans Sandberg	Jernkontoret
Marianne Thomaeus	MinFo
Lennart Laurén	Nordkalk Oy AB
Tomas From	Svenska Gruvföreningen
Lars M. Hultkvist	Sveriges Bergmaterialindustri
Kaj Hjulbäck	NUTEK
Carl-Otto Frykfors	Vinnova

Sven Gunnar Bergdahl	Bergsprängningskommittén
Kurt Johansson	Sveriges Stenindustriförbund
Åke Berg, Secretary	SGU

Physical planning:

Lars Ljung, Chairman	SGU
Jacob Johnson, Vice chairman	SGU
Assar Lundqvist	Boverket
Öivind Toverud	Statens kärnkraftsinspektion
Anders Carlsson	Swedpower AB
Kjell Windelhed	Bergsprängningskommittén
Lars-Gunnar Hellgren	Göteborgs stad
Dick Karlsson	Svensk Teknik och Design
Jan Bida	Sveriges Bergmaterialindustri
Kurt Hagenrud	Vägverket Region Skåne
Anders Nelson	Sv. Brunnsborrares Branschorganisation
Mats Henriksson	Länsstyrelsen i Västernorrlands län
Peter Wenster	Svenska kommunförbundet
Bo Olofsson	Institutionen för Mark- och Vattenteknik, KTH
Mårten Lindström	Sveriges Byggindustrier
Olov Niska	Banverket
Stig Norberg	Länsstyrelsernas GIS/IT-grupp
Bengt Blad	Energimyndigheten
Anders Carlstedt, Secretary	SGU

Environment and land use:

Lars Ljung, Chairman	SGU
Johan Anderberg, Vice chairman	SGU
Lennart de Maré	Jordbruksverket
Sven Swedberg	Länsstyrelsen i Västra Götaland
Ola Landin	Svensk Teknik och Design
Mats Olsson	SLU
Lars Erik Larsson	Svenska Torvproducentföreningen
Ulf Lindh	Metallbiologiskt Centrum
Taina Bäckström	Statens strålskyddsinstitut
Per Lilliehorn	Byggsektorns kretsloppsråd
Magnus Bergström	Norrtälje kommun
Agneta Peterson	Uppsala kommun
Mattias Sköld	Fiskeriverket
Bengt Fladvad	Svealands Kustvattenvårdsförbund
Karin Hanze	Kemikalieinspektionen
Sören Dahlén	Banverket
Olov Selinus, Secretary	SGU

Support for geoscientific R&D

Naz Ahmed Shaikh, Chairman	SGU
Bert Allard	University of Örebro
Sten-Åke Elming	University of Technology, Luleå
Lars O. Ericsson	Chalmers University of Technology, Gothenburg
Svante Björck	University of Lund
Håkan Sjöström	University of Uppsala
Stefan Claesson	Museum of Natural History, Stockholm
Olov Selinus, Secretary	SGU

- By regular meetings with user organisations and decision makers at various level

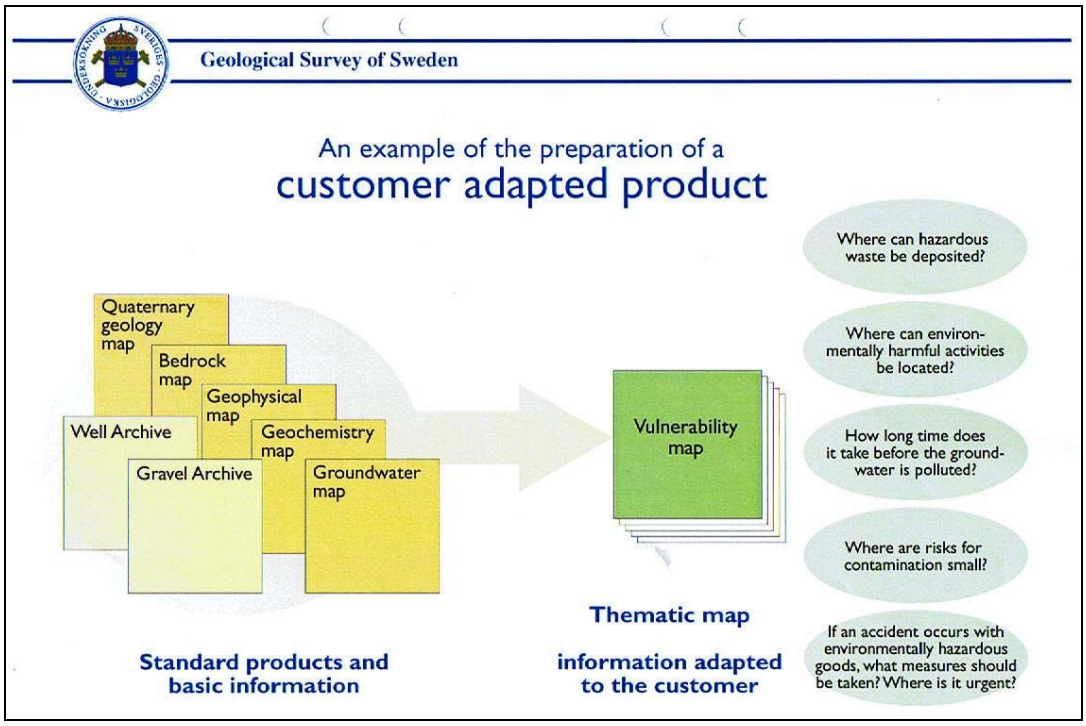
Yes

- Surveillance by the survey itself

Yes

- By complimentary directives from the Ministry

Yes



- How and who makes the priority among the various societal demands?

The Ministry and SGU

- How the performance of the survey is evaluated/measured
    - Regular external evaluation

      Regular external evaluation by the State Audit Institution.
    - Showing performance indicators in the Annual Report

      Annual Report of achievements with respect to government set goals and using performance indicators
    - Do you have quality management ISO 9001

The contract services are certified according to the standard ISO9001: 2000, since 2001. SGU as a whole plan to be certified according to the standards 9001 and 14001 in 2005. Analytical laboratory is accredited according to ISO 17025.

- What is your prime objective in communicating?
    - To receive more funding

      To certain extent
    - To market the geoinformation you have in an understandable way

      Yes

The contract services contribute to and follow the general SGU communication policies and strategies

- Please describe your main customers or users of your information and services

Customers	2000	2001	2002	2003	2004	Summa
Counties & municipalities	29 295	80 998	23 687	365 598	49 494	**549 072**
Governmental authorities	196 875	128 460	132 667	79 599	100 705	**638 306**
Enterprise	66 642	66 222	79 288	91 306	44 061	**347 519**
Universities & schools	15 952	21 331	26 014	14 925	16 999	**95 221**
Foreign activities	31 307	16 605	13 229	17 647	9 405	**88 193**
Others	11 959	4 529	14 049	15 293	14 801	**60 631**
Sum						**1 778 942**

1 Euro = 9 SEK

- Please describe the main societal sector where your products and information is used today

See the table above

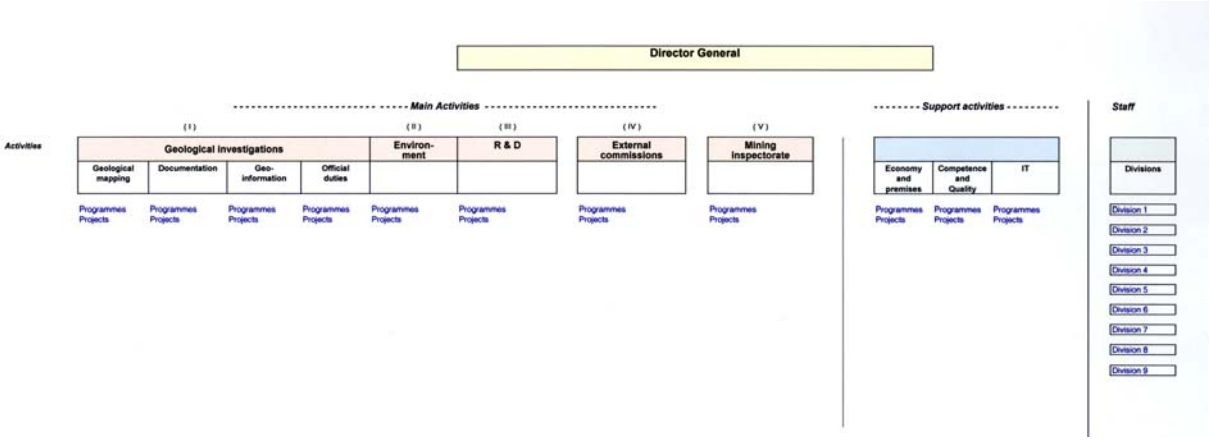
- Do you have a policy for the pricing of your products?

Yes

Organisational structure

- What organisation type has the Survey?
    - Hierarchic
    - Matrix (programmes and projects)

    Matrix, programmes and projects
    - Please provide an organisation chart



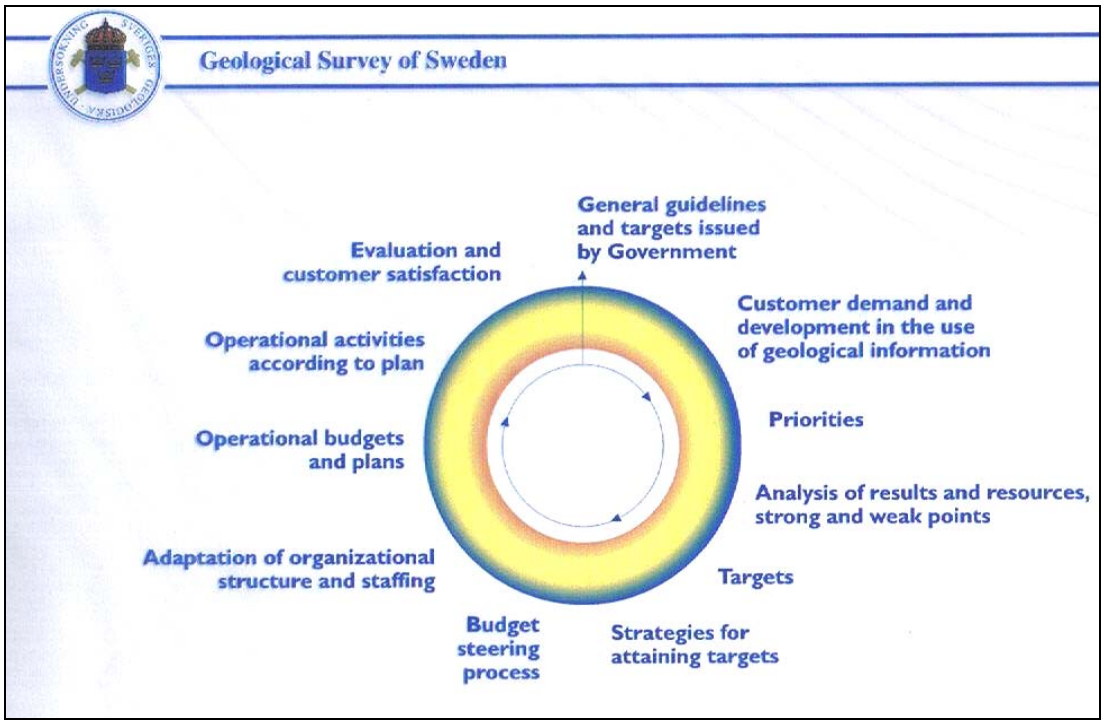
- Do you consider your Survey as
    - A demand oriented organisation

    Yes
    - A traditional geoinformation producer organisation

    To certain extent
- If you are demand oriented, what changes were necessary to adapt to this role

    Establishment of five Advisory Councils, customer Surveys, multidisciplinary way of working, more focus on applied R&D (Advisory Councils see Appendix 4)
- How much of the project work is outsourced (in house/out-house activities, % of the total amount spent in the last 3 years)

Chemical, rock mechanical and isotope analyses. Airplane rented for the geophysical measurements



Activities

- How much of the land area (%) and continental shelf area is covered by modern (not older than 30 years) geological maps in various disciplines

Discipline/Coverage	Local scale, %	Regional scale, %
Bedrock	50	75
Quaternary deposits	40	20
Groundwater	7	100
Geochemistry		45
Biogeochemistry		60
Geophysics		85
Marine geology	15	40

- Resources provided in last 5 years to various core projects respective disciplinary projects

Disciplines	Sum, KEuro	Urban areas	Orepotential areas	Regional mapping
Bedrock	10.3	4.0	3.9	2.4
Quaternary deposits	5.9	2.8	0.1	3.0
Marine geology	6.6	3.3		3.3
Groundwater	3.3	2.9		0.4
Geophysics	3.6			3.6
Geochemistry	2.5	1.0	0.8	0.7
Total, KEuro	32.2	14.0	4.8	13.4

1 Euro = 9 SEK

- Is both primary and synthesized information in digital form and available in databases?

Yes

- Is geological data accessible for users/customers on line?

Parts of 11 of the 64 SGU databases are accessible as on-line map-services at www.sgu.se (wells, 1:1 mill., bedrock, soil and groundwater maps, isotope age database, mineral resources, mineral production, geochemistry, biogeochemistry, springs)

- Is it possible for users to download information from your databases on line?

No

- If so how is that financed and what are the terms of usage?
- What is your linkage with other players in the innovation system?

Networking with relevant organisations

- What is the general length of a project?
    - Core projects (e.g. geological mapping)
    - Co-operation and research projects (partially subsidized) These projects also include bilateral projects

    Generally 2-4 years
    - The activities are grouped in disciplines
        - Bedrock geology
        - Bedrock quality for construction
        - Quaternary geology
        - Mineral prospecting (Base mapping and information service)
        - Groundwater
        - Geophysics
        - Geochemistry
        - Marine geology
        - Environmental studies

Map production

The **main** maps produced during the regular activities are described below. ***Bedrock maps*** are used in the exploration for natural resources like metallic and non-metallic minerals, dimension stone, and crushable rock as a replacement for natural gravel resources. Bedrock maps are also the basis for planning of building and plant construction, and are used increasingly in environmental conservation contexts. Bedrock maps are produced at scales between 1:50 000 and 1:400 000 and many maps are provided with separate descriptions. Digital information on lithology, structures, and stratigraphy is also available at scales 1:50 000 and 1:250 000.

Rock quality maps are compiled from regular bedrock maps with the addition of point information. The maps show main structural features, depth to bedrock surface, areas of high radium index in addition to a classification of the bedrock, technical analyses on point samples include e.g. the Nordic test for studded tyres, Los Angeles test, and point load index.

Quaternary deposit maps are important in physical planning for building and plant construction, environmental conservation contexts, searching for gravel and groundwater, localization of environmentally hazardous activities, cable- and pipe-laying, and passability. Quaternary deposit maps are available at scales between 1:50 000 and 1:400 000 with separate descriptions provided with many maps. Digital information on distribution, properties, and stratigraphy of Quaternary deposits is also available at scales 1:50 000 and 1:100000.

Groundwater (hydrogeological) maps form a basis, among other things, for water planning and for establishing groundwater protection measures. Maps are available at 1:50000 and 1:250 000 with separate descriptions to each map. Available digital information includes location and size of larger groundwater reservoirs and usually also classification of vulnerability.

Marine geological maps show the Quaternary deposits of the Swedish part of the continental shelf and provide information concerning dynamic sea-bed conditions, availability of certain industrial minerals, and environmental monitoring They are also an important source of information for biological inventories, aquaculture, fisheries, and defense.

SGU supplies two types of ***geochemical maps:*** biogeochemical and soil geochemical at the scales of 1:250 000 and 1:1 000 000. Biogeochemical maps show variations in heavy metal concentration in the environment,

resulting either from natural geological conditions or from human activities. Soil geochemical maps show pH and natural occurrence of elements in till and are used to show surplus and deficiency areas for nutrients and trace elements, as well as state of acidity. Available digital information consists of a total of about 74 000 positioned observations.

Geophysical maps are used primarily as a basis for geological bedrock mapping, prospecting for mineral resources, and planning purposes. SGU can provide information on the magnetic field, gamma radiation, electromagnetic field, and gravity, which can be used to produce interpretations on geological structures, rock type distribution, depth distribution of lithological units, and crush zones and faults. Maps are produced mainly as print-on-demand products

Customized products

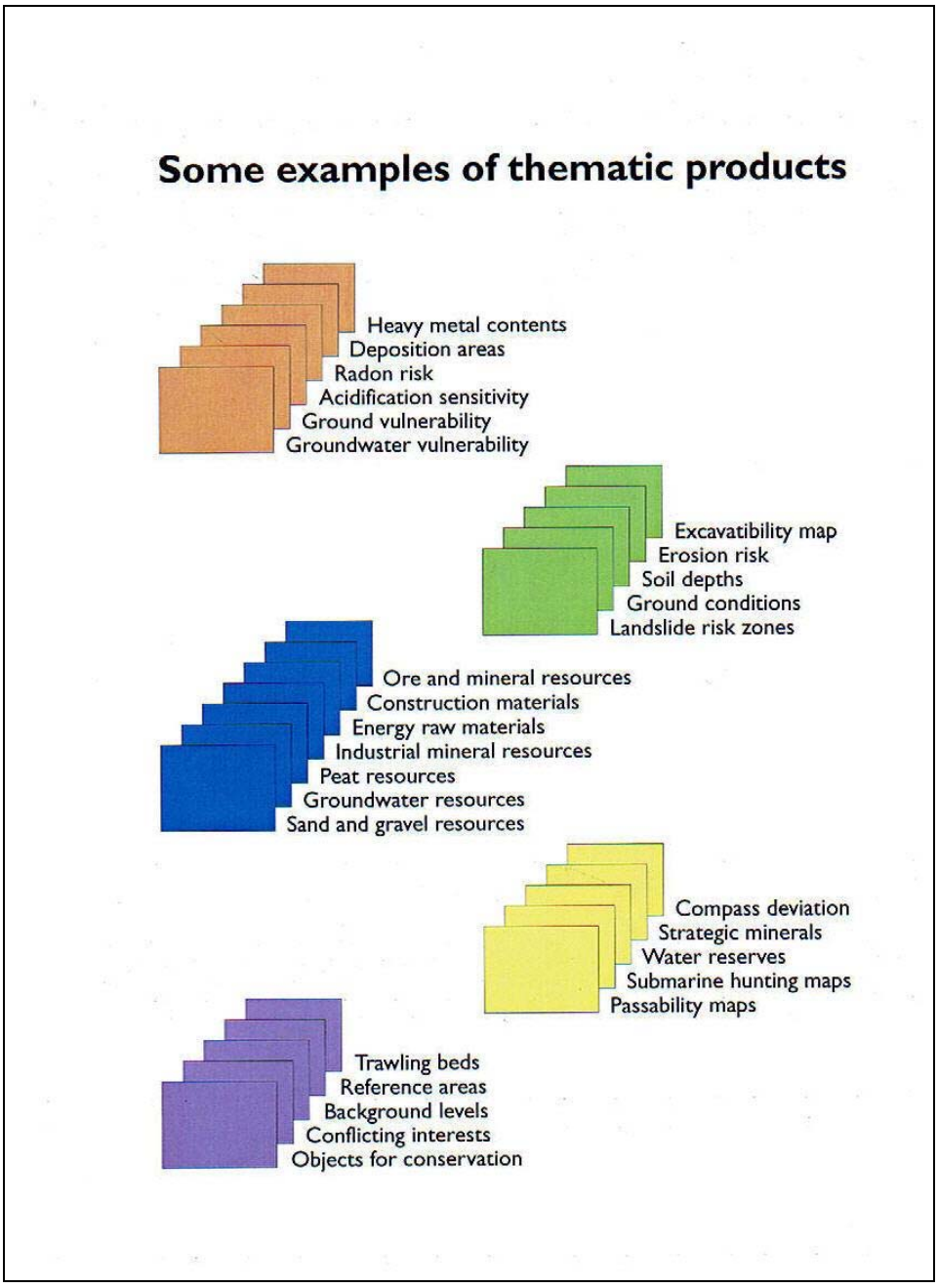
The application of new methods in field work and the increasing use of databases has made it possible to produce thematic products which meet the demands of customers from local, regional, and governmental authorities, private enterprises, consultants, scientific institutions, and the general public. Commissioned projects are carried out and recent examples include investigations in all geoscientific disciplines around major cities and detailed mapping in smaller areas to meet demands from the dimension stone industry. Other examples of customized products are vulnerability maps for groundwater, acidification sensitivity maps, passability maps, radon risk maps, and rock quality maps.

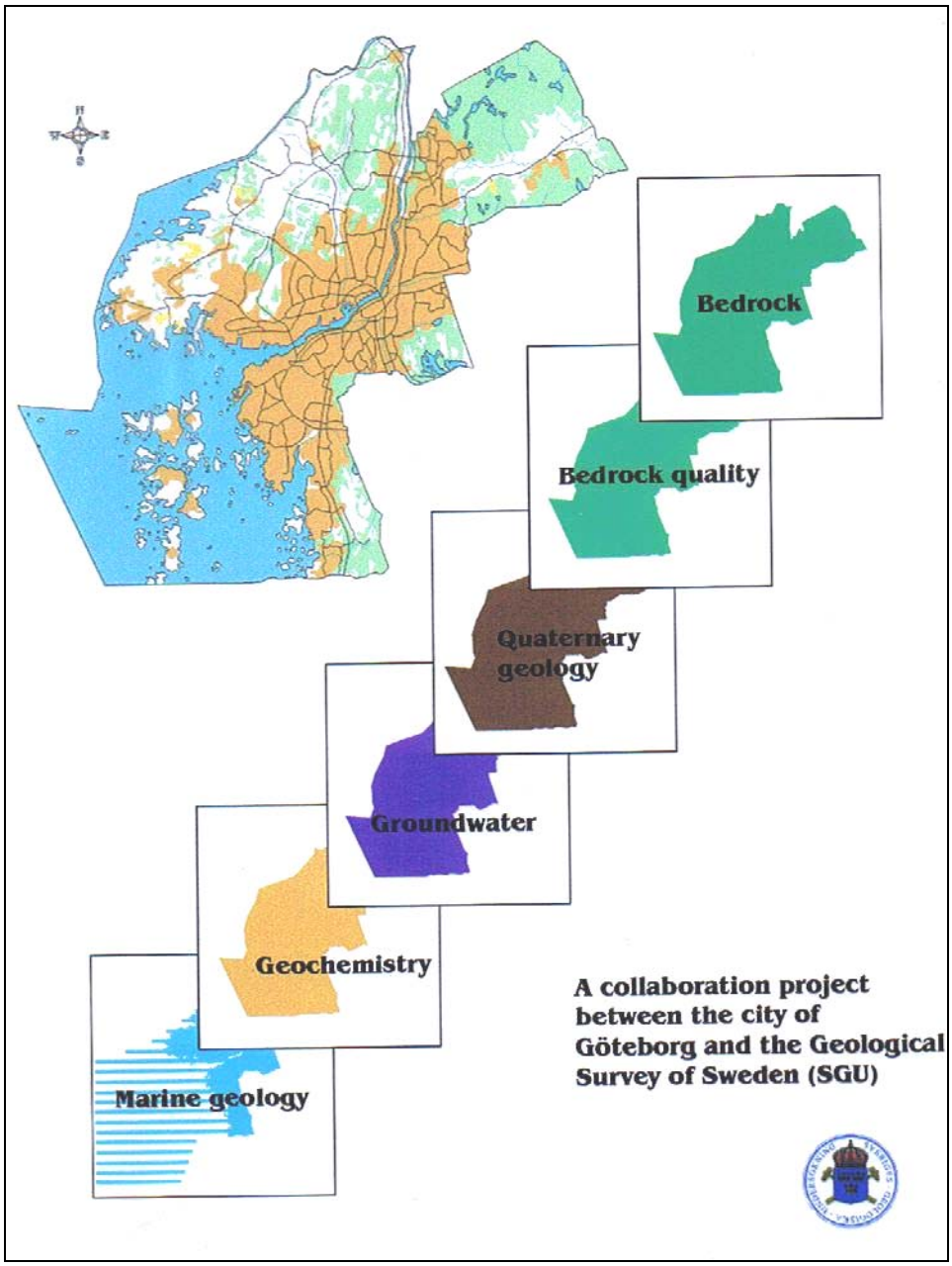
A ***vulnerability map*** is compiled from Quaternary deposit and groundwater maps and databases and shows the major groundwater resources and which of these are susceptible to infiltration of pollutants. The map commonly forms the basis for groundwater protection in a municipality. The map also shows the position of important public and private reservoirs. It can easily be supplemented to show refuse dumps, including disused sites. The maps can also be used to determine the best routes for transport of environmentally hazardous material and to provide information on where and how measures must be taken to protect groundwater and reservoirs.

Acidification sensitivity maps show the buffering capacity of ground and groundwater against acidification. Bedrock and quaternary deposit maps form the main sources of information. The map is based on several parameters, e.g. bedrock acidity, stratigraphy of Quaternary deposits, content of calcium carbonate in the Quaternary deposits, and groundwater level.

A ***passability map*** is based on Quaternary deposit data, and shows ground with low carrying capacity and boulders, which may restrict passability in the terrain.

SGU can compile data for geological factors, which affect the occurrence of ground radon. A ***radon risk map*** shows the radon content in soil-bound air.


Some examples of thematic products
Heavy metal contents
Deposition areas
Radon risk
Acidification sensitivity
Ground vulnerability
Groundwater vulnerability
Excavatibility map
Erosion risk
Soil depths
Ground conditions
Landslide risk zones
Ore and mineral resources
Construction materials
Energy raw materials
Industrial mineral resources
Peat resources
Groundwater resources
Sand and gravel resources
Compass deviation
Strategic minerals
Water reserves
Submarine hunting maps
Passability maps
Trawling beds
Reference areas
Background levels
Conflicting interests
Objects for conservation



The Göteborg project

Commercial activities

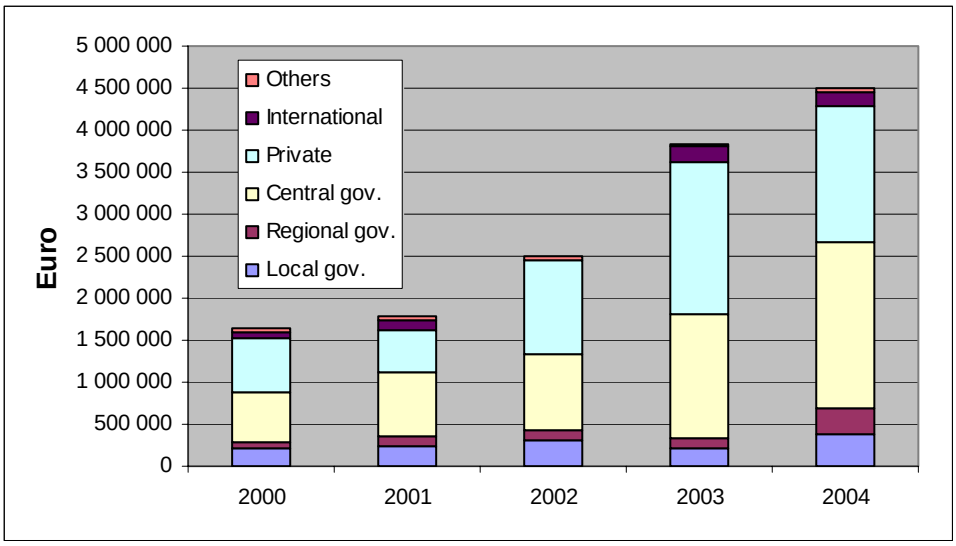
- Turnover, Euro

4.5 MEuro (contract/consulting services)

- Development the latest 5 years

Year	2004	2003	2002	2001	2000
Commercial, KEuro*, total	4 612	3 914	2 547	1 828	1 685

* 1 Euro = 9 SEK



- National (name the three most important sectors)

- Environment (contaminated sites, marine, groundwater monitoring and protection)
- Natural resources (promotion of stone and mineral deposits development)
- Energy (nuclear waste disposal, geothermal)

- Development the latest 5 years

- International (name the three most important sectors)

- Environment (contaminated sites, groundwater management)
- Mineral sector (geophysics and geological mapping)

- Development the latest 5 years
-

International work	**2004**	**2003**	**2002**	**2001**	**2000**
Euro	163 000	230 000	40 000	141 000	76 000

- Is external income demanded? If yes what limit is given?

Not demanded but allowed by the Ministry. Motivated as value-added services.
No set value or percentage of turn-over but the contract services are limited to a yearly volume that do not negatively effect planned Government funded activities for that year
The Business idea is: *"To meet customer demands of products not supplied by SGU government funded works"*

GOVERNMENT DIRECTIONS

"SGU may undertake consulting services that are closely connected with the government funded works and in such extent as allowed by ongoing government funded activities"

- In a business-like way
- Full cost coverage (direct and indirect costs)
- Profit required in international assignments

SGU
Sveriges Geologiska Undersökning

MOTIVES

- A more effective use of SGU resources
- Enhanced knowledge on society's need and use of geological information
- Marketing effect of SGU products and services
- Specific demand of SGU information and knowledge
- Contribution to SGU human resources management
- Contributes to a good overall SGU customer service

= Added value

SGU
Sveriges Geologiska Undersökning

- Is the pricing of services/products standardized?

Yes, in terms of hourly or daily fees for personnel and equipment used.

- How high and what type are the overheads?

Overheads are based on the full cost principle – coverage of direct and indirect costs. Ca 70-80 % on salary and social costs

- Is there any especially designed profit centers?

No

- What is done with the profit gained?
- Contract services shall not gain profit with the exception of the international part.
- Profit gained is accumulated and is in principle only available for the development of the contract services. If the accumulated profit exceeds 10% of the turnover a given year, the ministry must be notified, and measures decided upon.
- Yearly losses are in the same way covered by accumulated surpluses from earlier years.

Future outlooks

- Does your Survey have a strategic plan for the next 5-10 years?

Only for geological mapping. Present plan to 2008 (see Appendix 1). New plan under preparation

- Tendencies for the future budgets (ratio of state's budget and external income)

No changes expected in state budget. External income may increase

- How the various EU-projects affect your present and future activities

Participation in EU-funded projects as a result from FPs and as a result from various directives, is of great importance now and will continue to do so in the future

- Tendencies for commissions, volume and trends

↑ - Environment (contaminated sites, marine, groundwater, monitoring)
↑ - Natural resources (promotion of stone and mineral deposits development)
↑ – Energy (geothermal and CO2-disposal)
↓ - Energy (nuclear waste disposal and from an exceptionally high level)
↓ – Infrastructure
Estimated long-term turnover in contract services is 3.5-3.7 MEuro.

- Investments in the future (please describe in which fields)

Mainly reinvestments are stipulated

- Do you think that geological mapping will be still an activity in the next decade and be your core activity?

Yes, demand-oriented

- How you listen to decision-makers to identify important future issues

  A large number of decision-makers are represented in our Board and Advisory Councils, each of which has meetings at least twice a year. SGU has regularly contacts with municipalities, counties, geoconsultants etc. SGU has a number of bilateral agreements with other authorities and in these context regular meetings to exchange ideas

- How do you respond to the expectations of society?

SGU tries continuously to adopt advice in the course of its various activities

- How you influence public perception of your work?

  Customer contacts, information to the general public through media (website), exhibitions, fairs, courses, popular publications, invited lectures and special arrangements like the “Day of Geology”

- What services are likely to be abandoned in the future?

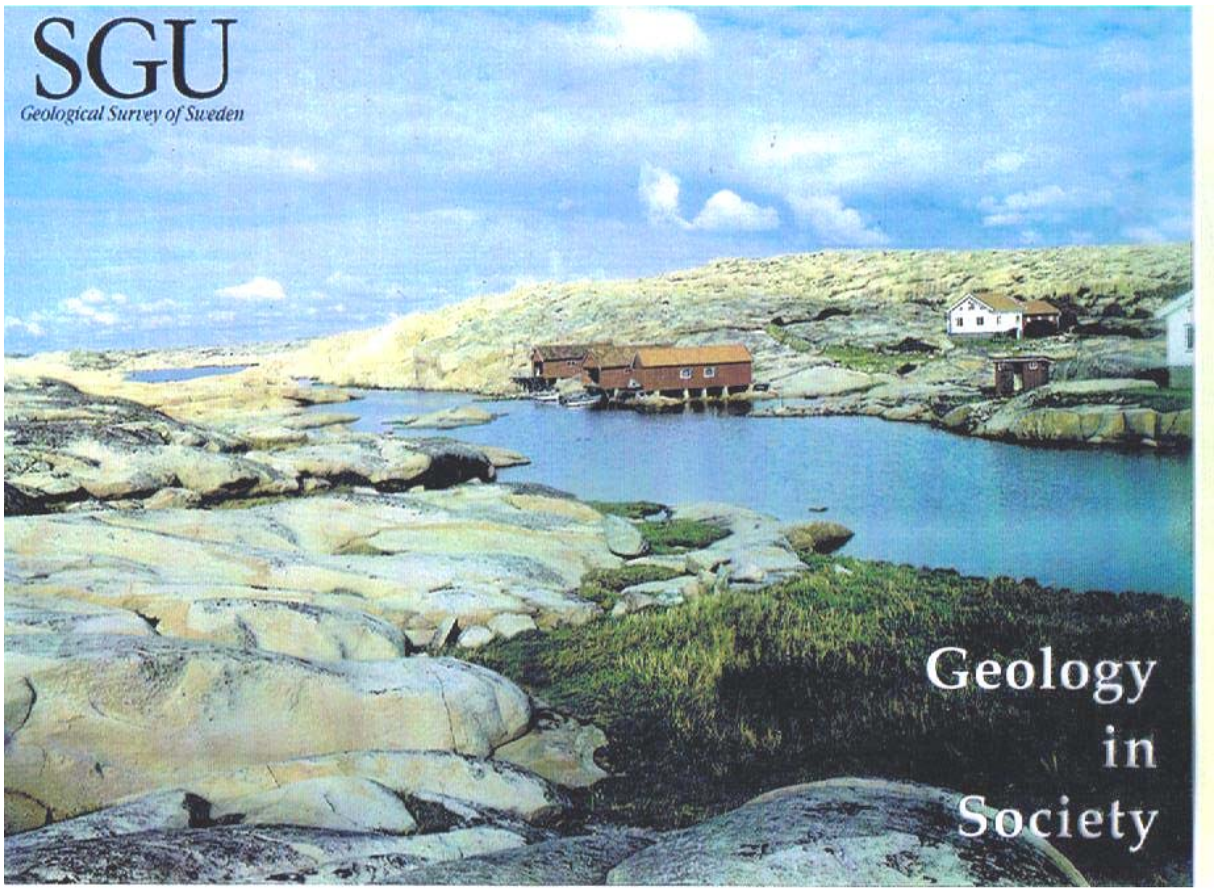
  A new plan for the activities after 2008 is under preparation

- What services are going to be extended?

  A new plan for the activities after 2008 is under preparation

- Are any new services planned, if yes which?

A new plan for the activities after 2008 is under preparation.



Appendix 1. Future plans

By year 2008 the databases should contain general geoinformation on:

- Bedrock throughout the entire country
- Occurrence and extent of different soil types throughout Sweden, including the continental shelf
- Important groundwater reserves throughout Sweden and possibilities for exploitation of groundwater
- Magnetic properties of soils and bedrock throughout Sweden, and the natural radiation (with the exception of certain sparsely populated areas of the country)
- Till geochemistry within areas with mining potentials
- Biogeochemistry within the densely populated parts of the country

Digital bases with general geological information on the **regional level** for the entire country. The information contained will be wide and correspond to the needs within different sectors of society.

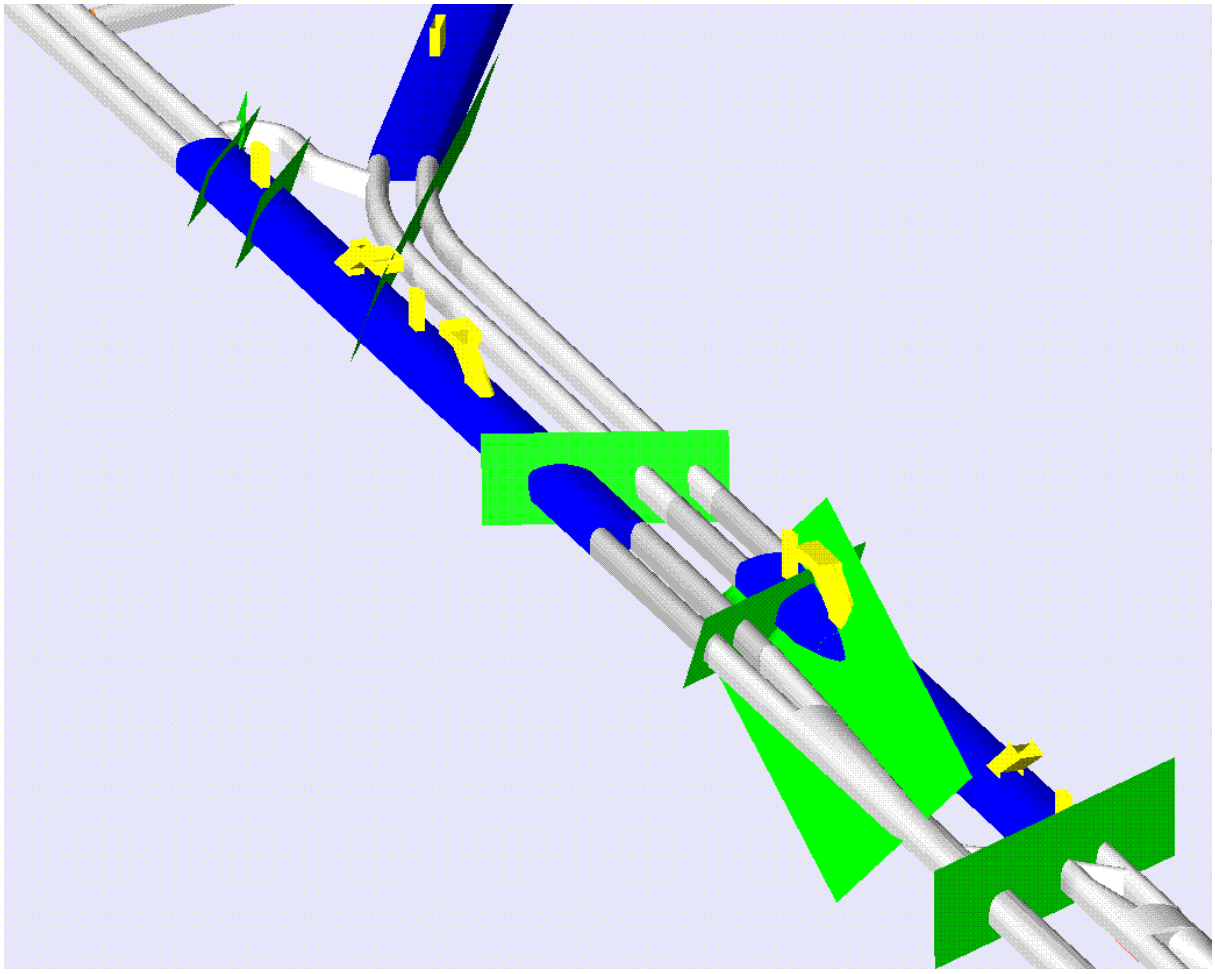
Digital bases containing geological information on the **local level.** The content of information and the geographical areas covered will give priority mainly to the needs for planning and environment in urban districts, infrastructure investments, economising with, and supply of, natural resources such as industrial minerals, ores, aggregates and groundwater.

- Large population centres with neighbouring areas of land and sea. These population centres can be defined as areas where, within a radius of 30 km from any point in the area, there are at least 100 000 inhabitants. Such areas constitute about 10% of Sweden's total area.
- Areas with mining potential, that are estimated to make up 20–25% of Sweden's total area.

Local level: Relatively dense and detailed information. E.g. maps in the scale of 1:50 000 or 1:100 000
Regional level: More sparsely collected information or a generalisation/selection of information found in the local level. E.g. County maps in the scale of 1:250 000–1: 500 000
National level: Very sparse or generalised information. E.g. maps in the scale range 1:1–2.5 million.

Geoinformation supply in the future:

The following demands should be placed: Need-differentiated geoinformation must be available for the entire country And be available in digital form. When necessary it can be made available in the form of printed or plotted maps. Subsurface geology is of special interest.



Geological and engineering geological data from the railway link between central Stockholm and the international airport Arlanda is stored at SGU. 3D-information was provided during the construction of tunnels mainly demonstrating rock contacts, joints, faults, water leakage and drilling (rock cores) giving information for support and reinforcement.

Appendix 2. Environmental objectives

15 national environmental quality objectives.
(Prop. 1997/98:145 Svenska miljömål, Riksdagsbeslut april 1999) Clean air

- **High quality groundwater**
- Sustainable lakes and watercourses
- Flourishing wetlands
- A balanced marine environment and sustainable coastal areas and archipelagos
- No eutrophication
- Natural acidification only
- Sustainable forests
- A varied agricultural landscape
- A magnificent mountain environment
- **A good urban environment**
- A non-toxic environment
- A safe radiation environment
- A protective ozone layer
- Limited influence on climate

Groundwater bearing geological formations of importance for present and future water supply shall at latest year 2010 have a long-term protection against exploitation that limit the use of water. At latest year 2010 the use of land and water shall be such that changes in groundwater level do not lead to negative consequences for drinking water supply, stability of ground or fauna and flora in associated ecosystemsAt latest year 2010 shall all groundwater bodies used or intended to be used for abstraction of drinking water in amounts exceeding 10 m^3 per day on average or supply more than 50 persons comply with valid Swedish standards for drinking water of good quality regarding anthropogenic pollutants
At latest year 2009 management plans are produced according to the Water Framework Directive that indicates how good groundwater status shall be achieved.

High quality groundwater:

Groundwater shall provide a safe and sustainable drinking water supply and contribute to a good environment for plants and animals in lakes and watercourses.

Appendix 3. Exploration activity

During 2004, new exploration permits were granted for a total area of 3,940 km^2. By year-end, exploration permits covered 8,790 km^2, or almost 2% of the entire country. The number of companies and exploration organisations possessing exploration permits totalled 45. 47 private individuals also held permits but such permits are insignificant in size.

Mineral Hunt

Every year since 1967 a competition called ‘Norrlands Mineraljakt’ (Mineral Hunt) has been arranged. Today it comprises the five northernmost counties covering about half of Sweden. All members of the public, except professional explorers, can participate. The annual total prize money is around US$20,000. The aim is to receive indications of new areas of metals and industrial minerals potential, with the ultimate aim of developing mineral projects, thereby creating jobs in remote areas. Exploration companies participate in the evaluation of the best finds.

Mineral Policy and Legislation

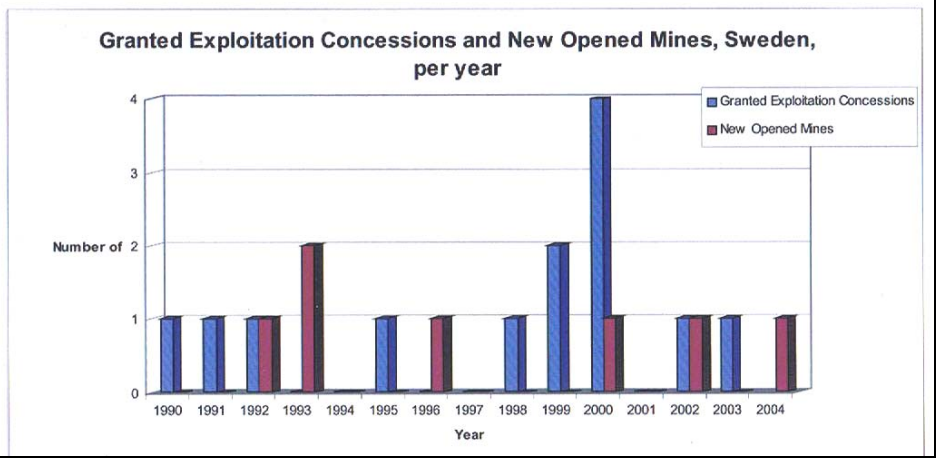
Mineral exploration and extraction in Sweden is regulated under the 1992 Minerals´ Act. The authority responsible for administration of matters under the Act is the Mining Inspectorate (Bergsstaten).

Under Sweden's Minerals Act, an exploration permit gives the holder the right to enter and explore on anyone's land. It also gives the holder the right to obtain an exploitation licence if an economic mineral deposit can be proven and the environmental aspects are acceptable. According to an amendment to the Act proposed in Parliament, landowners will be entitled to some compensation for the minerals extracted.

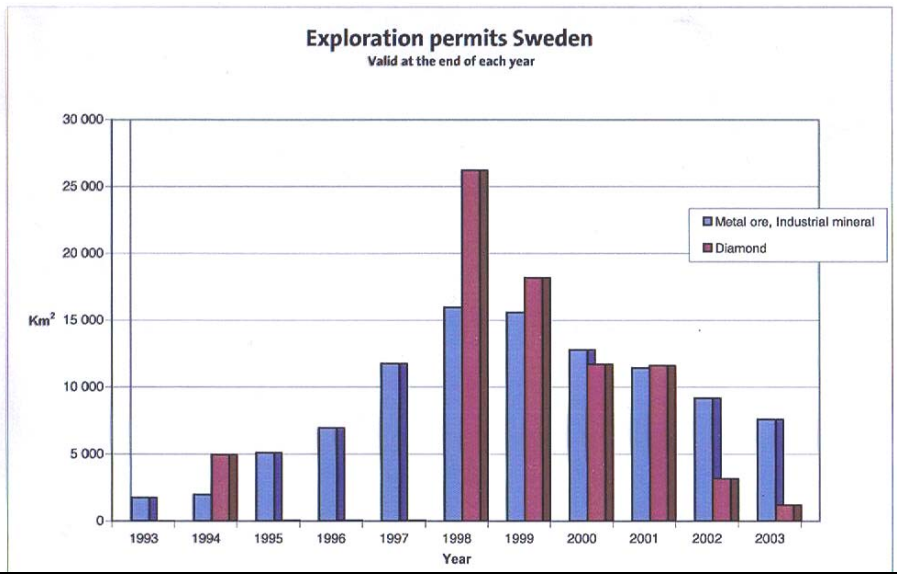
Role and Services of the Geological Survey

SGU has been researching the country's mineral potential for nearly 150 years and acts as the national centre for information on mineral policy and is the principal authority for the Mines Inspectorate, in addition to its role in geological data collection.

MINING INSPECTORATE OF SWEDEN



MINING INSPECTORATE OF SWEDEN



Comparison

General introduction

This comparative study is broad and addresses various aspects of the participating Geological Surveys. It is apparent that in recent years governments have restructured these organisations and their mandate is adopted to meet the present and upcoming societal needs for the geoscientific information.
It is interesting to note the integration of the Biological Resources Division into the United States Geological Survey. This has broadened USGS mandate beyond the traditional focus on geological, hydrogeological and geographical sciences. Another example is the recent merging of Outokumpu´s laboratories, which will contribute to the effective management of mineral resources and enhance the possibility for the GTK to offer services both at home and abroad. For GSI, Ireland, the special allocations to carry out the National Seabed Survey was an important step. It has clearly geared the capabilities of the whole organisation.

For SGU, Sweden, government steering in terms of the long-term plan for the geological mapping 2000-2008 is of great importance. Each Survey has its own historical background and their present scope of operation and at least their focus varies. This makes the comparison somewhat difficult. However, there are lessons to learn. Various aspects are analysed and compared in the following.
It is necessary to keep in mind that this is a comparative study and not an evaluation.

Societal expectations

All five geological surveys were established more than 100 years ago. They have provided excellent geoscience information to their government and to the society at large. From being minor organisation they have grown to bigger entities because the importance of impartial and reliable information has grown dramatically. Since their existence surveys have repeatedly adapted to meet new challenges and changing societal needs. Mineral prospecting and evaluation of these resources for the economic and industrial development was the driving force in creating these agencies. This task is considered to be of major importance today and in the future. Mineral resources are the indispensable means of subsistence and production on which the very existence and development of the living standard of mankind depend. Although private companies nowadays play a major role, especially in the later part of the chain of action, these still expect modern, digital basic geological information to be provided by the surveys. Ireland, Finland, USA and Sweden, with potential to find new such resources, point out that relevant geoscientific knowledge is essential and must be continuously enhanced.

The fact that geological information is of fundamental importance in nearly every field of human activity, and for the wise decision making a local, regional and global scale, has successively added more and more tasks to the geological survey organisations. Growing of modern society and industrial development has put great strain on quality and quantity of available water resources. Both local and regional geochemical information has become of vital importance. Mankind is more and more concerned about various kinds of pollution and it’s long term as well as short-term effects on health. Need for hydrogeological monitoring and geochemical base line mapping is an important task for each survey covered in this report. Digital geoinformation increases considerably the application possibility of data in various societal needs. The focal point is to further synthesise the basic geoscientific information into various kinds of thematic products, which directly meet the changing needs of the society. Modifying and reclassifying the geological data can produce many different kinds of thematic maps and products. It is a great challenge for geoscientists to develop the key components of the decision-making tools and methods to exploit geological data and facilitate its use in the modern society. Decision-makers must be constantly made aware of the possibility and importance of the geoscientific data and how it can assist in the decision making process. Geological survey organisations try hard to present their primary and synthesised information in such a way that potential user find it relevant and understandable in order to draw maximum advantage from it. Thematic maps, which directly illustrate various possibilities and limitations, are stressed by several surveys to provide sound basis for effective environmental management and regulatory control in exploitation of our natural resources.

Geological data is increasingly used in regional planning. GIS-applications have provided new possibilities in utilisation of the data. The proper considerations of sustainability in regional planning demand that more attention given to the geological factors. In hard exploited densely populated centres, there is an increasing need to place many functions serving the community such as new traffic routes, parking, storage, sport facilities and shopping centres in the underground. By processing the combined data (geology, geophysics, rock mechanics) new classification and models can be prepared illustrating for decision makers the suitable places for cost effective constructions and for safe disposal of certain waste/rest products. This requires development of a 3D-information system e.g. BGS, GSI and GTK.

Each Geological Survey has extensive geological databases that are continuously updated. Seamless databases facilitate updating of information irrespective of whether the changes are large or small. Data is quality controlled reliable and is of high scientific quality. Common standards for data management are essential for integration of maps and data across political and map boundaries.

In summary, societal expectation have varied in the past and will continue to do so in the future. The extensive geological databases, wide and appropriate range of expertise, well developed network and high scientific standard, together with the adaptation of modern technology, allow the geological survey organisations to play an important role in elucidation of the geological processes for the benefit of the society.

Visions and Missions

Each survey studied in this report has their mission and vision well described. **A common issue is the ambition to provide objective, impartial and reliable geological information, which will meet not only the present but also the future needs of the society.** The use of such information enables safe, sustainable and cost-effective choices for decision-makers at various levels in managing the environmental issues and utilisation of natural resources to enhance and protect quality of life and minimise loss from natural disasters.

The missions of the surveys are in general to investigate respective country's landmass and continental shelf and its natural resources for sustainable use. The five surveys further promote international work. BGS stresses high quality applied research and effective data management. Department of Interior Bureau (DOI) depicts four mission areas for USGS: Resource Protection, Resource use, Recreation and Serving Communities. SGU takes the responsibility for questions relating to bedrock, superficial deposits and groundwater. SGU does so by serving as a centre for geological information and as an expert agency and through its powers as a public authority. The knowledge and information concerning geological conditions and minerals management results in well-founded decisions that promote economically, socially and ecologically sustainable development.

Organisational structure

BGS belongs to the Department for Trade and Industry via Office of Science & Technology and Natural Environment Research Council (a non-Departmental Public Body) while GTK belongs to the Ministry of Trade and Industry. GSI is under the Department of Communication, Marine and Natural Resources (DCMNR), and USGS belongs to the Department of Interior (DOI). SGU belongs to the Ministry of Industry, Employment and Communication.

A more or less matrix type of structure is assumed in all surveys with activities performed in programs and projects. Common management of human resources is practised while at SGU human resources are organised along the discipline lines.

All surveys consider themselves as demand-oriented. At GSI this is done through shared cost projects, geotourism and education. Multidisciplinarity is considered as highly important by all organisations.

GTK supports a more strategic research. USGS stresses multidisciplinary work and more scientific mapping, data handling and management. All organisation charts are shown under respective survey.

BGS and GSI have outsourced (chartered) the ships for their marine surveys, which they consider as extremely cost-effective and qualitatively better. They see no disadvantages with this and recommend others to do in the same way. In the Seabed Project in Ireland, the entire marine surveys (multibeam, geophysical and groundtruthing) have been outsourced. GTK is outsourcing parts of the drilling and geophysical field services and the leasing of vehicles.

External linkages

All surveys consider themselves as centres of excellence. For BGS the market (CR) and NERC Council take the initiatives and for GTK the DG and the Strategic Board of Directors. BGS is a component body of Natural Environment Research Council (NERC), which is one of the seven research councils that fund and manage scientific research in UK. GSI is a lined division of the Department of Communications, Marine and Natural Resources. GSI has Consultative and Advisory committees together with the GSI management. USGS is a Bureau of the Department of Interior (DOI). The American Congress structures the funding in 5-year plans. For SGU and GTK the Board is the most important external linkage towards the parent Ministry while BGS, GSI and USGS are directly linked to their parent institution/department.

The surveys have regular contacts, either with mutual agreements or through organised meetings with the organisation of their interests. SGU is however unique in the respect that it has five permanent advisory councils which meet regularly at least twice a year. Networking on national and international level is of highest importance. Geoscience knowledge is important in all spheres of society. The surveys move towards more and more multidisciplinary approach in order to provide necessary geoscientific information for the solution of complex societal problems, e.g. in environment, climate changes, human health and welfare and natural hazards. **It is therefore necessary that the parent ministries/departments act on behalf of other ministries/departments and support surveys in financing and formulation of programs/projects and delivery of the results.**

Budget and Personnel

The figures concerning budgets and employees in the 5 different geological surveys are compiled below in tables and diagrams.

The State budget of BGS is relatively constant, it is increasing for GTK and slightly decreasing for GSI and SGU. As for as SGU is concerned it is not for the geological activities but due to the winding up of the oil storage activities. USGS has undergone re-organisation and the figures are therefore not comparable. However in the future they expect a constant amount of Federal money. Relating to other sources it is still constant at BGS but increasing at GTK and SGU, while GSI shows a decrease in 2003 compared to 2001 and 2002. Altogether the total budget is increasing in Finland but decreasing in Ireland and Sweden recent years and constant in Britain. The State budgets make 54% for BGS, 91% for GSI and 77% for GTK, USGS and SGU.

Annual Budget – EURO					
Budget- State					
	1999	**2000**	**2001**	**2002**	**2003**
BGS	29 830	29 830	29 830	29 830	29 830
GSI	3 555	9 391	13 461	8 702	5 682
GTK	36 652	36 554	39 815	39 162	40 020
SGU	24 553	26 145	22 318	23 873	21 792
USGS, 2002-1999 not relevant – re-organisation)					708 400

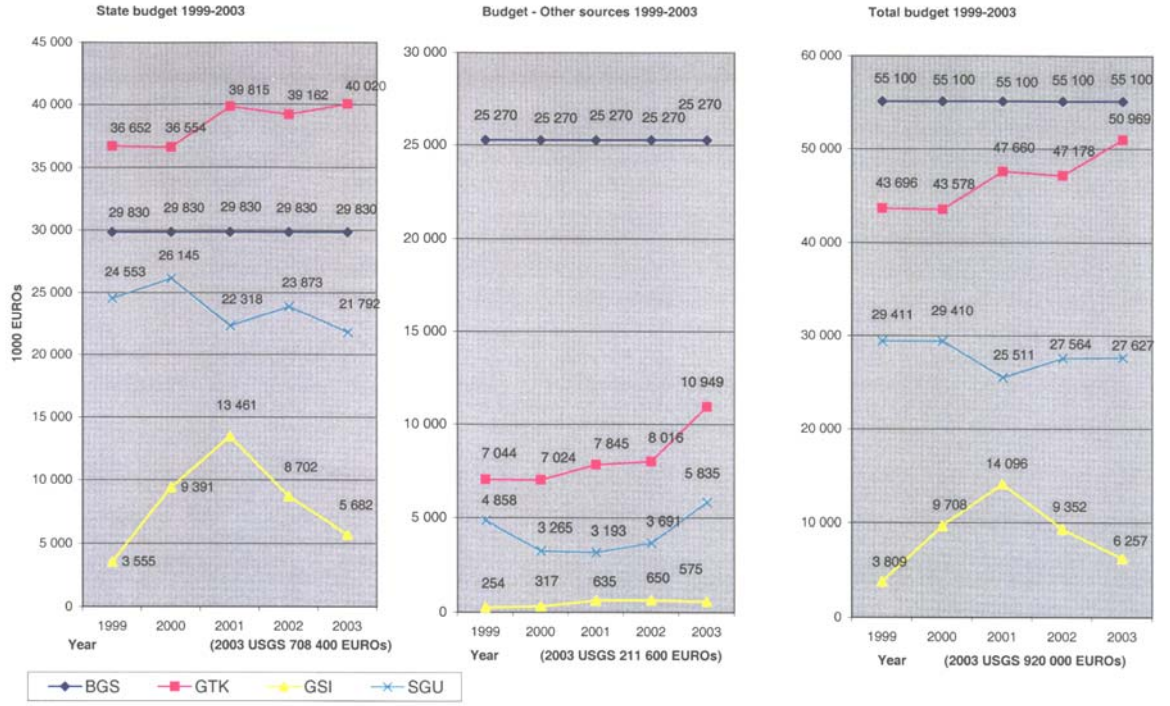
Budget- Other sources					
	1999	**2000**	**2001**	**2002**	**2003**
BGS	25 270	25 270	25 270	25 270	25 270
GSI	254	317	635	650	575
GTK	7 044	7 024	7 845	8 016	10 949
SGU	4 858	3 265	3 193	3 691	5 835
USGS, 2002-1999 not relevant – re-organisation)					211 600
Budget- Total					
	1999	**2000**	**2001**	**2002**	**2003**
BGS	55 100	55 100	55 100	55 100	55 100
GSI	3 809	9 708	14 096	9 352	6 257
GTK	43 696	43 578	47 660	47 178	50 969
SGU	29 411	29 410	25 511	27 564	27 627
USGS, 2002-1999 not relevant – re-organisation)					920 000

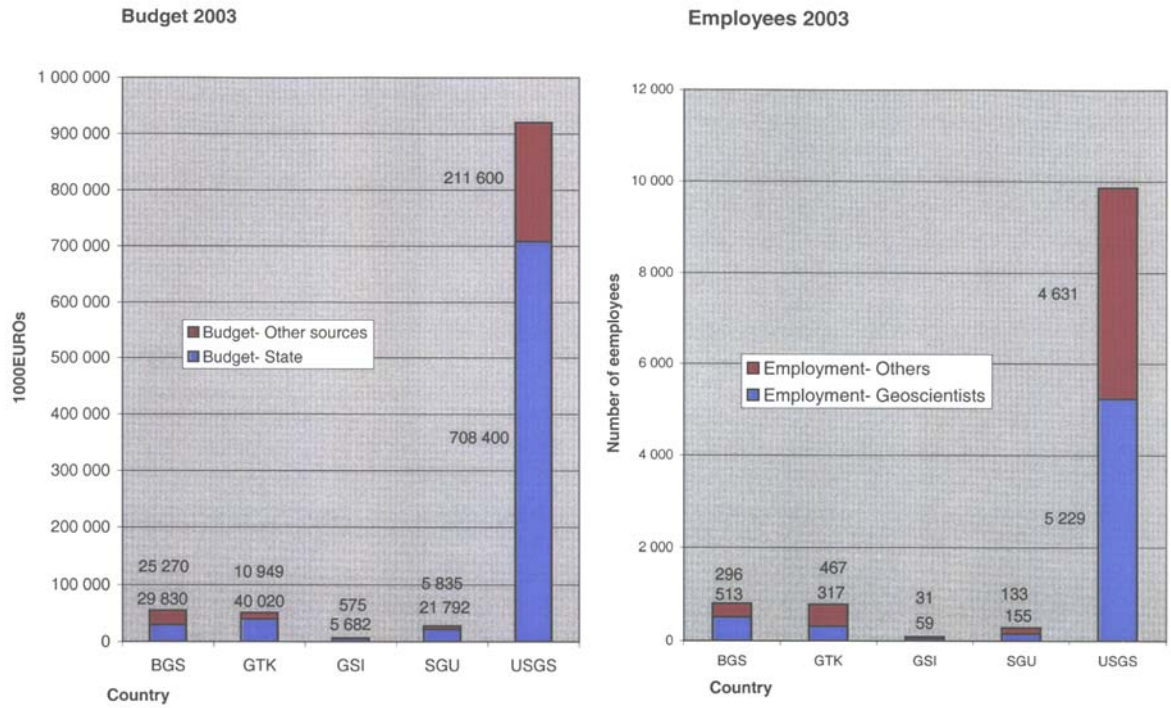
No significant change in the number of employees is noted among any of the surveys. It is interesting that BGS has employed about 30 engineering geologists. A decrease can be noted from 1999 to 2003 at GTK and SGU. The decrease at SGU is due to the winding up of the National Oil Stockpile Agency. The structure of the staff is different at USGS owing to re-organisation. Geographers, biologists and hydrologists are incorporated. The amount of geoscientists in relation to all employed is 63% at BGS, 65% at GSI, 40% at GTK, 53% at USGS and 54% at SGU.

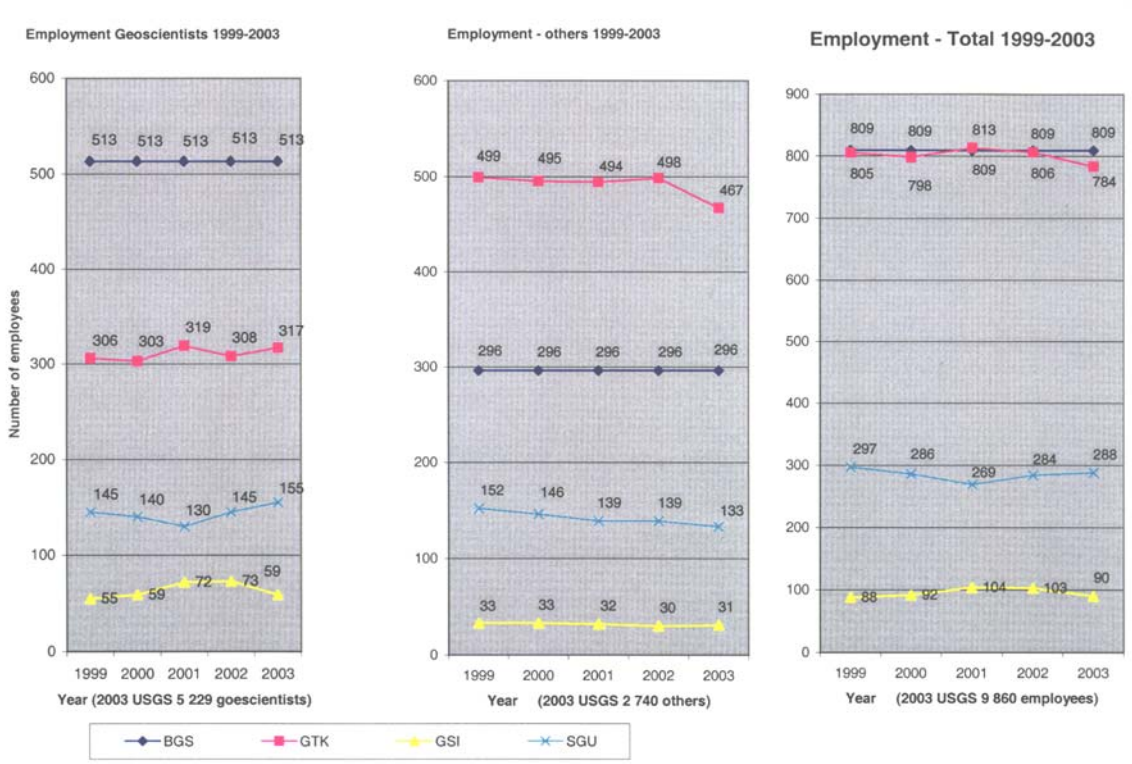
1999-2003					
Employment-Geoscientists					
Employment- Geoscientists					
	1999	**2000**	**2001**	**2002**	**2003**
BGS	513	513	513	513	513
GSI	55	59	72	73	59
GTK	306	303	319	308	317
SGU	145	140	130	145	155
USGS, 2002-1999 not relevant – Re-organisation					5 229

Employment- Others					
	1999	**2000**	**2001**	**2002**	**2003**
BGS	296	296	296	296	296
GSI	33	33	32	30	31
GTK	499	495	494	498	467
SGU	152	146	139	139	133
USGS, 2002-1999 not relevant – Re-organisation					4 631

Employment- Total					
	1999	**2000**	**2001**	**2002**	**2003**
BGS	809	809	809	809	809
GSI	88	92	104	103	90
GTK	805	798	813	806	784
SGU	297	286	269	284	288
USGS, 2002-1999 not relevant – Re-organisation					9 860


State budget 1999-2003
1000 EUROs
45 000
40 000
35 000
30 000
25 000
20 000
15 000
10 000
5 000
0
36 652 36 554 39 815 39 162 40 020
29 830 29 830 29 830 29 830 29 830
24 553 26 145 22 318 23 873 21 792
3 555 9 391 13 461 8 702 5 682
1999 2000 2001 2002 2003
Year
(2003 USGS 708 400 EUROs)
Budget - Other sources 1999-2003
30 000
25 000
20 000
15 000
10 000
5 000
0
25 270 25 270 25 270 25 270 25 270
7 044 7 024 7 845 8 016 10 949
4 858 3 265 3 193 3 691 5 835
254 317 635 650 575
1999 2000 2001 2002 2003
Year
(2003 USGS 211 600 EUROs)
Total budget 1999-2003
60 000
50 000
40 000
30 000
20 000
10 000
0
55 100 55 100 55 100 55 100 55 100
43 696 43 578 47 660 47 178 50 969
29 411 29 410 25 511 27 564 27 627
3 809 9 708 14 096 9 352 6 257
1999 2000 2001 2002 2003
Year
(2003 USGS 920 000 EUROs)
BGS
GTK
GSI
SGU


Budget 2003
1000EUROs
1 000 000
900 000
800 000
700 000
600 000
500 000
400 000
300 000
200 000
100 000
0
Budget- Other sources
Budget- State
211 600
708 400
25 270
29 830
10 949
40 020
575
5 682
5 835
21 792
BGS
GTK
GSI
SGU
USGS
Country
Employees 2003
Number of eemployees
12 000
10 000
8 000
6 000
4 000
2 000
0
Employment- Others
Employment- Geoscientists
4 631
5 229
296
513
467
317
31
59
133
155
BGS
GTK
GSI
SGU
USGS
Country



Current activities

Geological mapping and documentation

BGS has covered its land surface and continental shelf to almost 100% (at scale 1:50 000 respectively 1:250 000). A concentration on geophysical measurements will start as well as Quaternary deposits and hydrogeology in catchments areas. GSI has completed the bedrock investigations in the scale of 1:100 000. The investigations of Quaternary deposits are completed to 45% and the off shore mapping to about 50%. Concentration in the future will be on aggregate potential mapping (APM), and groundwater. 6 river basins are hydrologically investigated. GTK has covered Finland to 65% with bedrock maps (1:100 000), to 40% with Quaternary deposit maps (1:20 000) and to 90% with geophysical information and 35% with marine geology. USGS has mapped 20% of the land area in the scale of 1:100 000 or in a more detailed way in 1:24 000. The mapping is multidisciplinary and carried out in projects together with the States, sometimes with the help of students (FEDMAP, STATEMAP, EDMAP). SGU is using mainly the scales of 1:50 000 (local) and 1:250 000 (regional). Bedrock in local scale is covering the country to 50%, Quaternary deposits to 40%, groundwater to 7% and marine geology to 15%. In regional scale the bedrock maps cover 75%, Quaternary deposits 20%, groundwater 100%, geochemistry 45%, biogeochemistry 60%, geophysics 85% and marine geology 40%.

The length of mapping projects varies, although it is generally 2–5 years.

All the surveys present information on line and downloading is possible or partly possible. In general, much work is spent on data handling, management and presentation.

The strategic objectives of GTK´s future mapping are that the mapping programmes based on map sheet divisions, will be replaced by user driven data collecting and product development. The mapping data will be unified and updated in accordance with the new Euref-FIN-co-ordinate system to form general scale seamless map databases covering the whole country. The resources for mapping will be

strengthened and focus will be transferred to the mapping of centres of population growth and of potential areas for mineral resources. Urban geological mapping will be carried out in co-operation with relevant municipalities and the airborne survey programme will be completed.

Department of Interior (DOI), USA, shows a table with statistics related to mission and responsibilities, e.g.: 507 million acres of surface lands, 700 of mineral estate, 1.76 billion of the Outer Continental Shelf and 52% of the Nation's Wild and Scenic Rivers, 388 units in the National Park System (56 National parks), 308 recreational lakes, 31 million people relying upon DOI for their source of water, 4 200 tunnels and bridges, 39 000 buildings, 340 reservoirs, 35% of domestic coal, 48% geothermal power, 35% natural gas, 32% domestic oil, 43% volcanoes monitored, 121 earthquake monitoring stations and 7 000 water quality monitors.

Mineral resources

All geological surveys stress the importance of mineral resources. It is important to recognise the occurrences and the quality of resources for land use and planning. This has an overall economic and environmental importance in both national and international scale. In this context, mineral intelligence for Europe is necessary. GTK has a special role comparing to the other surveys as performing prospecting of ores, industrial minerals, aggregates and dimension stone. However, the co-operation with industry is well functioning.

Research and development

Geology encompasses a wide range of fields that are concerned with the earth. Only through a strong program of research can geological surveys make their appropriate contribution to the understanding of various aspects of environmental and natural resource problems. Meaningful penetration into the broad areas geological survey work requires a critical mass of scientists with attendant significant funding support.

BGS considers the R&D incorporated in the projects whereas GSI spends at least 10% of the budget and GTK 16–20%. The USGS has about 1355 scientists engaged in R&D activities as of January 2005 (Geology 588, Biology 480, Water resources 282 and Geography 5). SGU reports 7–10% of the total budget. BGS, GSI, GTK and USGS research work compared to SGU is of high international standard and research results are regularly published in internationally recognized journals. Among other things this has created a notable participation in international research projects.

Since 1990 SGU has a special appropriation to support applied geoscience research that is carried out by research workers at the universities. This amounts to about 0.6 mill Euros per year. The objectives are to achieve a systematic and long-term build up of geoscientific expertise and to improve SGU´s possibilities to provide the society with necessary geoscientific information. Great importance is attached to interdisciplinary and multidisciplinary research that offers opportunities for applying new approaches and new methods. In 2003, a third international evaluation of SGU´s support for applied geoscience research was carried out. The evaluation group concluded among other things that the projects that had been carried out were important and of high quality. The group recommended that this virtually unique support system should be retained and that the amount of support given should annually be substantially increased.

Some geological surveys are given opportunities to carry out specially designed research programmes in collaboration with industry and research organisations. Excellent examples are those performed during the last few years at SGU and GTK. The total amount spent in this kind of activities in Sweden during 2002–2004 was about 5.6 mill Euros out of which 50% was provided by SGU. In co-operation with the mineral industry SGU designed a program for innovation and cluster building in the industry-MINBAS. About 20 companies, universities, institutes and organisations participate in the program. The areas covered include optimisation of production processes from extraction to the finished products, the use of material from aggregates and industrial mineral and natural stone industries. Another project supported by SGU is Gellivare Hard Rock Research, the purpose of which is to set up

a centre for technological development, research and education in mining and rock engineering in Gällivare in the northern parts of Sweden. This project will co-ordinate and manage long-scale technology development with the private sector and Luleå University of Technology. The implementation of new technologies, new systems and methods in real-life environments is one important component of these efforts. SGU also finances by special appropriation R&D projects within the GEORANGE framework. It aims to develop the mineral and mining sector in the north of Sweden. The projects supported by SGU focus mainly on ore forming processes.

Finland is since 1995 using conversion to projects and equipment to settle Soviet Union era debt. Part of this debt is successfully used for applied geoscientific projects in which the Government involved the Geological Survey of Finland as co-ordinator and contractor. A vibroseis research project "FIRE" has been carried out in Finland. The technology applied provided 3D-images of the bedrock up to 70–90 km depth. The results help to understand fundamental problems related to the structure and evolution of the Earth's crust and various ore/mineral-forming processes, the evoloution of geological processes with time and the history of global climate changes on the Earth.

These investigations in the Outokumpu area revealed several strong reflective layers at the depth of 1.5–10 km of the upper crust. The Outokumpu ore belt is a classical ore province with massive Cu-Co-Zn deposits. The area is still considered to have significant ore potential. A deep drill hole was made to find out the deep geological structure of the ore belt and the geological character of the seismic reflectors. In addition the project will investigate many other topics (deep fluids, gases, thermal regime, microseismic activity, fission tracks, etc.) in an international network and use the hole later as a deep geolaboratory. Although no significant mineralisation was found in this hole, the rock association revealed is the correct type for searching the Outokumpu type massive sulphide deposits.

The drilling result together with the reflection seismic transects in eastern Finland suggest that the ore potential rocks of the Outokumpu type are much more common than previously anticipated. Therefore, reflection seismic measurements seem a very promising tool to directly locate ore potential rock types, given that they have sufficient reflection coefficients with the country rocks. In Outokumpu, the combination of reflection seismic measurements and deep drilling was necessary to confirm the geological character of the reflectors. Negotiations for further investigations in ore prospecting areas are promising.

International co-operation

All surveys consider international co-operation as very important and to be of increasing importance in the future. Today geological surveys are working in complex environments. Integration of local information into regional, and if applicable in global perspective, is of value. Networking should be developed to achieve this integration.
The European surveys consider the work inside EU and the co-operation with Eurogeosurveys, EGS, and FOREGS as highly important. The initiatives and directives coming from European Commission, EC, will affect all countries and also the surveys.

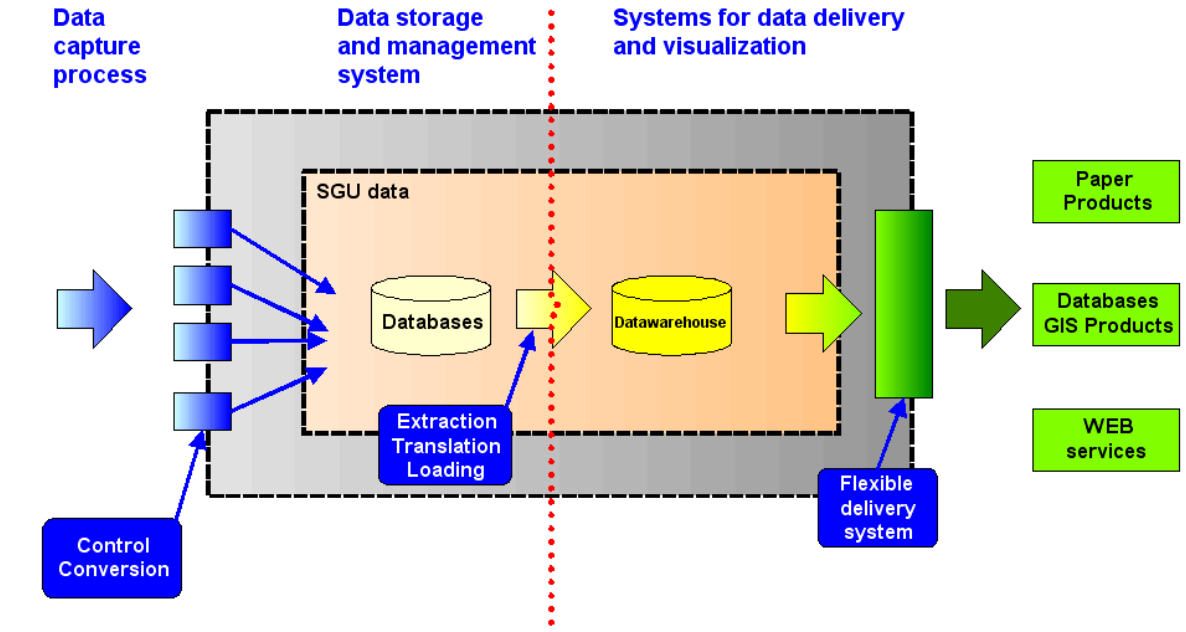
The European surveys studied in this report are more or less involved in EU-financed projects. The involvement of BGS in FP-projects amounts to 145 KEuros and they are co-funded. GSI is reporting co-operation concerning mineral resources, groundwater, geotourism and geoparks, EU initiatives and Ocean Drilling Programme. GTK is involved in as much as 17 EU-projects. USGS has activities involving several dozen scientists in regional mapping and investigation of mineral resources. SGU´s international co-operation is an integrated part of the R&D and takes actively part in areas as e.g. minerals, soils, groundwater, marine environment, geomedicine, natural heritage, land use, planning and aggregates. SGU is also engaged in a number of EU-financed projects.

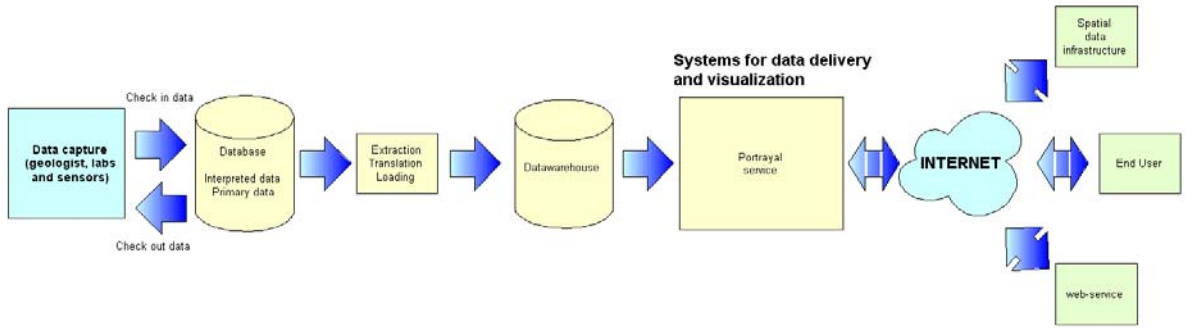
Data management and providing information

Future challenges in data management and capability of providing information is of vital importance. SGU considers that:

- All data should be better optimised for use in GIS systems. Data should be interoperable, seamless and more intelligent.
- Metadata according to ISO 19115 has to be established for all data.
- Data has to be harmonised according to international standards and de-facto standards. Data has to be delivered using internationally agreed XML/GML-based interchange formats.
- Data has to be dealt with in object oriented logical system architecture enabling cost-effective data capture, storage and delivery. The system has to be open, flexible and standards based.

Data has to be part of a dynamic network based national and international infrastructure for spatial information.





The Surveys compared consider that it is important to develop customer relationships and rely in the loyalty of existing customers, to provide services effectively and efficiently, introduce innovative products and services, produce high-quality products and services at low cost and with short lead time and to develop employee skills and motivation for continuous improvement in quality.

Products, which are produced, must be relevant to the problems of concern to the general public. The focal point should be to collect and to synthesise the basic geoscientific information further into various kinds of thematic products, which may directly meet the changing needs of society.

All surveys have contact with user-organisations to get societal impact on the activities. Surveillance investigations are usually made by the surveys themselves. Complimentary directives may occur.

Customer surveys are usually made (e.g. every 5th year and GSI every 4th year). Interesting investigations and future outlook and advice about future has been made in USA for USGS. The investigations are attached as Appendices. In summary it can be concluded that the surveys are more and more eager to listen to the demands of different users and are more flexible to reach the stated goals although in some different ways.

The main customers or users of USGS information in USA are government, departments, agencies, academia, industry, companies and general public. This is also valid for the other surveys. BGS, however, considers the insurance and engineering sector as especially important. The demand on GSI is to increase input on engineering and geotechnical information. Other sectors expressed by GSI are mainly environment/resource protection, minerals and infrastructure. GTK stresses land use and planning, mineral supply, infrastructure and construction, nature conservation and education..

Commercial activities

BGS has quite a large part (about 45 %) of commercial activities, which has not changed significantly in the last 5 years. The activities are mostly related to mapping and investigation of mineral resources. Funding from the World Bank is important in this context. GTK has 22% of the total budget in commercial activities and it has increased the last 5 years. GSI and USGS can be said to have no special commercial activities. SGU also shows an increase in commercial activities with an amount of 17% in 2004. The most important sectors are environment, natural resources and energy (nuclear waste disposal and geothermal energy). Internationally, it is mostly environment and the mineral sector. SGU predicts higher volumes for environment (contaminated sites, marine geology and groundwater), natural resources (stone, minerals), energy (geothermal and CO_2) and lower for energy (nuclear waste disposal) and infrastructure.

Future outlooks and challenges

All surveys have some sort of strategic plan. BGS´ new plan for the next 5 years will be available in the beginning of 2005. GTK also has a strategic plan (attached in the Appendix) and USGS a 5-year plan. DOI, federal agencies and people in the private sector are asked both with long-term and short-term priority. SGU has a long-term mapping plan to be completed in 2008. Work started last year (2004) to prepare a new strategic plan for all activities during 2008-2015.

GSI has made an outlook to 2015. Nation-wide groundwater protection schemes will be completed and available on the website. Onshore geological mapping will be available on demand over the web, with higher-resolution maps available for bedrock and subsoils for 40% of the country and focus on key prioritised areas. 30% national coverage of aggregate potential maps at county level will ensure better-informed mineral planning decisions and improved support for infrastructural development. Offshore bathymetric and geological mapping will be available for the entire Irish seabed area, including all strategic inshore areas. Online information on urban areas and transport routes will include ground stability and depth-to-bedrock. GSI will have streamlined its co-operation with other divisions of the Department. GSI plan to do business remotely and effectively over the Internet with its customer base, thus eliminating any perceived disadvantage with its proposed relocation. Appropriate legislation will be in place to ensure valuable data is deposited within GSI as a strategic resource. Comprehensive characterisation of waste at historic mine sites and the environmental risks they pose will form the basis for remediation strategies.

GTK is reporting strategic objectives for 2009 (attached under GTK). These can be summarised as follows:
“GTK will evolve into a European centre of excellence for delineating earth resources and promoting their sustainable use and is the national centre of excellence for geoscience data management and analysis. GTK’s regional activities will be profiled to co-ordinate with regional development plans, strengths and challenges.

Developing new forms and networks for jointly financed activities will support the implementation of strategic targets. The optimal target level of contract services will be attained, and activities will be focused towards those services that best promote GTK's impact. GTK's strategic direction and planning processes will be strengthened and its competitiveness will be improved through high-level know-how, active networking and international operations. The effectiveness of services will be improved through enhanced management and quality assurance procedures. GTK's internal service processes will be developed on a client/producer basis, the object being competitive services. The proportion of externally sourced services will be increased. A strategy for the management and development of human resources will be implemented and staff well being will be promoted through active personnel policy. Interactive operations and flow of information will be improved at all levels. Supporting professional development, opportunities for exchanging duties, and voluntary education, will ensure maintenance, enhancement and updating of organisational know-how. Recruiting is targeted at enhancing essential areas of activity and in promoting effective international liaison. GTK secures opportunities for young researchers for challenging careers in an international research environment".

The National Research Council, NRC, undertook a study concerning future roles and opportunities for the USGS (Appendix 2, USA). The USGS should provide national leadership and co-ordination in (1) monitoring, reporting, and where possible, forecasting critical phenomena, including seismicity, volcanic activity, streamflow, and ecological indicators; (2) assessing resources, including oil and natural gas (domestic and foreign), minerals, water, and biota; and (3) providing geospatial information.
These activities include the following overlapping categories: surveys, monitoring, data analysis, research, information dissemination, and product generation. Subject to the overriding requirement that the USGS fulfil its primary and high priority mission responsibilities, the committee believes that the USGS should continue to conduct each of these activities, but that the balance of activities should shift toward the value-added activities of data analysis, problem solving, and information dissemination. A shift of balance does not mean that the USGS should reduce data gathering or long-term data collections, but that it should do more to interpret what the data mean and to make the data useful and accessible.
A science strategy for the geologic division of the USGS, 2000-2010, "Geology for a changing world" was made (Bohlen et al. 1999, USA Appendix 4). Some goals are:

1) Conduct geologic hazard assessments for mitigation planning
2) Provide short-term prediction of geologic disasters and rapidly characterise their effects
3) Advance the understanding of the Nations energy and mineral resources in a global geologic, economic, and environmental context
4) Anticipate the environmental impacts of climate variability
5) Establish the geologic framework for ecosystem structure and function
6) Interpret the links between human health and geologic processes
7) Determine the geologic controls on ground-water resources and hazardous waste isolation.

Some highlights are:

1. Linking the Science Goals: Mineral Resource and Hazard Studies
2. The Geologic Division Today
3. Remote-Sensing Studies Save Taxpayers Millions of Dollars
4. The Global Seismographic Network
5. Discovery of Significant Earthquake Hazard in the Pacific Northwest
6. Seismic Hazard Maps Help Save Lives and Property
7. USGS Response Helps Avert Catastrophe at Mount Pinatubo
8. Identifying Critical Energy Resources
9. Areas of Florida That Could Be Inundated by Sea-Level Rise
10. Great Plains Sand Dunes Show Recent Mobilisation
11. The Effects of Climate Change on Ecosystems

12. Protecting the Everglades Ecosystem
13. Vog Hazard in Hawaii
14. Cleaning up Boston Harbour
15. Finding Water for Thirsty Southwestern Cities
16. Digital Information Systems Assist in Decisionmaking
17. Experimental three-dimensional Geologic Maps

BGS future budgets are currently under review. The State budget is expected to increase by 5%. GSI expects a slow increase of income coming from external sources in proportion to State funding in the future. GTK also supposes a stable budget for the future and so do USGS and SGU. BGS, GSI and GTK expect a slight increase of commissions whereas USGS predicts a similar situation as now. SGU predicts that the external income may increase.

The main investments for BGS will concern capital spent on buildings, laboratories and IT. Investments in laboratories will increase the capabilities to analyse organic substances. GTK intends to increase investments on geolaboratory and geophysical equipment. SGU will keep existing equipment, thus mainly reinvestments are stipulated.

EU directives, such as groundwater, mining waste, INSPIRE, GMES, etc. are supposed to have an impact on all the European surveys. Co-operation is essential.

BGS holds mapping as a core activity but not the only one. 3D-modelling will be important, an opinion which is also supported by GTK. GTK also considers mapping as a core activity but will integrate to spatial data and updating of databases. GSI is suggesting a more demand-oriented mapping and also stresses documentation, e.g. road cuttings, infrastructure information from roads, quarries, cores etc. Urban geology is considered important in all countries. Geological mapping is a traditional activity for the surveys all around the world. USGS considers mapping to be a core activity also in the future. Interdisciplinary aspects are possible. Updating is necessary (e.g. structural features). Further details on USGS mapping is given in Appendix 1 (USA).

The listening to decision-makers is considered as important at all surveys. BGS has consultations, advisory panels, stakeholders´ meetings and research policies and arranges stakeholder meetings, client contacts and media responses. The response to the expectations of society is kept abreast of national and international developments and best practice in EGS according to GSI. GTK is stressing contacts with local authorities and to the ministries and has networking with other governmental research organisations, universities, education units and authorities. Concerning USGS the contacts are reported in Appendices. SGU has regularly contacts with municipalities, counties, geoconsultants etc. and has a number of bilateral agreements with other authorities and in this context regular meetings to exchange ideas. SGU listens to a large number of decision-makers as those are represented in the Board and Advisory Councils, each of which has meetings at least twice a year.

BGS does not consider itself to be adequately funded to educate general public. However, information to the general public is important for all. BGS stresses media initiatives, parliamentary and other briefings. GSI does outreach work by publications, booklets, brochures, lectures, exhibitions and fieldtrips. Many inquires are coming to GSI (>4000 during 2003) and most were related to groundwater, bedrock information and mineral exploration. Contacts with engineering geologists and geotechnicians will be increased. Activities such as MPM (marine geology), APM (aggregates), abandoned mines remediation, geological heritage, geohazards, geoparks, coastal zone management, database management, the website will also be increased. Public perception of work is maintained by transparency according to GTK. SGU has customer contacts, information to the general public through media (website), exhibitions, fairs, courses, popular publications, invited lectures and participated in special arrangements like the “Day of Geology”.

BGS considers that none of the major services or activities will be abandoned but that all will evolve. GSI stresses that all geological disciplines are important and are supporting each other.

BGS considers on-line access to information, modeling, 3-4D-visualisations, security supplies, climate change, georisks, geohazards, water supplies (mostly quality), waste disposal, medical geology, baseline work, energy, mineral resources, mineral intelligence and aggregates are important issues. These issues are also important for other surveys. Water quantity, salt-water intrusion and surface water are no big issues in Britain. Geotechnical and engineering geological problems, such as landslides, shrink, swell and subsidence are interesting subjects in Britain. BGS considers groundwater chemistry to shrink, as private companies will be responsible for these tasks but that groundwater modelling will increase. In addition BGS thinks urban geology and geochemistry is important, aggregates, contaminated land, land use, and planning and transport links. Services to be extended according to GSI are environmental planning and conservation in the land and marine areas. GSI stresses geophysics and geochemistry to a complete national coverage and as earlier mentioned geotourism. GTK also supports 3-4D- modelling. GTK plans new processing services for mining and extracting industry at Outokumpu, including environmental cleaning techniques for polluted soils and mining wastes. USGS reports many interesting issues and among those complimentary to the above mentioned, are geoparks. These are no big issues in Britain, but are in Ireland, together with urban expansion, material and mineral resources, radioactive waste, remediation, water-level changes, sea-level rise, subsurface geology, carbon sequestration, geothermal energy, skill assessment, personal development and language skills. Most of these issues are also relevant for SGU but must be put to a priority. **In conclusion it is predicted that routine mapping will be less important in the future and that the mapping will be more scientific and demand-oriented**. Issues which will be important are sustainable use of natural resources, waste management, geohazards, risk assessment, policy making, material and quality aspects, data management and exchange, 3-4D-modelling, land use, planning, climate change, urban environment, subsurface geology, medical geology, geotourism, geotechnical and engineering geology. As for SGU is concerned a new plan for the activities after 2008 is under consideration.

Conclusions

Various geological surveys have different history, tradition, economy and not least geology. This means that it is generally difficult to make comparisons. There are, however, some general trends. Most Surveys were founded in the 19th century to provide information on national resources, which became necessary during the Industrial revolution. During some decades Geology has become more and more remoted from decision-makers´ less knowledge of geology, despite the fact that life is depending on geological prerequisites. Basic geological information is nowadays not generally understood in society. The reason for this is mainly insufficient marketing of geology. Most surveys are more and more dedicated to demand-oriented tasks and many thematic products have been developed and well-received in society. The development of thematic products does not mean that a basic, qualitative information material of all types of geology is not needed but that balance with demand-oriented products is necessary. This is stressed by the surveys contacted in this study. Multidisciplinary work is considered a way to reach this.

During the discussions with e.g. USGS it was pointed out that geological processes are the crucial factors in determining the conditions for today's flora and fauna. As geology represents the "floor" of the ecosystem, it is essential that an ecological perspective also takes geology into account. By studying geological diversity, it is possible to learn about the earth's structure, the evolution of life and in which geology has been a governing factor in determining the conditions of life. Health, sustainable development and geology is clearly linked. Geology is the base for our environment and what we eat and drink. Biodiversity and health depend inherently on the quality of the physical environment. Geodiversity is essential. Geochemical information on local and regional scale is an extremely useful product. It directs the attention of the society and investors to the mineral and environmental potential of a land area, as well as possible limitations to develop this potential**. It was stressed by BGS, GSI and GTK that an important task for geological surveys is to carry out geochemical base line mapping programs for rocks, soils and groundwater**. The results are needed in forming sound environmental legislation and for appropriate general policies. A close co-operation between the

geological surveys is necessary to address the need for a coherent, systematic, regional/worldwide, multi-element geochemical database. Data collection, co-ordination, trustworthy and impartial interpretation is essential in the environmental issues because the market and the society in general may have conflicting interests.

During the general discussions with the surveys it was called attention to the fact that the international development and international events have more and more impact on us. Many geological features must be seen in a larger, transnational, pan-European and even global scale, as natural resources, river basins, climate change, and other environmental questions do not follow national boundaries and must be solved in co-operation. The questions discussed with the European Union (EU), which in many cases later are transferred, as directives must be followed by the geological surveys actively from the start of the discussions to the accomplishment of the directives. It was further pointed out that many efforts are made by Eurogeosurveys (EGS) on questions raised by EU concerning groundwater, soils, natural (mineral) resources, sustainable use, hazards, risks, land use, planning, data storing and exchange. These are highly ranked and call upon serious attention. It seems to be a consensus on this by most Surveys. This is also valid for the work with the Frameworks 6 and 7.

Many of the important advances in geoscience in the near future will require observational programs such as for example INSPIRE, GMES etc. that transcent disciplinary lines. Survey policy decisions and funding mechanisms must take account of such requirements.
It was stressed that it is necessary to pay more attention to the tasks relating to international and European scientific co-operation. Active engagement in the preparatory phases as well as in the projects is important. The participation in national and international projects enhances the organisation's knowledge base in local, regional and global context as stressed by BGS, GSI, GTK and USGS. Exchange of scientific staff is an excellent way to raise the competence level. These organisations regularly present their R&D results in the national and international community through publication in order to achieve a broad reputation and be regarded as an attractive partner.

In this context geological surveys must be at the services to the government and general public and avoid being a profit centre based on the sale of professional services and geoscientific information on the open market and competing with private companies. **It is not possible to fulfil two conflicting missions at the same time.**

The surveys have realised the importance of timely, targeted, relevant and reliable information to policy-making authorities and to the public in general. Appropriate solutions must be found for the careful disposal or long-term isolation of toxic waste products. There is a great challenge for geoscientists to demonstrate the technical possibility and reliability of the geological disposal concept. It is necessary to co-operate with other agencies and organisations at home and abroad to evaluate research results actively and transparently. It was stressed that various safety concepts developed should clearly define how disruptive events can be avoided and help in developing the appropriate regularly infrastructure. It is necessary to ascertain the likelihood of potential changes in the environment brought about by various phenomena as well as the extent of the changes. This can be best achieved by systematic accumulation of information, national and international, on these events and processes is critical for the comprehensive scenario analysis.

The surveys are rather restrictive in decreasing their present activities. The reason is that most activities are of need in society. However, the tendency is that the activities must be more and more demand-oriented. Future geological mapping is considered to become more scientific and adopted to the varying and changing needs in society. Updating of the existing information is necessary. Geological modelling is supported by many surveys (e.g. BGS, GTK).

As emphasised by the other surveys, better possibilities for 3-4D-modeling in the mapping programs are essential. Such models support and facilitate a multidisciplinary way of working and are valid for both urban and subsurface geology.

Urban sustainability has been identified as an important goal in major cities. It contains apart from environmental also social and economic elements. Major issues are water supply, flooding, ground instability, waste management, land-use planning, transports, energy supply, air quality, underground facilities etc. During the fiscal year of 2001, the Swedish government defined SGU´s role in the achievement of the various environmental goals. In this context SGU has given, sole responsibility for "High quality groundwater" and important tasks in the goal regarding "Good urban environment". The government to work on these subjects allocated substantial amounts of additional funds.

Concerning expanded activities there are many suggestions from the surveys. They all support the issues related above mentioned in relation to international co-operation and R&D. Urban geology and legislation/insurance (BGS) is also supported by GTK. Urban geology includes the subsurface (underground facilities). In the latter case geo-engineering is of importance. Urban geochemistry and medical geology is mentioned by GSI. Quality questions (material and water) are of importance, whereas the water quantities are of less importance in Britain and also in Sweden and Finland that are countries with large amounts of fresh water available. Concentration on water quality is, however, necessary. River and water basins are of interest. Relating to surface water the soil and bedrock properties must be taken into account. Also bedrock and soil qualities must be considered, including geochemical and geophysical parameters. Geo-engineering is considered as very important at BGS and GTK and is essential in urban geology, infrastructure and georisks/geohazards. The incorporation of biology such as at the USGS is also interesting. Mineral resources, protection and exploitation, including aggregates, are important activities and will be more important in the future, and these issues are mentioned by all surveys. Mineral intelligence is of great need in Europe as emphasised also by e.g. EGS. Environmental questions are in general of importance and include both protection and necessary exploitation. Waste disposal and remediation is assumed high relevance in the future even if the actions must start very early to be preventive.
Urban geology, subsurface geology, urban geochemistry, geophysics, sustainable use of natural resources, including groundwater, georisks/geohazards, material and water qualities, mineral intelligence, environmental issues (waste disposal), climate change, energy, geomedicine and geo-engineering are according to the surveys compared in this report the future topics of importance in society.

Data management and exchange is of highest importance according to all surveys. Information must be easily available on websites etc. Prerequisites for downloading must also be prepared. Most surveys are on their way to do this. Information to society is fundamental and has great importance.
Development of databases with as much basic geo-information as possible from all disciplines is emphasised by the surveys. Near-related information such as in geo-engineering is included at BGS and GSI. This enables to produce thematic products often in co-operation with users. Documentation activities at the surveys play a very important role in this respect. It is important that basic as well as applied information is easily available to stakeholders, users and general public.

Some of the surveys consider involvement of general public in geology for educational purposes important (GSI and GTK). For this reason GSI and USGS are strongly supporting geotourism, natural heritage and the creation of geosites and geoparks. These activities result in a strong impact on the general public.
GSI and USGS have been very successful in these respects. Such activities have created a better understanding of geological features in society.

Outsourcing is common in surveys, however, in-house laboratory services are considered necessary at BGS and GTK. These services keep their competence on high level. BGS and GSI have taken cost-effective actions in areas such as vehicles, aeroplanes, vessels and other equipment. BGS and GSI use chartered vessels in their marine geology activities with great advantage. In the Seabed Project in Ireland, the entire marine surveys (multibeam, geophysical and groundtruthing) have been outsourced.

It is important to analyse different scenarios and look for alternative possibilities in the usage of equipment, which may lead to more flexible and cost-effective operations.

The organisational structure varies in different surveys. The surveys compared have no more strict disciplinary structures. In SGU´s case the division of human resources in disciplines may in some cases prevent effective solutions. Co-operation among various disciplines is good as long as it does not disturb their own sphere.

The importance of personal development, development of professional skills and language skills are stressed by all surveys. Possibilities to take part in multidisciplinary projects, R&D and in international work are of benefit for the entire organisation.

SGU´s matrix organisation, in combination with internal buying and selling, together with the division of human resources in a strictly disciplinary order, is more complex and less understandable in comparison to other surveys studied in this report. Management groups in the surveys compared, devote a large amount of their time in strategic thinking, follow-up, and in taking corrective measures, not only in economic terms, but also concerning the geological results and of their quality and applicability.

Efforts for quality certification are on going at most surveys. Quality certification and description of processes assure that the work is done in accordance to a common, transparent, and well-defined way, but does by no means indicate the scientific quality of the results achieved.

It is pointed out that geological work is dependent on the scientific competence of the persons involved and on the observational and analytical capacity to draw the best possible conclusions among a vast number of variables which govern the earth system at present and in the past. Given the huge range in space and time scales, physical and chemical processes involved, it is not surprising that interpretations may differ. This can to certain extent be resolved by having an adequate number of geoscientists with considerable experience and deep knowledge.

Personal development and professional skills are necessary to be continuously improved. Other competence should be added to the organisation if needed. The organisation based on disciplines has been more or less abandoned in many surveys. Flexible usage of personnel in different activities is of common practice.