



GEOLOGICAL SURVEY OF FINLAND
GTK

A N N U A L R E P O R T 2 0 0 3





GTK's mission

To create conditions for supporting sustainable raw materials supply and land use.

GTK's objective

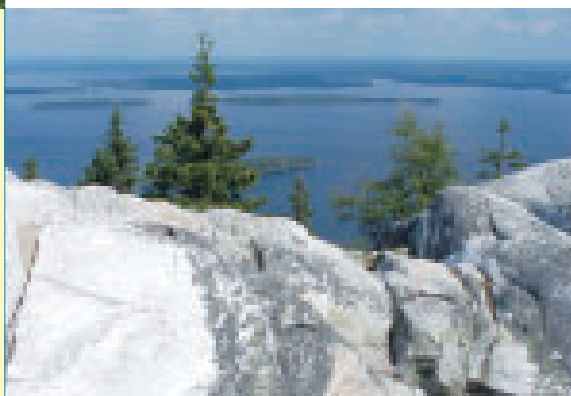
To create prosperity and welfare for society at large.

GTK in short

- The Geological Survey of Finland (GTK) is a national geological research centre under the Ministry of Trade and Industry
- GTK was established in 1886
- GTK has offices in Espoo, Kuopio and Rovaniemi
- The personnel was 786 (manpower years) in 2003
- The overall costs amounted to EUR 51.3 million
- The income from contract services was EUR 9.2 million
- The activities were guided by two strategic programmes:
 - *bedrock and raw materials*
 - *land use and environment*

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View towards Lake Pielinen from the Koli quartzite fell.

Finland is nominating its first natural heritage sites for inclusion in the Unesco World Heritage List: the Saimaa-Pielinen lake district and the Kvarken archipelago on the uplift coast of western Finland. Both the Saimaa-Pielinen lake district and the Kvarken archipelago possess special geological features that explain certain stages in the Earth's history. On this basis, the sites can be considered to be globally unique natural heritage within the meaning of the World Heritage Convention and could be added to the list on the basis of the geological criteria (LI) contained in the Unesco operational guidelines. The Saimaa-Pielinen lake district is also considered to be a site "of exceptional natural beauty and aesthetic importance" thereby also fulfilling the natural criteria (LIII) in the operational guidelines. Photo: Jari Väätäinen

◀ Quartzite quarry at Nilsjä.

▲ Serpentine soapstone boulder, Polvijärvi.

Photo: Jari Väätäinen



GTK, a European centre of geological excellence

In 2003, the Geological Survey of Finland (GTK) was able to meet the targets set out in its performance agreement with the Finnish Ministry of Trade and Industry. GTK also experienced an exceptional number of high points during the year.

Perhaps the most important of these top achievements was the completion of the field work and results of the Barents Region environmental project. The five-year undertaking, which had a budget of almost EUR 5 million, was jointly funded by the Russian Ministry of Natural Resources, the Finnish Ministry of Trade and Industry, the Finnish Ministry of the Environment, the Finnish Ministry for Foreign Affairs and (during the early stages) by the Norwegian Ministry of the Environment. The summary material is an excellent basis for the challenging task of large-scale environmental research and ore exploration in the region.

As part of a five-year collaborative project between GTK and Outokumpu Mining Oy, the geological information on the Outokumpu region was put into a single database and made available for general use. The Australian research organization CSIRO was involved in the regional modelling process. The project went according to plan but it did not at this stage produce any new finds that would have warranted reporting.

The field work and the report on the deep seismic project were completed during the year. The undertaking, which had a budget of EUR 10 million, was covered by a debt conversion agreement between Finland and Russia. Putting the project results to good use will require several years of scientific work by GTK and its research partners.

In the spring, GTK, NEDRA, a company owned by the Russian government, and the Russian trading house Machinoexport signed an agreement on the drilling of a 2.5 km borehole in Outokumpu for scientific purposes. This project will also be funded through debt conversion.

The beginning of December saw the launching of the *Geomari*, a marine geology research vessel funded jointly by GTK and the Finnish Naval Research Institute. The vessel will be used by both research agencies though it will sail under the GTK flag.

GTK has signed a memorandum of understanding with the British Geological Survey (BGS) on closer cooperation in aerial geophysical surveys, and the agreement will be finalized in spring 2004. The project is a sound example of European scientific cooperation. All Finland's land and sea areas will be covered by airborne surveys during the next five years.

Digitization of old mapping data has proved more difficult and time-consuming than anticipated. According to the revised plans, all digital material should be in usable form by the end of 2004, which will mark the end of this high-priority project that has tied a huge amount of personnel resources. As expected, the undertaking has slowed down new mapping work and to minimize the delays, GTK has subcontracted some of the work to universities. The results have been very promising and the cooperation benefits both parties. The mapping was carried out in accordance with the new GTK quality system and under the supervision of the customer.

Even though GTK achieved its performance targets, it was only able to report one commercially viable mineral occurrence to the Ministry of Trade and Industry. Until now, GTK has always exceeded the annual target of six occurrences but now it seems that it is no longer possible to build on the existing reserves. However, we believe that new regional mapping projects will reveal additional occurrences.

The Fennoscandian Exploration and Mining Conference, held in Rovaniemi in early December, showed that there is growing international interest in the mineral deposits of Finland and the Fennoscandian Shield. A number of mine projects in Finland have reached the preparatory stage but it may be years before studies on their environmental, technical and economic aspects have been completed.

GTK has entered into an agreement on national resource accounting with the Finnish Ministry of the Environment and the Finnish Environment Institute. The work on the system will start in 2004 and should be completed in 2007. By combining sand and gravel formation data with the extraction information required under the Land Extraction Act, the system will give information about the amount and quality of the available resources. The system will be Internet-based and will also contain information on alternative materials so that they can be used more efficiently. The Finnish Environment Institute provides GTK with the

annual extraction figures required under the Land Extraction Act and has responsibility for the maintenance and availability of statistics as part of its mapping and inventory activities.

In 2003, GTK was actively involved in building the exhibition at the Finnish Stone Center in Juuka. In 2004 GTK has committed itself to achieve the targets set out by the Finnish Natural Stone Association for the 'Year of Finnish Stone 2004', while in September GTK will be one of the organizers of the Day of Geology. GTK was able to substantially increase its visibility in the media during 2003.

External income exceeded EUR 10 million for the first time, which means that GTK has achieved the external funding target set in 1997. The recently started international projects lasting several years present new challenges to those responsible for project planning and monitoring and require a high level of business and contractual skills.

Last autumn GTK and the Ministry of Trade and Industry agreed that VTT Mineral Processing, located in Outokumpu, will be merged with GTK. This decision leads to an increasing diversification of the field of know-how and resources of GTK in providing services for industrial applications.

The international evaluation of Finnish geosciences, which was jointly organized by the Academy of Finland, the Ministry of Trade and Industry and the Ministry of Education gave a positive picture of GTK's activities. According to the international experts involved, GTK is a sufficiently large and well-networked centre of excellence, which can make an active and solid contribution to large scientific projects involving neighbouring countries, the EU and global issues. It is also a serious partner in the building of international networks. According to EuroGeoSurveys (EGS), focusing on improving skills and the building of networks with universities, research institutes and other partners is the key to continuous success. GTK has already incorporated the recommendations and proposed action contained in the previous international evaluation in its operational development.

I would like to express my warmest thanks to the Ministry of Trade and Industry, to GTK customers and partners, and to the GTK staff for their fruitful cooperation during the seven years I have worked at the agency. It has indeed been a pleasure to have you as colleagues. When I came to GTK, I was looking forward to working in an open and at the same time constructive and critical atmosphere and I must say that my expectations have been amply fulfilled. GTK has always been a centre of geological excellence with few peers. I am happy and proud to hand over responsibility for a successful and highly respected GTK to the new Director General, Elias Ekdahl.



Raimo Matikainen

Message from the Board of Directors



In 2003, the Academy of Finland, the Ministry of Education and the Ministry of Trade and Industry commissioned an evaluation of the geosciences in Finland. The international evaluation group concluded in its report that the Geological Survey of Finland plays a key role in Finnish geosciences, and in its recommendations it emphasized the need for more geological mapping and for closer cooperation between GTK and the universities.

The deep seismic reflection sounding project has undoubtedly been the largest and most important geological research project in Finland in recent years. The purpose of the project, carried out as a cooperative venture between Finland and Russia, was to examine the structure of Finnish bedrock. The project, which was funded as part of the conversion of the debts of the former Soviet Union, also involved the geological departments of a number of universities. The interpretation of the project results will produce a detailed cross-section of Finnish bedrock, which will give us valuable information about its origins and history.

Despite changes in its operational environment, GTK has been able to venture into new research fields and operational areas. The most notable examples are the launching of research into environmental geochemistry, research on natural stone, collaboration in marine geology with Finnish Naval Headquarters and the expansion of international activities, particularly the rapid growth in project exports to Africa.

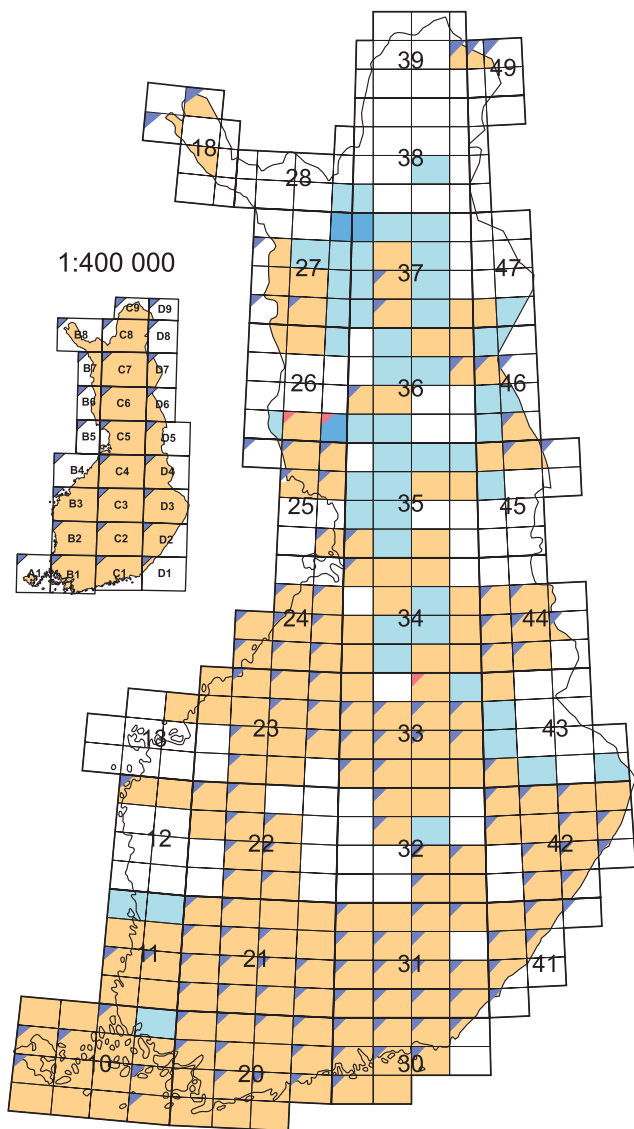
The term of office of the present GTK Board of Directors will end in 2004. I would like to express my satisfaction for the fact that during these years, GTK has assumed an increasingly important role both as a player in Finnish society at large and as a partner for industry and commerce.

The six years I have served as Chairman of GTK's Board of Directors have considerably strengthened my belief that a research organization like GTK is needed.

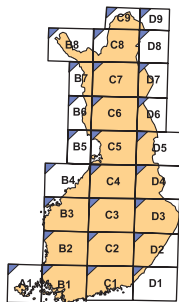
I should like to thank the GTK staff and Board of Directors for their sound performance. At the same time, I should also like to wish good luck and all success to the new Board and the new Director General.








Christer Sundström

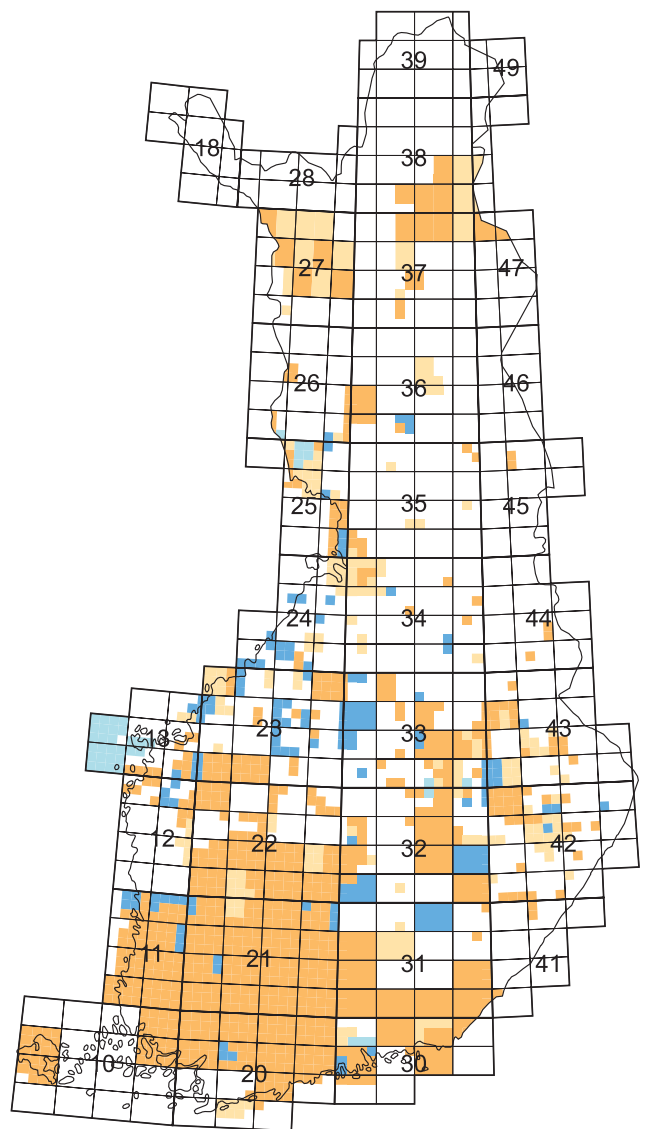


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


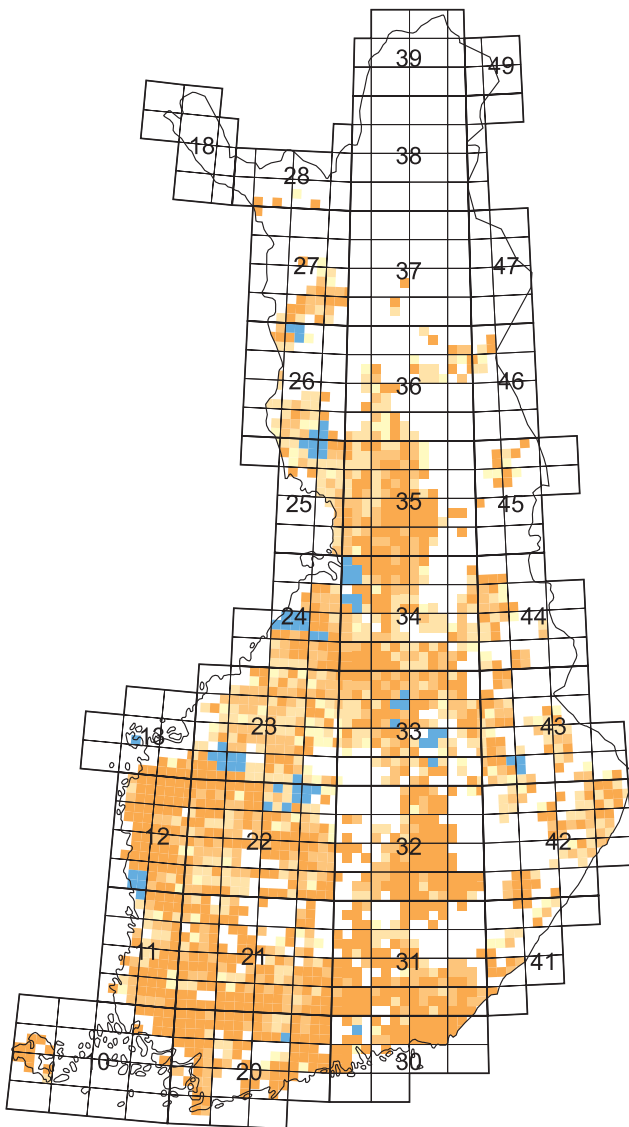
Kallioperäkartat 1:100 000
Berggrundskartor
Maps of PreQuaternary Rocks

-  Kartta julkaistu 2003
Kartan publicerad 2003
Sheet published 2003
-  Selitys julkaistu 2003
Beskrivningen publicerad 2003
Explanation published 2003
-  Kartta julkaistu ennen 2003
Kartan publicerad före 2003
Sheet published before 2003
-  Selitys julkaistu ennen 2003
Beskrivningen publicerad före 2003
Explanation published before 2003
-  Kartoitus käynnissä tai kartta tekeillä
Kartläggning pågår
Mapping in progress



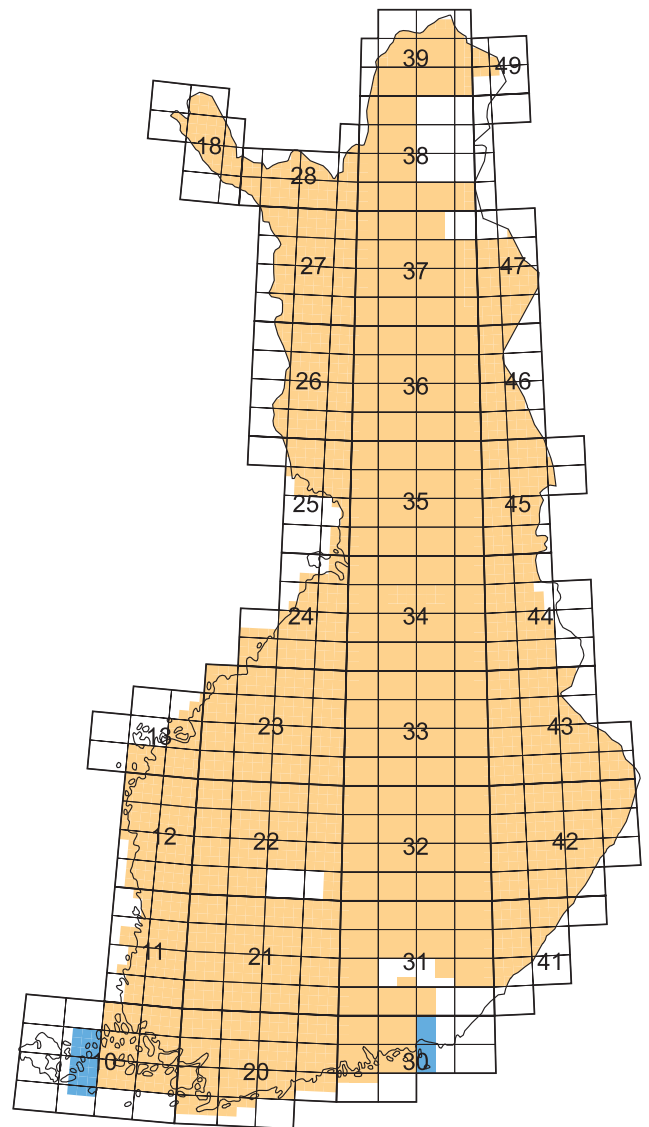
Maaperäkartat 1:20 000/1:50 000
Jordartskartor
Maps of Quaternary Deposits

-  Kartta saatavissa painettuna ja/tai numeerisena 2003
Kartan publicerad och/eller tillgänglig i digital form 2003
Sheet published and/or data released in digital form 2003
-  Kartta saatavissa painettuna ja/tai numeerisena ennen 2003
Kartan publicerad och/eller tillgänglig i digital form före 2003
Sheet published and/or data released in digital form before 2003
-  Kartoitettu ennen 2003
Kartlagd före 2003
Mapping completed before 2003
-  Kartoitettava
Kartläggning pågår
Mapping in progress



Turveinventointi
Torvinventering
Peatland research

- Suoalasta inventoitu 75-100 %
Inventerad andel 75-100 %
Surveyed peatland area 75-100 %
- Suoalasta kartoitettu 50-75 %
Inventerad andel 50-75 %
Surveyed peatland area 50-75 %
- Suoalasta inventoitu 25-50 %
Inventerad andel 25-50 %
Surveyed peatland area 25-50 %
- Suoalasta inventoitu < 25 %
Inventerad andel < 25 %
Surveyed peatland area < 25 %
- Kartoitettavana 2003
Inventering pågår 2003
Survey in process 2003



Matalalentomittaukset
Aerogeofysiska mätningar på låg höjd
Aerogeophysical low-altitude surveys

- Mitattu 2003
Mätningen utförd 2003
Surveys completed 2003
- Mitattu 1972-2002
Mätningen utförd 1972-2002
Surveys completed 1972-2002

Bedrock and raw materials

The purpose of the bedrock and raw materials programme is to map and investigate Finnish bedrock and its raw material potential and to produce geological information and services for society as a whole and GTK's interest groups. The aim is to promote the sustainable use of ores, industrial minerals and natural stone found in Finnish bedrock and to actively promote the setting up of industries based on them in Finland.



Programme Director Pekka Nurmi

During the year under review, GTK played an active role in improving the operating environment for the excavating industry, particularly by producing new mapping information on bedrock areas with the best raw material potential and by making geological information more widely available. The report on the Kettukuisikko gold occurrence in Kittilä was submitted to the Ministry of Trade and Industry, which will invite tenders for the site from international mining companies. In a joint project with the Ministry of Trade and Industry, GTK made claim reports since 1985 available on the Internet through its server, and in accordance with its new public information policy, GTK decided to make the documents pertaining to ore exploration in its old claim areas gradually available at a price covering the transfer costs. GTK provided the industry with information about Finnish ore potential at major international events in such places as Toronto and Rovaniemi. The latter hosted the 2003 Fennoscandian Exploration and Mining Conference (FEM), which has become one of the most important European events in the field. This year it attracted more than 300 participants from 20 countries and GTK was actively involved in the organization of the event.

International companies are showing growing interest in ore exploration in Finland, which has led to an increasing demand for geological information and expertise. GTK's capacity to examine the exploitation potential of raw materials in bedrock and to provide the excavating industry with more comprehensive services received a boost when the Ministry of Trade and Industry decided to transfer VTT Mineral Processing in Outokumpu to GTK from the start of 2004.

The field work for the deep seismic reflection sounding project was concluded in 2003. The high-quality material gathered during the project, which was covered by debt conversion arrangements between Finland and Russia, can be used for basic mapping of bedrock, research, and the identification of ore-bearing zones. The preliminary interpretation of the results has already revolutionized our idea of the Earth's crust in Finland to the depth of 60 kilometres. The Geomex project covering the Outokumpu area, which was carried out in collaboration with Outokumpu Mining Oy, was concluded during the year. It produced important new information and digitized models of the history of the bedrock in the Outokumpu area and the origin of ores. A borehole to be drilled to a depth of 2.5 kilometres in 2004-2005 will provide further information about the geological structure of the area. An agreement on the undertaking, which will also come under the debt conversion arrangements between Finland and Russia, was signed in 2003.

There was a substantial increase in the demand for GTK's expert services outside Finland, too. Mapping projects on bedrock and raw materials have been in progress in Mozambique and Tanzania for a number of years, and in the latter country, an extensive airborne geophysical survey programme was completed. A training programme on environmental management in the mining industry was organized in Russia.

Regional mapping programmes

Bedrock mapping is increasingly carried out on a need basis. In unmapped areas, most of which are in northern and eastern parts of Finland, a system in which the data are collected at a scale of 1 : 250 000 will be gradually introduced. This will substantially speed up the mapping programme. A total of 3 850 km² was covered by bedrock mapping and five bedrock maps were printed. At the end of the year, the GTK database contained 321 000 outcrop observations. GTK also concluded an agreement on the transfer of Outokumpu Mining Oy geodata to its own registers



GTK participated in the planning and building of the geoinformation centre at the Finnish Stone Center in Juuka, eastern Finland. Photo: Jari Väättäinen

over the next few years, which will make the records on bedrock, etc. much more comprehensive.

A total of 8 255 observation points were covered by regional gravity measurements, which were carried out to examine the structures of layered intrusions in Koillismaa and the arc complex in southern Finland, and to support the mapping of industrial mineral deposits in central Ostrobothnia.

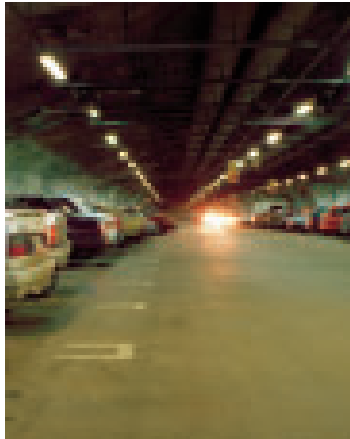
Metalliferous ores

In accordance with its strategy, GTK focused on the early stage of ore exploration which is directed towards scientific research and modelling. The aim is to produce basic information about mineral reserves in Finnish bedrock, develop exploration methods and locate new ore-potential areas. All new occurrences are reported to the Ministry of Trade and Industry so that they can be sold to private companies for further investigation and possible mining operations. In the exploration of metalliferous ores, the focus was on gold, which offers the best chances for new mining and in which the industry is also showing growing interest. The most important gold exploration projects were in the schist area of central Lapland, in Peräpohjola, central Ostrobothnia, and the Tampere-Forssa area. A report of the Kettukuusikko gold occurrence in Kittilä was submitted to the Ministry of Trade and Industry so that it could be marketed for further investigation by the industry. New modelling methods based on joint interpretation of geodata were developed for identifying

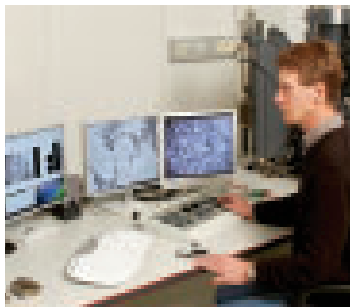


GTK was able to determine that the trondhjemite gneiss of Siurua in Pudasjärvi is 3 500 million years old and thus the oldest rock in Finland and the European Union. Photo: Kaleva/Laura Vuoma

Students from the Universities of Helsinki, Oulu and Turku and the Åbo Akademi University on a GTK-organized advanced course on bedrock mapping. Professor Nick Oliver from the James Cook University in Australia acted as their teacher. Photo: Mikko Nironen



Safe and successful rock construction calls for a sound knowledge of bedrock. The Forum underground car park in Helsinki. Photo: Jari Väättäinen



GTK's new CAMECA SX100 electronic probe micro-analyser is used for analysing the chemical composition of minerals and metals, and producing images of their structures. The photograph shows Bo Johansson, a geologist, with the new instrument. Photo: Jari Väättäinen

gold deposits and gold-potential areas, and they were tested in central Lapland.

Examination of the potential for platinum group metals in the layered intrusions in northern Finland continued in Koillismaa and eastern Lapland. Reports on the nickel exploration projects in southern and central Finland that have been going on for several years were completed and nickel deposit models were developed in cooperation with the Australian research institute CSIRO. A new zinc deposit model for the area around Vihanti was completed. The new metallogenic map of Finland was published and GTK began the preparation of the Fennoscandian metallogenic database in collaboration with the neighbouring countries.

BEDROCK AND RAW MATERIALS	2003	2003
	planned	implemented
Claims related to mineral exploration, hectares	8 000	3 585
Economically significant exploration targets reported to the Ministry of Trade and Industry	6	1
Aerogeophysical surveys, line km	120 000	195 300
Gravimetric surveys, km ²	2 000	1 100
Bedrock mapping, km ²	1 500	3 853
Bedrock maps 1:100 000	4	5
Bedrock observations/KALPEA	5 000	9 456
Inventory of rock aggregates, km ²	3 000	3 000

Natural stone

The aim of GTK is to secure a supply of raw materials for the Finnish stone industry and ensure their sustainable use. In order to provide more resources for research in the field, a research professor specializing in the natural stone sector was appointed at the GTK Kuopio Office. The natural stone industry is a growing business and most of the quarries are located in regions where they are important providers of employment, such as north Karelia, Kainuu and southeastern and southwestern Finland. Considerable progress has been made in stone production technology.

Exploration surveys of natural stone were carried out in such areas as parts of Pirkanmaa, southern parts of central Finland and central Lapland. A regional mapping project covering six municipalities in eastern Uusimaa was concluded during the year.

The natural stone industry development projects receiving funding from the Interreg IIIA Karelia programme in which GTK acted as the implementing body were also among the natural stone projects carried out during the year. They included the Suomussalmi soapstone project, the development project launched by the City of Kuhmo covering the networking and material competencies of companies and the project pertaining to the applicability survey of the rock aggregate in the Ruskeala quarry of the Juuan Dolomiittikalkki Oy. GTK took part in a project that involved the gathering of a database of natural stone by-products and the construction of an expert system.

GTK was actively involved in the planning and building of the Finnish Stone Center at Nunnanlahti in the municipality of Juuka. The purpose of the Center, which was opened in the summer, is to promote the development of the stone industry, to encourage the creation of small enterprises in the sector and provide them with support. It is also a major tourist attraction. The Finnish Stone Center is a collaborative effort by a



Diamond drilling in progress as part of an investigation of a natural stone site in Pirkanmaa. Photo: Paavo Härnä



As part of the central Lapland building stone project, stone suitable for use in construction has been sought in the Sodankylä-Kittilä area. The picture shows granite rock being cleaned at Hirvasvaara in Sodankylä. Photo: Risto Vartiainen

number of players in the stone industry, including the Juuka Stone Village Foundation, GTK, the Technical Research Centre of Finland (VTT), the North Karelian joint municipal authority for education, the University of Art and Design Helsinki and Centro Tecnológico del Marmol, a Spanish research institute. The geoinformation centre of the Finnish Stone Center, which was designed and built by GTK, uses the latest multimedia technology to display different aspects of geology and provides comprehensive information on natural sto-

nes, the natural stone industry and the different uses of stone

The year also saw the completion of the final report of the LYKE project. This extensive undertaking, which was carried out in 1999-2002 and which was coordinated by GTK, covered a number of research fields and focused on the environmental impacts of natural stone production.

Olavi Selonen

Industrial minerals

In industrial mineral exploration, the focus was on meeting the growing need for pigment minerals in Finnish industry, with calcite in southwestern Finland, talc in eastern Finland and kaolin in northern Finland being the most important targets. During the last few years, GTK has reported 12 industrial mineral occurrences to the Ministry of Trade and Industry, seven of which have been transferred to companies. Four of the occurrences contain calcite and three ilmenite.

In 2003, the Ministry of Trade and Industry sold the claims for the ilmenite occurrences at Kairineva in Halsua and Peräneva in Kälviä to Kalvinit Oy, which launched further investigation in the areas.

For about ten years, GTK has been actively searching for ilmenite, the raw material used in titanium white, in western and southern Finland. So far, the most important find has been the Koivusaarenneva occurrence in Kälviä, which GTK reported to the Ministry of Trade and Industry in 1996. Kalvinit Oy has carried out further investigations in the area and full-scale trials in 1998-2001 showed that the ilmenite in Koivusaarenneva can be used for the production of titanium oxide pigment.

GTK discovered the Peräneva and Kairineva occurrences a few kilometres from Koivusaarenneva. They are a substantial addition to the ilmenite reserves in the area and make the establishment of a mine much more likely. The quality of the ilmenite in the occurrences studied is on a par with the concentrates imported to Finland. The annual consumption of titanium oxide in the world is more than 4 million tonnes or worth more than EUR 8 billion. The consumption of titanium pigments has been rising steadily at an annual rate of three per cent and prices are also on the increase. Kemira's pigment plant in Pori turns out about 100 000 tonnes of pigment every year and production will go

up to 150 000 tonnes by 2005. The total value of Finnish pigment production is about EUR 250 million.

Of the calcite occurrences discovered by GTK, the Hyypiämäki occurrence in Kisko and the Norrlammala occurrence in Västanfjärd are owned by the mining company Omya Oy, while the Järvenkylä calcite occurrence in Sauvo and the Iso-Sorro calcite-dolomite occurrence in Kisko belong to Nordkalk Oy. In 2003, Omya Oy began test extraction at the Hyypiämäki occurrence in Kisko and full-scale test runs at the Förby plant. The plan is to produce ground calcium carbonate (GCC) suitable for paper production. A total of 0.5 million tonnes (worth EUR 100 million) of GCC is imported to Finland every year.

Olli Sarapää

Deep seismic sounding reveals bedrock structures

The deep seismic reflection soundings in Finnish bedrock carried out as part of the joint deep seismic reflection sounding project FIRE involving GTK, the Institute of Seismology of the University of Helsinki, the Institute of Geosciences of the University of Oulu and the Sodankylä Geophysical Observatory were concluded in June. The seismic soundings covered a total of 2 100 line kilometres in 2001-2003. The measurements were carried out by Spetsgeofizika and Machinoexport, two companies owned by the Russian government and the project was covered by a debt conversion agreement between Finland and Russia. GTK and the universities were responsible for the planning, organization of the field work and interpretation. The reporting and interpretation of the



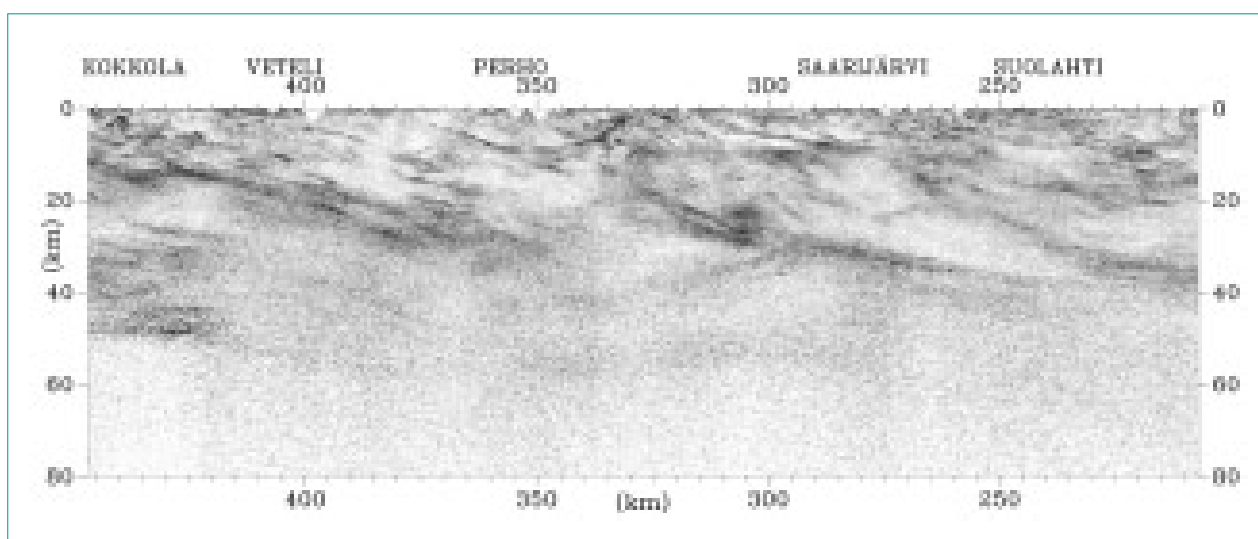
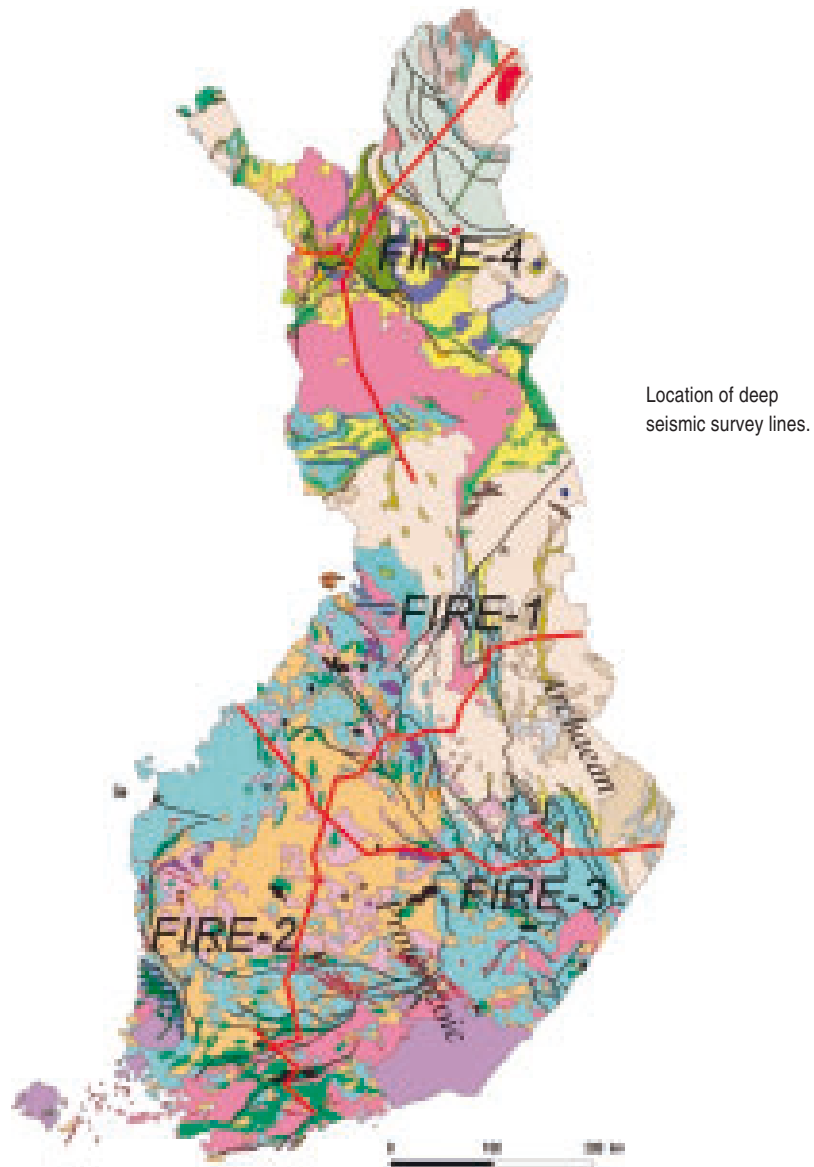
Experts from the FIRE project discussing the work at a meeting on site at Leppävirta. From the left, project managers V. Kostjuk from Spetsgeofizika and Ilmo Kukkonen from GTK, with interpreter Pekka Naumov, geophysicist I. Moissa, director R. Berzin and head geophysicist N. Zamoshnyaya, all from Spetsgeofizika.

results of the FIRE project will continue until the end of 2005.

Seismic reflection soundings have provided us with new information about the history and structures of Finnish bedrock. The results revealed previously unknown bedrock structures to a depth of 50-60 kilometres. The results show that even in the lower parts of the Earth's crust there are layers with a thickness of only a few hundred metres. The reflections are generated by variations in density and seismic velocity that are caused by variations in rock types and weakness zones in bedrock. The results also provide information about the collision of continental plates and the folding of mountain ranges that shaped Finnish bedrock 2 700 to 1 800 million years ago.

The sounding results provide a collection of high-quality material for basic mapping of bedrock, research and the identification of ore-bearing zones. As part of the FIRE project, a number of tests with seismic reflection methods were carried out in known ore-bearing zones with the aim of examining the suitability of the method for mineral exploration. The results were promising.

Ilmo Kukkonen



The seismic reflection method has revealed previously unknown bedrock structures extending to a depth of 50-60 kilometres. The curved lines in the picture are related to the collision of continental plates 1 880 million years ago, which shaped the bedrock in central Finland.

Land use and environment

The land use and environment programme covers the mapping and surveys of quaternary deposits and their natural resources and research in environmental geology. The aim is to produce information, applications and services for decision-making, land use planning, industry and commerce so that the supply of raw materials and land use can be secured on the basis of sustainable development.



Programme Director Hannu Idman

A total of five different joint projects catering for land use needs were launched in the land use and environment programme during the year. The most far-reaching of them is the agreement between GTK and the Ministry of the Environment on the joint development of natural resource accounting. GTK and the University of Kuopio established a joint research professorship in environmental geochemistry to support and promote research and teaching in the sector. GTK issued more publications for international circulation than in previous years on topics such as environmental change, final disposal of nuclear waste and groundwater quality. A mapping project on environmental geochemistry focusing on Northwest Russia that has been going on for several years was concluded on schedule during the year.

Mapping

Three joint mapping projects were launched during the year. The three-year GeoNat mapping project was started in the geologically unique Kvarken region. The aim of the undertaking, which will cover both land and sea areas, is to support land use solutions and promote joint efforts by the Finnish and Swedish regional administrations to make Kvarken a World Heritage Site. Most of the funding for the project is coming from the EU Interreg IIIA Programme.

A project for producing nation-wide digitized information on quaternary deposits and soil at a general scale was launched in collaboration with MTT Agrifood Research Finland and the Finnish Forest Research Institute. The undertaking, which will run for several years, is based on the shared use of the agencies' material and on the latest geographic data and image processing technology. The results will serve the needs of both Finnish users and the EU.

In the Helsinki metropolitan area, a three-year KallioINFO development project providing information for building in urban areas and growth centres. The undertaking is part of the Competitive Rockbuilding development programme run by TEKES covering a total of nine municipalities in the Helsinki subregion.

Barents Ecogeochemistry and the geochemical mapping programme of FO-REGS, two extensive international mapping projects focusing on the state of the environment, were concluded on schedule during the year. Coordinated by GTK, the draft of the Barents Ecogeochemistry final report was completed and some of the preliminary results were presented in different forums, such as St. Petersburg and a number of international conferences.

The mapping of natural resources carried out as part of the land use and environment programme covered areas that are important to industry and society at large and the projects went according to plan.

The aim of cooperation with the Ministry of the Environment on natural resource accounting is to promote the sustainable use of sand and gravel and to put the resources for guiding and monitoring their extraction on a more effective basis. New estimates on Finland's peat reserves were published, and detailed mapping reports were submitted for six municipalities. The peat map site facilitating the dissemination of mapping results on the Internet was made technically operational. Mappings and modelling of important groundwater areas were carried out as jointly funded projects and contracted undertakings.

Environmental geology research

During the year under review, environmental geology research focused on two areas: the exploitation of mineral resources and land-use research.

In research related to the exploitation of mineral resources, both the project on the



One of the goals of the GeoNat project, currently under way in the Kvarken, is to survey natural geological values in the region. The photograph shows the north-west ridge of Rogen moraine boulders at right angles to the glacial flow at Kaukaluoto in the municipality of Mustasaari. Photo: Olli Breilin

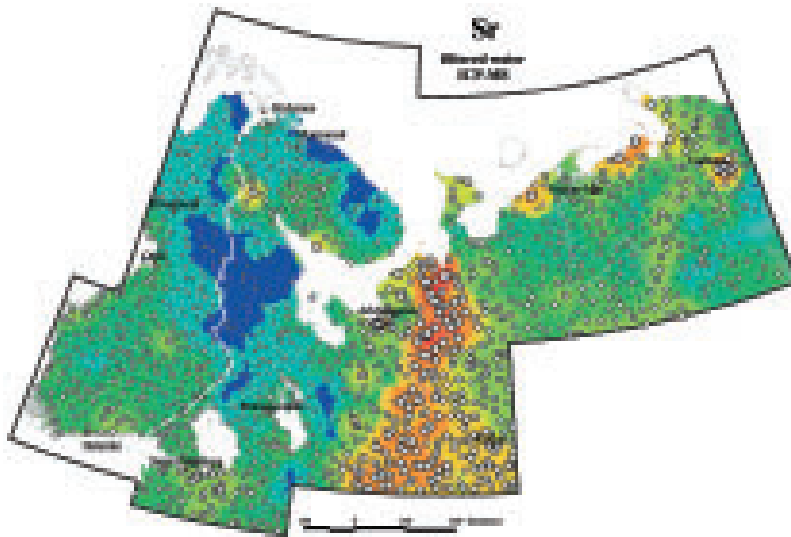
Raadesuo near Kisko is a raised bog complex including ridge-hollow pine bogs. Photo: Jari Väättäin

state of and remediation methods for old mining sites, and the project on greenhouse gases in peat mires and the growth rate of the peat layer in mires continued during the year. The latter project also involves the Universities of Joensuu and Helsinki and is part of the research programme “Greenhouse impacts of peat and peat use in Finland”, a joint undertaking by the Ministry of Trade and Industry, the Ministry of the Environment and the Ministry of Agriculture and Forestry.

GTK completed a nationwide survey of the quality of well water used as household water in sparsely populated areas. The survey, which covered 1 000 wells, provided information about a number of elements on which no comprehensive information has previously been available. These include iodide, bromide, barium, lithium, rubidium, arsenic, antimony, beryllium, thallium, tin and thorium. It was found that the condition of wells in Finland has improved. For example, there were fewer wells with a high nitrate content than in previous surveys. Geologist Tarja Hatakka examining water samples.

Photo: Jari Väättäinen





The 5-year Barents Ecogeochemistry project, a neighbouring areas cooperation project, was concluded and results of international importance were published in St Petersburg and Espoo.

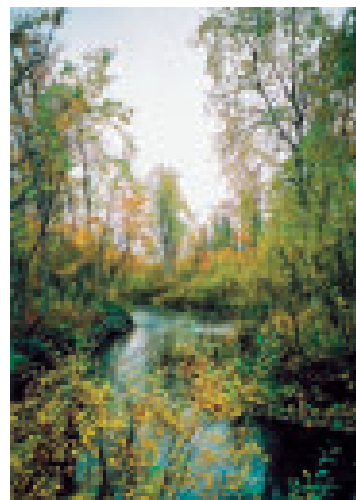
Strontium content in stream waters in the Barents survey area. Areas marked in red have a high content, while those marked in blue have a low content.



Measuring water alkalinity in Eastern Karelia.

The extensive final report of the project covering the development and life span of the stone production environmental information system was published in the Finnish Environment series. The EU-funded MINEO project (Assessing and monitoring the environmental impact of mining activities in Europe using advanced Earth observation techniques) was concluded. A new three-year project “Environmental technology in mining” involving business groups was launched during the year. The project is coordinated by Outokumpu Oyj and partly funded by TEKES and the aim is to develop technology and know-how in the field of mine closures that would have export potential.

The surveys on regional land use carried out during the year covered a wide variety of areas. The PERMAFROST project on the permafrost phenomenon, part of the research on the final disposal of nuclear waste, continued in the international research network in collaboration with power companies. The FEMMA project on methods for assessing the environmental impacts of forestry continued as an undertaking funded by the Academy of Finland, and the project “Tools for combating water pollution caused by forest drainage” a new project on the topic, was granted funding as part of the “Ecoefficient Society” research programme financed by different ministries and the Academy of Finland.



A small river in the central Russian taiga from which samples were taken.

LAND USE AND ENVIRONMENT	2003	2003
	planned	implemented
Groundwater reservoirs, assessments on availability	10	12
Peat inventory, km ²	300	274
Reported marketable amount of peat, million m ³	90	148
Peat surveys, spot data	12 500	11 119
Surficial mapping 1:20 000/1:50 000, km ²	1 500	1 151
Surficial maps 1:20 000/1:50 000	100	183
Spot data on surficial mapping	1 300	2 190
Marine geological mapping, km ²	700	550
Marine geological sounding, line km	1 000	1 600
Marine geological assessments	6	8
Environmental assessments	75	90

Mining sites

GTK examined the chemical changes in a tailings stockpiling facility containing ferrous sulphide and its impacts on surface water and groundwater, and the suitability of wetland treatment for the purification of the seepage water in the stockpiling facility. The suitability of geophysical methods for describing the structure of the tailings stockpiling facility was also tested.

Soil investigation in a tailings stockpiling facility showed that compressing peat provides an excellent protective layer, which prevents the underlying layers and the groundwater in them from becoming contaminated. If the seepage waters are discharged onto the surface or to the contact areas of the dams surrounding the facility, the wetland treatment method can be applied.

The joint professorship in applied environmental geochemistry backed by GTK and the University of Kuopio that was set up in August 2003 will promote research cooperation in environmental matters relevant to the excavating industry and the metal industry. The professorship will also help to expand our



basic knowledge of the chemical behaviour of heavy metals in land and water environments, which in turn will make it easier to develop technology for the remediation of contaminated areas.

Marja Liisa Räsänen

Seepage water area in a tailings stockpiling facility at Luikonlahti old copper mine in Kaavi. Photo: Marja Liisa Räsänen

Consideration of environmental aspects when extracting land resources

Depending on the overall economic situation, between 60 and 100 million tonnes of land resources, such as gravel, sand and crushed stone is used in Finland every year. The largest amounts of land resources are produced in areas near growth centres where environmental aspects and the need to protect groundwater supplies have to be considered when decisions are made on land resources supply and other forms of land use.

The duty to report extraction activities that was incorporated in the updated Land Extraction Act in 1997 created a

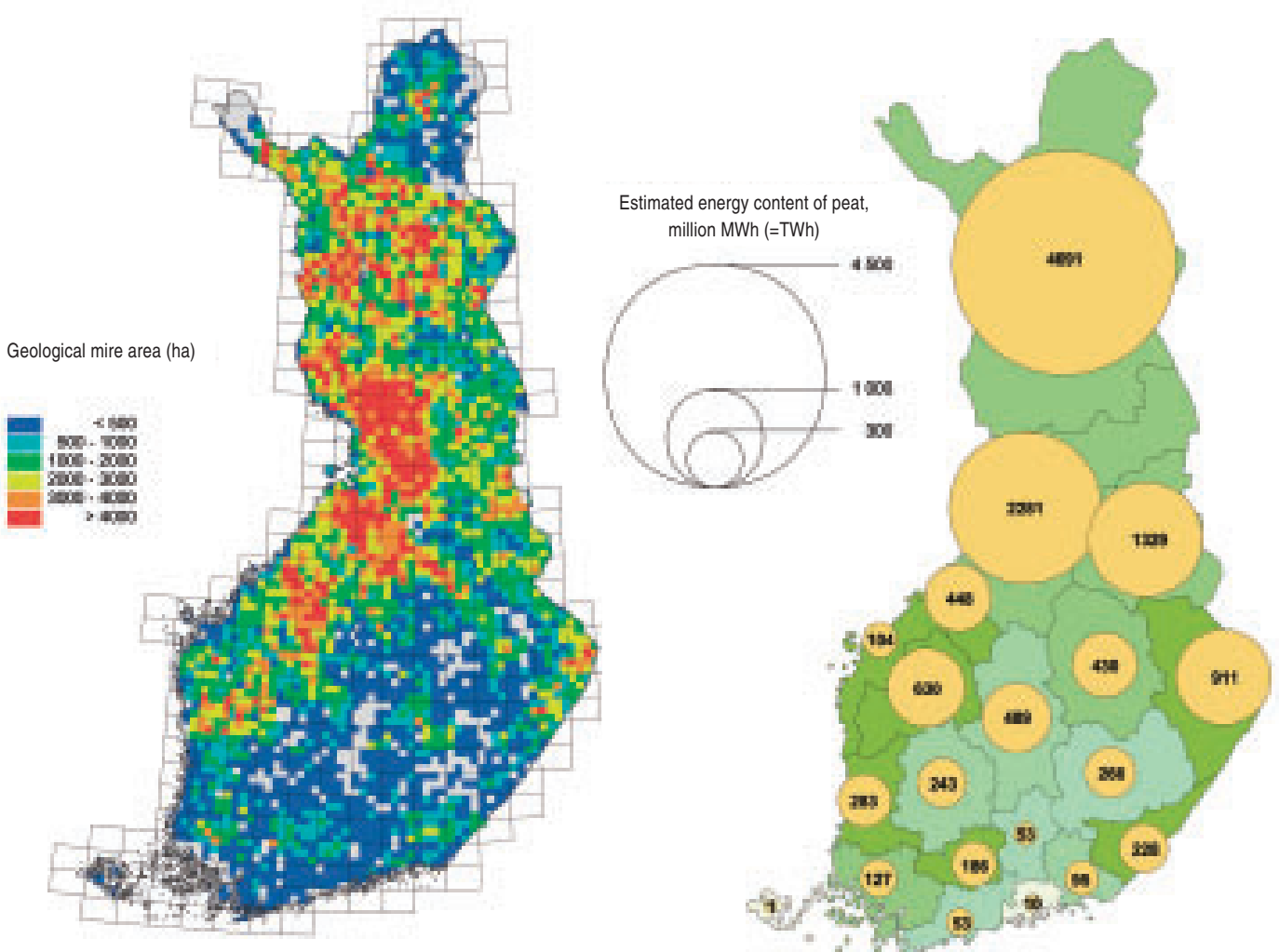
basis for natural resource accounting, which provides information about the amount and quality of the remaining land resources. A pilot project carried out by GTK and the Finnish Environment Institute in 1999-2000 showed that a well-functioning and workable accounting system can be put into effect by combining the extraction and resource register data.

The Ministry of the Environment, the Finnish Environment Institute and GTK have agreed to collaborate in the development of natural resource accounting. The system will be made part of

GeoKernel, GTK's data management system, which can be accessed via the Internet. GTK has already launched a development project on natural resource accounting under which the project framework plan and work plan for 2004-2006 were drawn up in collaboration with the environmental administration in 2003. The aim is to secure the land resources supply for society at large and improve material effectiveness in accordance with the principle of sustainable development.

Ismo Ahonen

Finland's peat reserves



GTK published the latest estimates on Finland's peat reserves. Finland has a geological mire area of 5.1 million hectares, which is estimated to contain a total of 69 billion cubic metres of peat in situ. The exploitable mire area amounts to 1.2 million hectares, which contains 30 billion cubic metres of peat. Most of this (24 billion cubic metres) is decomposed peat that can be used for energy generation, while the rest is light sphagnum peat that acts as a substrate or comes under the category of environ-

mental peat. The energy content of the exploitable peat reserves is about 13 000 TWh. This is equivalent to 1 100 million tonnes of oil or two thirds of the energy content of the known oil reserves of Norway.

However, the actual total of exploitable peat reserves is lower, as environmental protection and other land use and economic considerations limit the amount of peat available for extraction.

Lapland and northern Ostrobothnia are the Finnish regions with the largest

mire area. According to a recent survey, about one third of the exploitable peat reserves are in Lapland.

Kimmo Virtanen

Geoservices

The Geoservice Centre is the GTK national service unit that provides most of its laboratory, geophysical and field research services.

During the year under review, on the basis of the preparatory work carried out by GTK and the Ministry of Trade and Industry, the Finnish government decided to incorporate VTT Mineral Processing into GTK. This internationally renowned cluster of expertise in process mineralogy, located in Outokumpu, eastern Finland, became part of GTK Geoservices at the start of 2004, which supplemented GTK's already extensive range of services in the minerals sector. In addition to mineral processing, the equipment and expertise of the unit will also permit the development of more advanced environmental services in such areas as the investigation of contaminated areas and processing. The equipment includes a pilot-scale dressing plant.

Geolaboratory

The 5th International Conference on the Analysis of Geological and Environmental Materials, an event in the conference series of the International Association of Geoanalysts (IAG) was held in Rovaniemi in June. GTK's Geolaboratory was responsible for organizing the event. The fact that Finland had been chosen as the venue for the meeting showed that we are trusted and that geoanalytical and geochemical research in Finland is held in high international esteem. A total of 110 experts from 22 countries took part in the conference.

The three-day scientific programme at the conference covered quality assurance in the taking and processing of samples and analysis, and new analysis techniques for geological and environmental samples. On a new topic concerning applied geoanalysis, the conference discussed matters related to global ecogeochemical mapping.

The operations of the mining laboratory in Sodankylä established in 1997 were expanded as a result of the reopening of the Pahtavaara gold mine. Customer-funded laboratory activities provide jobs for about ten people in Sodankylä, which is significant from the point of view of employment in the region. This also has a major impact on know-how at the national level and the provision of services in the mining sector in Finland.

In connection with its quality system and accreditation, the Geolaboratory takes part in number of international proficiency tests on a regular basis. During the year under review, it participated in four international test programmes which had a total of 11 analysis rounds. Most of the results were excellent and showed that the testing services provided by the Geolaboratory are of high quality by international standards.

Geophysics and marine geology

Most of GTK's airborne geophysical surveys were carried out as part of its international projects. In addition to an unusually large project in Tanzania covering a total of about 150 000 line kilometres, GTK carried out an airborne survey project in Portugal and Spain that mainly served the needs of ore exploration.

As a result of the extensive international airborne survey projects, the national mapping programme in Finland could not be carried out to the extent envisaged. A total of 18 000 line kilometres were covered in Hamina and Kumlinge in June, and for exploration of natural resources, measurements were also carried out using a denser line spacing in selected areas in eastern and northern Finland. In addition to traditional applications in bedrock mapping, airborne geophysics was also used for locating eskers covered by Quaternary deposits, which is very important for sectors



Electronic geophysical measurements of the terrain made by the GTK monitoring device at the Ämmässuo landfill site. In the foreground is geophysicist Taji Huotari with a trainee, Paula Jääskeläinen, behind her. Photo: Jari Väättäin

such as groundwater research. The capacity of the equipment was increased by doubling the number of NaI sensors in one of GTK's two gamma radiation measuring devices, which means that GTK now has two spectrometers with similar performance.

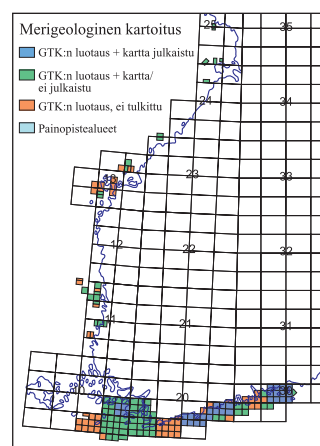
As part of a debt conversion agreement between Finland and Russia, GTK acquired and tested Russian geophysical equipment. It included technology that is not commercially available in the West.

In the development of methods, the emphasis was on the applications of environmental geophysics, for example the examination of the thickness and structure of mining waste heaps and the study of the topographic structures beneath them.

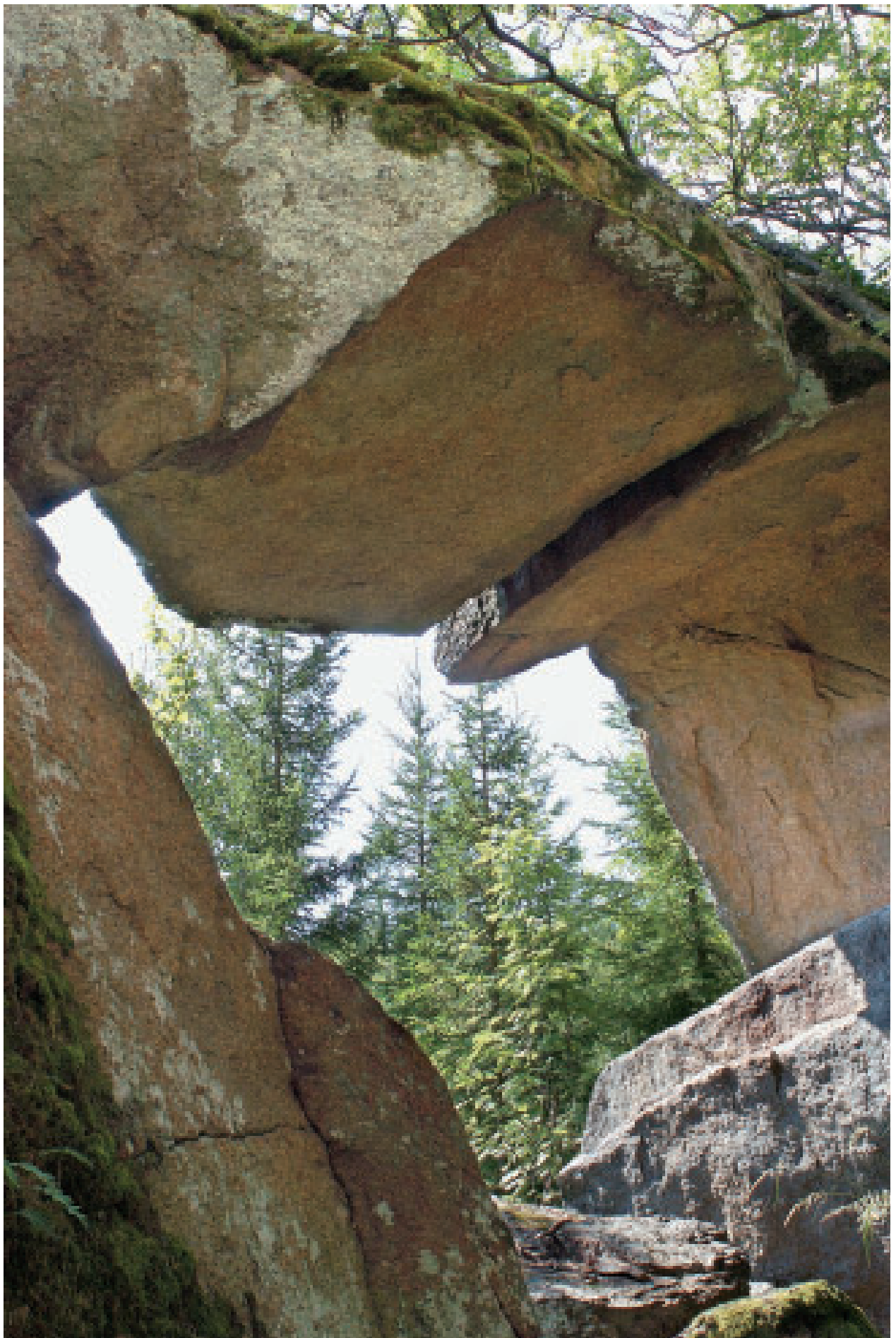
New research vessel launched

The joint research vessel commissioned by GTK and the Finnish Naval Research Institute was named

Geomari on December 16, 2003. Joint ownership enables the two parties to save costs and expand their expertise in studying the sea bottom.



Marine geology surveys 2003



Rock arch at Rantasalmi.
Photo: Jari Väätäinen



The research vessel shared by GTK and the Finnish Naval Research Institute was launched and named *Geomari* in Pansio on December 16, 2003.
Photo: Matti Tuhkanen

The contract for the building of the vessel was signed with Mobimar Oy in 2002 and the work started in spring 2003. Summer 2004 will be spent on sea trials and the vessel will be fully operational for the 2005 sailing season.

As part of a more extensive geological research project in the Kvarken region, the research vessel *Geola* carried out soundings in the uplift area of the Vaasa archipelago. The areas surveyed covered two map sheet areas and the results can be used for feasibility studies for such projects as planning of fairways, for assessing the extent to which geological structures continue into the sea and the diversity of sea bottom geology.



The 5th International Conference on the Analysis of Geological and Environmental Materials was held in Rovaniemi in June. The GTK Geolaboratory was responsible for organizing the event. The picture shows some of the participants in front of the conference building.

GEOSERVICES	2003	2003
	planned	implemented
SUPPORT SERVICES		
Samples analysed chemically	75 000	122 510
Chemical determinations	1 500 000	2 486 959
Till samples taken	6 000	4 271
Soil samples (contaminated land)	1 450	527
Samples of lake and sea sediments	1 500	3 890
Water samples	600	750
Drilling, metres	33 000	25 798
Ground measurements	420 000	291 952
BOUGHT SERVICES		
Deep drilling, metres	40 000	31 044
Ground measurements	50 000	16 364

Information management

The purpose of the GTK information management programme is to ensure long-term availability, accessibility and usability of geodata and to organize IT services in accordance with operational requirements. GTK aims to achieve this by harmonizing databases, IT architectures and service packages, by using data security arrangements that meet Government specifications and by developing expertise and methods on a systematic basis. GTK information management can reach these targets through close cooperation with mapping and research. Making research results and other geological information available to users and to the public at large is an essential part of GTK operations.

Information management development at GTK remained focused on projects improving management and usability of information. In the GeoKernel project, an updated system for managing the geological aspects of geographic data will be built to cover the entire information production chain, from gathering the information in the field to producing maps and disseminating information. GTK was able to solve the most important questions covering the structure and workability of its databases. The testing of field data collection devices was carried out as planned. The first part, the sand and gravel system, entered the trial stage at the end of 2003.

The intention was to convert the last important documents into digitized form in 2003, the last year of the document project, but the target was not quite reached. The job will be completed by individual GTK units as their own digitizing projects. Both projects aim at keeping GTK's service capability at a high level at a time when information technology is making rapid process. GeoKernel and the digitizing of the material have also required a substantial amount of resources — an estimated 15 manpower-years in 2003 alone.

The year also saw the start of a new project: the transfer of Outokumpu Oyj's ore exploration material to GTK. During the pilot year, the two organizations agreed on the terms and conditions of cooperation and the first items of the vast quantity of material were transferred.

GTK expanded the distribution of its map products on the Internet. In addition to the Quaternary deposits map service and the Exploration package intended for ore exploration companies, the Internet now also provides access to the extensive Geoimage bitmap collection, which includes printed bedrock maps and large numbers of geophysical maps. In a collaborative venture, GTK and the Ministry of Trade and Industry began to distribute claim reports on the Internet and the intention is to make it more extensive over the next few years. Both the content and appearance of GTK's Finnish-language website were updated. There are a total of 16 reference databases covering archived material plus the material in libraries and collections. There is also a large number of thematic databases. The GTK Internet site registered a total of 605 000 external visits.

GTK research staff published their findings in domestic and international series. GTK printed in its serials a total of 20 publications and 12 maps. A total of 2 245 publications were sold, while at the same time GTK had 75 publication exchange partners in Finland and 353 in other countries.

The GTK libraries received a total of 1155 periodicals, of which 520 were purchased. In addition, a total of 1347 books and 239 geological maps were acquired.


GTK played a prominent role in building the exhibitions at the Finnish Stone Center in Juuka. A smaller geology exhibition was also opened in the foyer of the GTK Kuopio Office. The Espoo mineralogical museum was closed in November because of construction work. A new and more extensive museum and exhibition will be opened in early 2005 when GTK's new customer service facilities are completed.

International cooperation included the compilation of the Multilingual Thesaurus in geology, the international geoinformation model and geographic information technology. GTK presented its online map service at an international meeting on geographic data in Italy.

GTK adopted a new information management strategy in the autumn. The new strategy will focus on the management of the information flows in research and mapping, the management of GTK material and the development of networked services.



A group of nursery school children visiting GTK's museum.
Photo: Caj Kortman



GEOGRAAFISKA INSTITUUTIN GEOKARTTA

GTK:n karttapalvelimet

Geokarttapalvelut

Geokartta on palvelu, jossa voit tutkia maan pintaa ja sen muuttamista. Voit tutkia maan pintaa ja sen muuttamista. Voit tutkia maan pintaa ja sen muuttamista.


www.geokartta.fi/index.html



Active Map Explorer

Active Map Explorer on karttapalvelu, jossa voit tutkia maan pintaa ja sen muuttamista.

www.geokartta.fi/active-map-explorer/



Information about maps published by GTK is available at the address <http://www.gtk.fi/geokartta/index.htm>

International cooperation

In international cooperation, GTK focused on projects in the neighbouring countries, projects in Africa financed by the Nordic Development Fund and the World Bank, and research projects and regional development projects financed by the European Union.

In cooperation with the neighbouring countries, the Barents Ecogeochemistry project was concluded during the year and the results that are most important to the international research community were made public in St. Petersburg in November and in Espoo in December. The year also saw the completion of the deep seismic reflection sounding project FIRE, the biggest Finnish-Russian collaborative project in geology involving GTK and the preliminary geological and geophysical interpretations were made available to the scientific community. The sounding profiles contain new detailed information about the deep-lying structure of the Fennoscandian Shield and are crucial to the modelling of the development of the continental plate and research on its geological processes. In a continuation of the project, a record-deep borehole (2.5 km) will be drilled in Outokumpu in eastern Finland in 2004-2005 for research purposes. GTK ordered the work from NEDRA, a Russian State-owned company specializing in deep drilling and the trading house Machinoexport.

The three-year inter-disciplinary GEONAT project was launched in the Kvarken region in collaboration with SGU. The GTK-coordinated undertaking has already produced one important result; the Kvarken archipelago is now among the Finnish sites the Finnish government proposes for inclusion in the World Heritage List.

The EU-financed research projects, PERMAFROST, ENVRISK, EUROSEISMIC and SEAREG proceeded on schedule. The providers of funding were satisfied with their progress and the results so far achieved. The MINEO project was concluded at the end of June as planned and received excellent marks in an international project assessment. In the FOREGS Geochemical Mapping project the final map versions were being prepared. The European Geochemical Atlas will be published on the Internet starting in 2004. The geochemical material on background concentration is the first detailed record covering such a large area in the world. GTK was only able to contribute to the BALTCOAST project until early 2003 as it proved impossible to reach agreement on Finnish national co-financing for the undertaking.

As there are differences in invoicing regulations and financing conditions between providers of EU-funding, getting national co-financing for EU projects has proved a challenge.

GTK's most important international scientific cooperation projects and partners include the following:

Geological mapping

- **GEONAT** – A three-year inter-disciplinary mapping project, which is financed through EU Interreg funding. The project was launched at the start of the year in the Kvarken region in collaboration with SGU
- **Kola Fjord project** – Geochemical and marine geological mapping in the Murmansk region

Applied geophysics

- **Spetsgeofizika, Russia:** Deep Reflection Seismic Survey in Finland – **FIRE**
- **Europrobe Programme, Svekalapko Project:** Integration working group, and geothermal, paleomagnetic and geoelectric sub-projects
- Object Oriented P223E EM Modelling – **AMIRA**



The GTK airborne surveys in Tanzania were completed at the end of the year.
Photo: Kai Nyman

State of the environment and sustainable development

- **Barents Ecogeochemistry:** Regional geochemical sampling in Russia, Finland and Norway in the western part of the project area. S/C Mineral, Arkhangelskgeolrasvedka, Central Kola Expedition and S/C Mireko (formerly Poljarnouralgeologia)
- **FOREGS:** Geochemistry Working Group
- European seismic metadata and information centre – **EUROSEISMIC**



A contract was signed in Maputo under which GTK will carry out geological survey work in the southern part of Mozambique. The four-year project is part of the Mozambique ore reserves development and training programme. Castigo Langa, Mozambique Minister for Energy and Natural Resources (left), and Research Manager Gabor Gaál, representative of the consortium led by GTK, signing the contract for the project in September.
Photo: Markku Tiainen



The study area for the new project covers the whole of southern Mozambique.

- **EUFAAR** European Fleet of Airborne Geoscience – A remote sensing consortium involving 15 European research organisations
- Strategy development for long-term pollution control in regions of extreme environmental risk – **ENVRISK/INTAS**
- Sea level change affecting spatial development in the Baltic Sea region – **SEAREG/Interreg IIIB**
- **BaltCoast/Interreg IIIB**
- Assessing and monitoring the environmental impact of mining activities in Europe using advanced Earth observation techniques – **MINEO**
- **European Environmental Agency – EEA:** European Topic Centre/Terrestrial Environment – **ETC/TE**
- **Permafrost** (GTK, SKB, Posiva, Nirex, OPG)

Research on minerals and materials, environmental cooperation

- University of Cape Town
- State University of Pittsburg, USA
- State University of Pennsylvania, USA
- NORDSIM, Naturhistoriska Riksmuseet, Stockholm
- All-Russian Geological Research Institute (VSEGEI), St. Petersburg
- Russian Academy of Sciences, St. Petersburg, Petrozavodsk and Apatity
- Eesti Geoloogiakeskus

Promoting the mineral industry

- **James Cook University, Economic Geology Research Unit:** The Vihanti-Pyhäsalmi zone, the Central Lapland greenstone belt and iron oxide copper-gold deposits in Lapland
- **University of Queensland, Department of Earth Sciences:** Structural geological study of southern Finland
- **CSIRO** (Commonwealth Scientific and Industrial Research Organization): Joint research on komatiites and mafic volcanic rocks in Finland; modelling the Outokumpu ore deposit.

Water supply

- Toxicological Pollution Detection in Ground Water: From Real Time Early Warning to Overall Assessment – **TOXICAL**
- University of Waterloo, Ontario, Canada: **Water-Rock Interaction Project**

Project exports

There was an increase in project exports and they covered a wider area than before. Exports accounted for 39% of GTK's project invoicing, which was substantially more than in previous years.

The projects in Africa funded by the World Bank and the Nordic Development Fund that extend over several years cover the exports of know-how in geological mapping and research and the application of the latest research technology and methods in a developing-country environment in Mozambique, Tanzania and Uganda. The purpose of the projects is to locate new mineral and energy resources and to transfer know-how by training geologists and technical staff in the target countries.

In Mozambique, a GTK-led consortium was given the task of preparing geological maps covering the country's southern, central and northwestern parts. The work

EXPORT PROJECTS CARRIED OUT IN 2003:

Project	Client	Funding	Duration	Size (EUR million)
MOZAMBIQUE: Geological maps covering the central and northwestern parts of the country (Lot 2)	Ministry of mineral resources and energy	NDF/ IDA	10/2002-12/2006	4.3
MOZAMBIQUE: Geological maps covering the southern parts of the country (Lot 3)	Ministry of mineral resources and energy	NDF/ IDA	09/2003-12/2006	2.0
TANZANIA: Geophysical and geochemical mapping	Ministry of energy and minerals	NDF/ IDA	7/2003-07/2007	3.7
UGANDA: Alternative energy resources (subcontracting)	Ministry of energy and mineral development	AfDB	01-06/2003	0.2
ETHIOPIA: Development of raw material resources	Ministry of mining and energy	Finnish Ministry for Foreign Affairs	10-11/2003	0.1
SPAIN: Airborne geophysical survey	Private ore exploration company	Private	01-02/2003	0.1

will be carried out in two sub-projects and the maps will cover an area as large as Finland. In 2004 the work will also include the mapping of industrial minerals and geochemistry.

GTK supplied Uganda with expertise for mapping peat and geothermal energy resources. GTK's contribution was part of an Electrowatt-Ekono project in which alternative energy-generation methods are being studied.

GTK continued to examine the Ethiopian raw material sector in a project commissioned by the Finnish Ministry for Foreign Affairs. In October, GTK and Kemira Oyj organized an Ethiopian-Finnish seminar, which discussed the chances of establishing a national fertilizer industry.

GTK expanded its networking with partners that complement its own expertise. In order to bring environmental expertise for the mining industry together, the partners in Green Net Finland set up 'Green Net Mining' which has GTK, Technical Research Centre of Finland (VTT), Outokumpu Oyj, Jaakko Pöyry Infra and the Finnish Road Enterprise as members. Marketing and product development of airborne geophysics is now carried out jointly with Sander Geophysics Ltd, a Canadian company, and the British Geological Survey (BGS), while GTK is producing geological maps in collaboration with the International Institute of Geo-Information Science and Earth Observation (ITC), a Dutch body.

The markets for projects in which GTK is strong and that are funded by development financing institutions, mainly the World Bank Group (IDA and IFC), the African Development Bank (AfDB) and the European Union, are likely to remain good in the next few years.



Research Director Gabor Gaál from the Geological Survey of Finland and Project Manager Hayaz Mruma and Permanent Secretary Patric Rutabanzibwa from the Tanzanian Ministry of Energy and Minerals at the signing ceremony for the cooperation agreement.
Photo: Antti Kahra

Neighbouring area cooperation in the Kola Fjord

A neighbouring area cooperation project between GTK and MAGE (Marine Arctic Geological Expedition), a Russian research institute, was launched at the end of 2003. The project will last three years (2003-2005) and on the Finnish side, funding is provided by the continental shelf working group at the Ministry of Trade and Industry. The aim of the project is to examine the methods and alternatives for improving the state of the environment in the Kola Fjord area. The project helps to promote sustainable development and meet the objectives of the EU Northern Dimension as part of the efforts to improve the state of the environment in Northwest Russia and stabilize the region.

The research project is managed by MAGE and involves experts from other leading Russian research institutes, such as VSEGEI and the Marine Biology Institute. Finnish experts come from GTK and the Finnish Institute of Marine Research.

MAGE will be responsible for collecting background material for the area from different institutions and for providing the necessary infrastructure.

GTK will be responsible for testing the equipment as part of the project and for training the Russian project staff to use it so they can continue the project on their own. The surveys in the Kola Fjord will be performed using GTK's digital



The GTK research vessel *Geola* in Murmansk.

equipment, result processing equipment and sampling equipment.

Both GTK and MAGE will be responsible for the chemical analysis of the samples. The analysis methods will be harmonized with Western practices and

quality processes. The aim is to identify the ecological threats requiring the most urgent action and present proposals for solving them.

Jyrki Rantataro

GTK carried out a minerals sector development project in Tanzania

GTK launched a minerals sector development project in Tanzania. The consultancy agreements between GTK and the Tanzanian Ministry of Energy and Minerals were signed on June 10, 2003. The aim of the projects is to identify new

mineral reserves and to transfer know-how. The total value of the consultancy agreements is EUR 5.5 million.

The projects form part of a larger development project in the minerals sector that the Tanzanian government

launched in 1994 with the assistance of the World Bank to attract more private investment. As part of the project, the Nordic Development Fund granted the Tanzanian government a loan of USD 9.2 million in 1998 to which the Tanzanian government added a contribution of USD 2.5 million.

The projects will be carried out in collaboration with the Tanzania Geological Survey (TGS), while the Department of Geology of the University of Dar es Salaam and the Southern and Eastern African Mineral Centre (SEAMIC) will act as local subcontractors. The mapping project will also involve ITC, a Dutch body. The project will continue for about four years and a total of 35 Finnish experts will participate in it for periods of varying duration. The aim of the project is to improve the geological know-how of the Tanzanians in a number of sectors, such as the interpretation of geophysical data, geological and geochemical mapping and airborne geophysical surveys. The project will also involve the building of an up-to-date IT infrastructure and the development of the TGS laboratory.

Airborne surveys completed

During the first stage of the project, airborne surveys covering an area of 30 000 km² were carried out. Accurate measurements were performed at a line spacing of 200 metres in four areas in the western and northwestern parts of Tanzania using Finnish aircraft. GTK's partners Finnair Cargo/Malmilento and Utin Lento Oy operated from bases in Geita, Tabora and Musoma. TGS geophysicists were involved in the measurements and in November, two Tanzanian geophysicists received three weeks' training in interpreting airborne geophysical survey data.

Mapping next

The mapping project will be based on field work and new accurate airborne survey material and will involve geological and geochemical mapping at a scale of 1 : 100 000 on five map sheets. As



Professor A. Mruma from the University of Dar es Salaam, one of the project participants, studying a rock outcrop in the Kahama area.
Photo: Seppo Lahti



GTK has been training Tanzanian geophysicists to interpret airborne survey material.
Photo: Kai Nyman

part of the project, geological and geophysical maps at a scale of 1 : 500 000 covering selected areas in western Tanzania will be produced, while at the same time, geophysical maps at a scale

of 1 : 200 000 covering the whole country will also be prepared. Field work will start in 2004.

Antti Kahra

Finance and administration

Preparations for the incorporation of the VTT Mineral Processing research group into GTK were finalized in the autumn and it became part of GTK as of January 1, 2004.

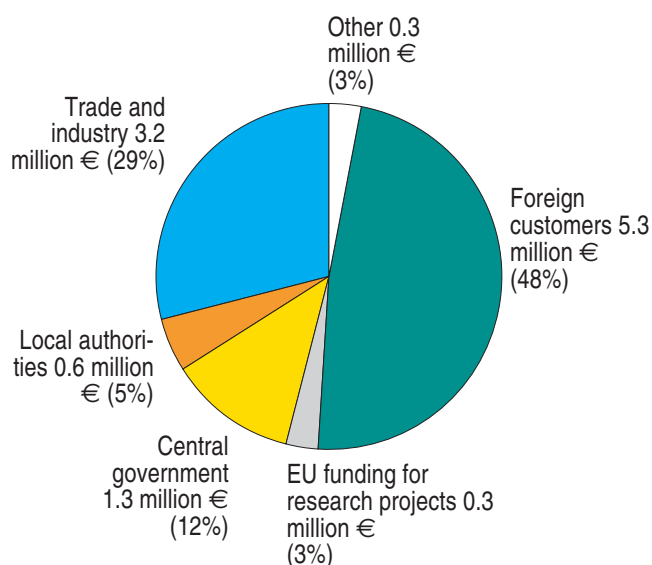
The assessment and development of the tasks of the GTK administration that had been launched in 2002 continued during the year. After the completion of an external evaluation report, the work was continued by GTK staff. On the basis of the reports, GTK decided to merge the administrative services in different units into a national Administration Services Unit as of January 1, 2004. The task of the new unit is to produce services and it will have the management, units, projects and staff of the GTK, the Government, external customers, partners and other organizations as its clients and interest groups.

GTK made personnel strategy part of its overall strategy and determined the areas on which development work will concentrate and the action that will be taken in 2004-2011 so that GTK can achieve its strategic objectives. The emphasis in personnel strategy will be on the “Kaiku” workplace well-being development project, the aim of which is to improve GTK’s management practices and the functioning of the working community. On the basis of the analysis of the results of the skills survey carried out in 2002, GTK prepared development projects for improving strategic skills in all operational spheres. An implementation project for updating the payroll and personal data system was also launched during the year.

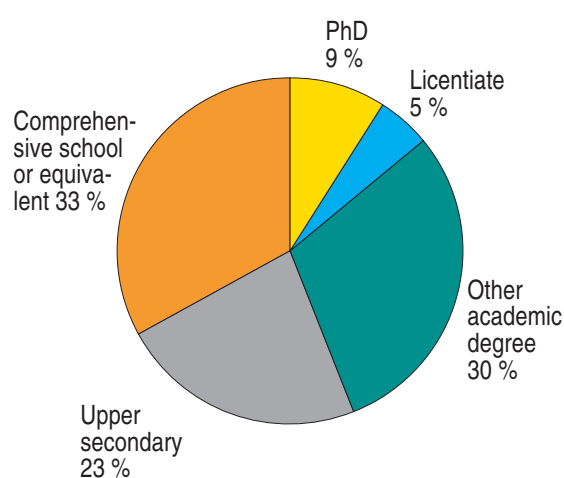
The most important research fields were strengthened by setting up a research professorship in precious metals in Rovaniemi and a joint professorship in environmental geochemistry with the University of Kuopio. The number of seasonal workers employed during the summer months, and Finnish and foreign university students employed as trainees totalled 56.

Health checks for different age groups carried out as part of the staff working capacity maintenance programme ‘Voimavaarauhjelma’ and the projects for improving the ergonomics of GTK’s laboratories continued during the year. GTK also took part in the national weight-reduction programme.

Income by customer group in 2003



Staff by education in 2003



The impacts of GTK's new pay system were examined as part of a research project carried out by Helsinki University of Technology, which covered reforms in Government administration pay systems intended to promote equal pay. Six other Government agencies also took part in the survey. Pay system applications were developed on the basis of the work of a GTK pay system development group.

In financial administration, the most important development project was the updating of the travel administration system. Accounting and payment sections were incorporated in the travel system and in the new system travel expense claims are checked and approved electronically. Planning of a project to introduce paperless accounting will start in 2004.

Staff

Manpower years totalled 786, which is 23 fewer than in the previous year. Manpower years in contract services grew by four compared with 2002, while at the same time there was a decline of 24 manpower years in other services. The number of manpower years based on job-creation schemes went down by three, compared with 2002.

At the end of the year, 44 per cent of all GTK staff had a university degree, and nearly a third of this number had researcher training. At the same time, staff members held 23 lectureships at various universities.

Income

GTK's income in 2003 totalled EUR 11.0 million of which EUR 9.2 million came from contract services and EUR 1.8 million from other sources. The figure was 27% higher than in the previous year. Income from contract services went up by EUR 2.5 million, compared with 2002. To a large extent, the increase was due to major projects in Mozambique and Tanzania. Income from other services decreased by EUR 175 000. Foreign clients and Finnish industry were the biggest customer groups.

Self-generated and external funding accounted for 24 per cent of GTK's financial structure, compared with 20 per cent in 2002.

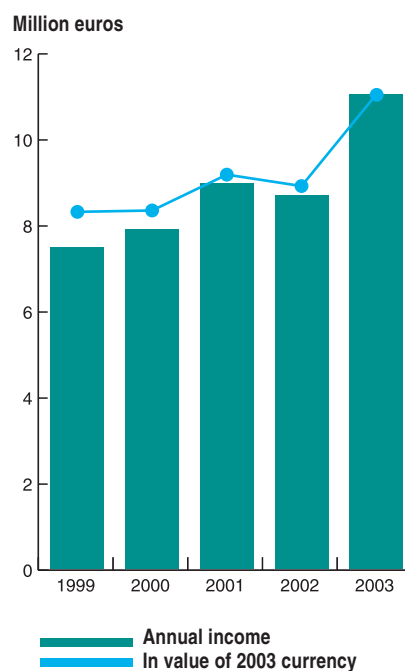
Costs

GTK's costs in 2003 totalled EUR 51.3 million, or EUR 3.1 million more than in the previous year. Payroll costs accounted for EUR 29.8 million (58 per cent), running costs for EUR 19.1 million (37 per cent) and capital costs 2.4 million (5 per cent) of the total. Capital costs on fixed assets amounted to EUR 2 277 000 of which EUR 1 992 000 were depreciations and EUR 285 000 interest payments (interest rate 4.2%). Interest payments on capital employed in current assets totalled EUR 159 000 (interest rate 2.6%).

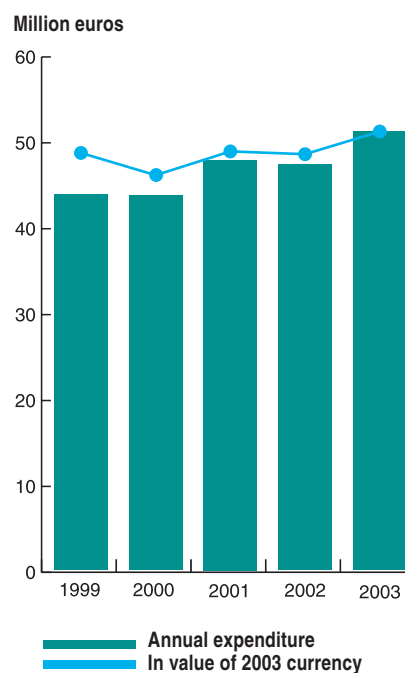
Premises

At the end of 2003, GTK had at its disposal 41 045 m² of state-owned premises. The main office at Otaniemi in Espoo comprised 16 253 m², the Kuopio Office 8 242 m² and the Rovaniemi Office 5 978 m². The buildings of the National Drill Core Depot in Loppi comprised 6 954 m². GTK's other storage facilities and bases totalled 3 618 m².

Income in 1999-2003



Expenditure in 1999-2003



Review of the financial statements

Income and expenditure statement Jan 1 – Dec 31, 2003

Deficit for the financial year totalled EUR 41.8 million, which was EUR 1.6 million more than in 2002. Operating expenses were slightly lower than in 2002. The biggest item was staff expenses, at EUR 29.8 million, or 57% of all operating expenses. Fewer services were acquired than in 2002, they totalled EUR 12.3 million. Acquisition of services includes EUR 4.2 million (EUR 6.0 million in 2002) spent on the deep seismic reflection sounding project covered by debt conversion arrangements between Finland and Russia. At the same time, income received as debt conversion is entered under extraordinary income. More materials, supplies and goods were purchased than in the previous year, totalling EUR 3.4 million. Travel expenses amounted to EUR 2.9 million, or EUR 0.3 million more than in 2002. Depreciations totalled EUR 2.0 million, which is slightly less than the EUR 2.1 million spent on capital investment. Some EUR 0.8 million of capital investment was spent on the acquisition of a research vessel, a joint project between GTK and the Finnish Naval Research Institute.

Balance sheet, December 31, 2003

The balance sheet total was EUR 17.8 million, or EUR 4.5 million more than a year before.

Assets

The value of fixed assets came to EUR 7.2 million, or EUR 0.9 million more

Staff in manpower years						
	2002		2003			
Contract services		75		79		
Other operations		704		680		
Total budget funding		779		759		
Employment funds		18		15		
Other external funds		12		12		
Total external funds		30		27		
Grand total		809		786		

Staff, costs and income by programmes in 2002 and 2003						
	2002		2003		2003/2002	
MANPOWER YEARS (mpy)	Mpy/1000 €	%	Mpy/1000 €	%	Change %	
Bedrock and raw materials	426	53	418	53	-2	
Land use and environment	248	30	250	32	1	
Information management	135	17	118	15	-13	
	809	100	786	100	-3	
COSTS (1 000 €)						
Bedrock and raw materials	26 752	55	29 261	57	9	
Land use and environment	13 328	28	13 974	27	5	
Information management	8 117	17	8 106	16	-0	
	48 197	100	51 341	100	7	
INCOME (1 000 €)						
Bedrock and raw materials	5 364	62	7 794	71	45	
Land use and environment	3 038	35	2 953	27	-3	
Information management	269	3	272	2	1	
	8 671	100	11 019	100	27	

than a year before. The expenses of large contract service projects were capitalized into the balance sheet, which pushed current assets to EUR 7.5 million. Accounts receivable totalled EUR 2.5 million, or EUR 0.6 million more than in 2002.

Liabilities

The State's equity totalled EUR 7.1 million, or EUR 1.0 million more than in 2002. Liabilities came to EUR 10.7 million. Advance payments amounted to

Costs in 2002 and 2003			
	2002	2003	2003/2002
	1000 €	1000 €	Change %
Payroll	28 485	29 775	4,5
Running costs	17 139	19 130	11,6
Capital costs	2 573	2 436	-5,3
Total costs	48 197	51 341	6,5

Costs responsibility calculation of contract services in 2002 and 2003			
	2002	2003	2003/2002
	1 000 €	1 000 €	Change %
Revenues from contract services	6 709	9 232	38
Direct costs of contract services	-4 679	-7 468	60
Proportion of contract services in common costs	-1 436	-1 585	10
Total costs of contract services	-6 115	-9 053	48
Fixed overplus (revenues - direct costs)	2 030	1 764	-13
- % of income	30	19	
Surplus (revenues - total costs)	594	179	-70
- % of income	9	2	
Income % of costs	110	102	

Scope of operations by unit in 2003						
	Income		Expenditure		Staff	
	1 000 €	%	1 000 €	%	Mpy	%
Espoo Unit	4 213	38	13 123	26	206	26
Kuopio Unit	905	8	7 465	15	131	17
Rovaniemi Unit	470	4	5 794	11	94	12
Geoservice Centre	5 240	48	17 662	35	262	33
Information Management	88	1	3 645	7	48	6
Manag. and Administration	103	1	3 280	6	45	6
GTK TOTAL	11 019	100	50 969	100	786	100

Income and expenditure statement

(1000 €)

	1.1.2003 - 31.12.2003		1.1.2002 - 31.12.2002	
Operating income				
Income from contract services	5 902		6 709	
Other operating income	<u>2 455</u>	<u>8 357</u>	<u>2 001</u>	<u>8 710</u>
Operating expenses				
Materials, supplies and goods:				
Purchases during the financial period	3 362		2 853	
Increase (-) or decrease (+) in stocks	281		185	
Staff expenses	29 830		28 520	
Rents	4 142		3 967	
Purchased services	12 335		13 097	
Other expenses	3 292		3 043	
Increase (-) or decrease (+) in products stocks	-2 987		-112	
Manufacturing for own use (-)	-21		-97	
Depreciation	<u>1 992</u>	<u>-52 226</u>	<u>2 153</u>	<u>-53 609</u>
Deficit I		-43 869		-44 899
Financial income and expenses				
Financial income	4		2	
Financial expenses	<u>5</u>	<u>-1</u>	<u>1</u>	<u>1</u>
Extraordinary income and expenses				
Extraordinary income	4 186		6 511	
Extraordinary expenses	<u>8</u>	<u>4 178</u>	<u>40</u>	<u>6 471</u>
Deficit II		-39 692		-38 427
Income and expenses from payment transfers				
Expenses	<u>-</u>	<u>-</u>	<u>31</u>	<u>-31</u>
Deficit III		-39 692		-38 458
Income from taxes and compulsory charges				
Value added tax collected	1 135		1 331	
Value added tax paid	<u>3 280</u>	<u>-2 145</u>	<u>3 116</u>	<u>-1 785</u>
Deficit for financial period		<u>-41 837</u>		<u>-40 243</u>

Balance sheet

(1000 €)

	31.12.2003	31.12.2002
ASSETS		
Fixed assets and other long-term investments		
Intangible assets	756	904
Tangible assets	6 447	5 449
Shares and other long-term investments	5	5
	<u>7 208</u>	<u>6 358</u>
Current and financial assets		
Materials, supplies and goods in stock	7 473	4 766
Short-term receivables		
Accounts receivables	2 508	1 947
Prepaid expenses and accrued income	451	211
Other short-term receivables	136	15
Advance payments	29	2
	<u>3 124</u>	<u>2 175</u>
Cash, bank receivables and other financial assets	2	3
	<u>10 599</u>	<u>6 944</u>
Total assets	<u><u>17 807</u></u>	<u><u>13 302</u></u>
LIABILITIES		
Own capital		
State's equity	7 131	6 171
Liabilities		
Long-term		
Other long-term liabilities	3	5
Short-term		
Advance payments received	3 936	736
Accounts payable	1 093	1 212
Transactions between accounting offices	654	656
Items to be forwarded for payment	438	435
Accrued expenses	4 279	3 911
Other short-term liabilities	273	176
	<u>10 673</u>	<u>7 126</u>
	<u>10 676</u>	<u>7 131</u>
Total liabilities	<u><u>17 807</u></u>	<u><u>13 302</u></u>



Porphyritic granite, Pirkanmaa.
Photo: Jari Väätäinen

Geological Survey of Finland publications and reports 2003

Geological Survey of Finland, Special Paper

34 Räisänen, Marja Liisa & Nikkarinen, Maria (eds.) 2003: Complexity of glacial dispersal and hydromorphic processes in till geochemistry. 69 p., 1 app. (13,50 €)

36 Autio, Sini (ed.) 2003. Geological Survey of Finland, Current Research 2001-2002. 97 p. (27 €)

Tutkimusraportti – Report of Investigation

156 Virtanen, Kimmo; Hänninen, Pekka; Kallinen, Riitta-Liisa; Vartiainen, Sirkka; Herranen, Teuvo & Jokisaari, Ritva 2003: Suomen turvevarat 2000. Summary: The Peat Reserves of Finland in 2000. 101 p., 7 apps. (27 €)

157 Nironen, Mikko 2003: Keski-Suomen granitoidikompleksi. Karttaselitys. Summary: Central Finland Granitoid Complex - Explanation to a map. 45 p., 1 appended map. (20 €)

Turvetutkimusraportti – Report of Peat Investigation

342 Muurinen, Tapio & Aro, Ilkka 2002: Tutkimus Haukiputaan soista ja turvevarojen käyttökelpoisuudesta. Abstract: The mires and peat reserves and their usefulness in the municipality of Haukipudas. 58 p., 2 apps. (14,50 €)

343 Korhonen, Riitta & Suomi, Timo 2003: Jalasjärvellä tutkitut suot ja niiden turvevarat. Osa 2. Abstract: The mires and peat reserves of Jalasjärvi. Part 2. 36 p., 5 apps. (14 €)

344 Virtanen, Kimmo & Herranen, Teuvo 2003: Piippolassa tutkitut suot ja niiden turvevarat. Osa 2. Abstract: The mires and peat reserves in the municipality of Piippola, Central Finland. Part 2. 78 p., 4 apps. (16,50 €)

345 Virtanen, Kimmo; Kallinen, Riitta-Liisa & Herranen, Teuvo 2003: Alavieskan tutkitut suot ja niiden turvevarat. Abstract: The mires and peat reserves in the municipality of Alavieska, Western Finland. 47 p., 4 apps. (14,50 €)

346 Luukkanen, Ari 2003: Kiuruvedellä tutkitut suot ja niiden turvevarat. Osa 5. Abstract: The mires and peat reserves of Kiuruvesi. Part 5. 69 p., 4 apps. (12 €)

347 Toivonen, Tapio 2003: Honkajoella tutkitut suot ja niiden turvevarat. Abstract: The mires and peat reserves of Honkajoki. 40 p., 4 apps. (15,50 €)

Ydinjätteiden sijoitustutkimukset, Tiedonanto – Nuclear Waste Disposal Research, Report

109 Hellmuth, Karl-Heinz; Tarvainen, Timo; Backman, Birgitta; Hatakka, Tarja; Vesterbacka, Pia & Savolainen, Heimo 2003. IAEA Coordinated Research Project (CRP) "The use of selected safety indicators (concentrations, fluxes) in the assessment of radioactive waste disposal". Report 4: Natural geochemical concentrations on the Baltic Shield of Finland for use as indicators of nuclear waste repository safety. 161 p. (18 €)

113 Tarvainen, Timo; Backman, Birgitta; Hellmuth, Karl-Heinz; Hatakka, Tarja & Savolainen, Heimo 2003. IAEA Coordinated Research Project (CRP) "The use of selected safety indicators (concentrations, fluxes) in the assessment of radioactive waste disposal". Report 5: Chemical weathering rates on the Baltic Shield of Finland for use as indicators of nuclear waste repository safety. 51 p. (10,50 €)

114 Kaija, Juha; Rasilainen, Kari & Blomqvist, Runar 2003. IAEA Coordinated Research Project (CRP) "The use of selected safety indicators (concentrations, fluxes) in the assessment of radioactive waste disposal". Report 6: Site-specific natural geochemical concentrations and fluxes at the Palmottu U-Th mineralisation (Finland) for use as indicators of nuclear waste repository safety. 45 p. (9 €)

115 Pitkänen, Petteri; Löfman, Jari; Luukkonen, Ari & Partamies, Sami 2003. IAEA Coordinated Research Project (CRP) "The use of selected safety indicators (concentrations, fluxes) in the assessment of radioactive waste disposal". Report 7: Site-specific natural geochemical concentrations and fluxes at four repository investigation sites in Finland for use as indicators of nuclear waste repository safety. 85 p. (13 €)

116 Read, David 2003. IAEA Coordinated Research Project (CRP) "The use of selected safety indicators (concentrations, fluxes) in the assessment of radioactive waste disposal". Report 8: Natural uranium fluxes and their use in repository safety assessment: implications for coupled model development. 33 p. (9 €)

117 Paananen, Markku & Ruskeenieni, Timo 2003: Permafrost at Lupin: Interpretation of SAMPO electromagnetic soundings at Lupin. 22 p., 4 apps. (7 €)

118 Siitari-Kauppi, M.; Marcos, N.; Klobes, P.; Goebbels, J.; Timonen, J. & Hellmuth, K.-H. 2003. The Palmottu Natural Analogue Project: Physical rock matrix characterisation. 63 p. (10,50 €)

Vuosikertomus - Annual Report

Geologian tutkimuskeskus GTK.
Vuosikertomus 2002. 51 p.

Geological Survey of Finland GTK.
Annual report 2002. 51 p.

Suomen geologinen kartta – Geological map of Finland, 1 : 100 000

- Kallioperäkartojen selitykset – Explanation to the maps of Pre-Quaternary rocks (8 €)

Paavola, Jorma 2003: Vieremän kartta-alueen kallioperä. Summary: Pre-Quaternary rocks of the Vieremä map-sheet area. Lehti 3342. 40 p., 2 apps.

Perttunen, Vesa & Hanski, Eero 2003. Törmäsjärven ja Koivun kartta-alueiden kallioperä. Summary: Pre-Quaternary rocks of the Törmäsjärvi and Koivu map-sheet areas. Lehdet 2631 ja 2633. 88 p.

- Kallioperäkartat – Pre-Quaternary rocks (8 €)

2633 Koivu 2744+3722 Pokka	Perttunen, Vesa (2003) Manninen, Tuomo (2003)
3242 Kuopio	Lukkarinen, Heikki (2002)
3411 Piippola	Kousa, Jukka & Luukas, Jouni (2002)
3623 Nampa 4321 Nurmes	Hanski, Eero (2003) Luukkonen, Erkki (2003)

Erikoiskartat – Miscellaneous maps

Huttunen, Timo; Saarelainen, Jouko; Väänänen, Tapio; Putkinen, Seppo; Ikonen, Jorma; Kohonen, Jarmo; Pekkarinen, Lauri; Vuollo, Jouni & Äikäs, Olli: (Map). Huttunen, Timo (ed.); Hytönen, Markku; Kejonen, Aimo; Rönty, Hannu; Saarelainen, Jouko; Tervo, Tapani; Väänänen, Tapio & Äikäs, Olli: (Guide). Koli : geologinen retkeilykartta = geological friluftskarta = geological outdoor map 1 : 20 000. Kuopio: Geologian tutkimuskeskus, 2003. 1 map + guide, 73 p. (10 €)

Johansson, Peter (ed.) 2003. Pallas-Ounas-tunturi : geologinen retkeilykartta = geological outdoor map 1 : 50 000, 2nd rev. ed. Rovaniemi: Geologian tutkimuskeskus. (10 €)

Johansson, Peter & Mäkinen, Kalevi (eds.) 2003. Koilliskaira : geologinen retkeilykartta = geological outdoor map 1 : 100 000, 2nd rev. ed. Rovaniemi: Geologian tutkimuskeskus. (10 €)

Korhonen, J. V.; Aaro, p.; All, T.; Elo, p.; Haller, L. Å.; Kääriäinen, J.; Kulinich, A.; Skilbrei, J. R.; Solheim, D.; Säävuori, H.; Vaher, R.; Zhdanova, L.; Koistinen, T. (comp.) 2002. Bouguer anomaly map of the Fennoscandian Shield : IGSN 71 gravity system, GRS80 normal gravity formula. Bouguer density 2670 kg/m³, terrain correction applied. Anomaly continued upwards to 500 m above ground : scale 1 : 2 000 000. Espoo: Geological Survey of Finland; Trondheim: Geological Survey of Norway; Uppsala: Geological Survey of Sweden; Moscow: Ministry of Natural Resources of Russia. (20 €)

Korhonen, J. V.; Aaro, p.; All, T.; Nevanlinna, H.; Skilbrei, J. R.; Säävuori, H.; Vaher, R.; Zhdanova, L.; Koistinen, T. (comp.) 2002. Magnetic anomaly map of the Fennoscandian Shield : DGRF 65 anomaly of total field. Anomaly continued upwards to 500 m above ground : scale 1 : 2 000 000. Espoo: Geological Survey of Finland; Trondheim: Geological Survey of Norway; Uppsala: Geological Survey of Sweden; Moscow: Ministry of Natural Resources of Russia. (20 €)

Nironen, Mikko; Kuosmanen, Eira & Wase-nius, Pekka (koonneet) 2002. Keski-Suomen granitoidikompleksi = Central Finland Granitoid Complex. Kallioperäkartta = Bedrock map, 1 : 400 000. Espoo: Geologian tutkimuskeskus. (8 €)



Mauri Pekkarinen, Minister for Trade and Industry, and Jyri Järvihaavisto, Special Advisor to the Minister, visited GTK on August 26. Topics for discussion included raw materials management and land use issues. Photo: Jari Väättäinen

**Maaperän peruskartta 1 : 20 000/1 : 50 000, selitykset –
Explanation to the maps of Quaternary Deposits 1 : 20 000**

1012 02	Bäkenskär	Stén, Carl-Göran
1012 04	Kobbaklinter	Stén, Carl-Göran
1133 01	Nästi (2002)	Kielosto, Sakari; Stén, Carl-Göran & Juntunen, Risto
1133 02	Malko	Kielosto, Sakari; Stén, Carl-Göran & Juntunen, Risto
1133 03	Pato	Kielosto, Sakari; Stén, Carl-Göran & Juntunen, Risto
1133 04	Karjalankylä	Kielosto, Sakari; Stén, Carl-Göran & Juntunen, Risto
1133 05	Vaaljoki	Kielosto, Sakari; Stén, Carl-Göran & Juntunen, Risto
1133 06	Hinnerjoki	Kielosto, Sakari; Stén, Carl-Göran & Juntunen, Risto
1133 07	Kalela	Kielosto, Sakari; Stén, Carl-Göran & Juntunen, Risto
1133 08	Lellainen	Kielosto, Sakari; Stén, Carl-Göran & Juntunen, Risto
1133 09	Honkilahti	Kielosto, Sakari; Stén, Carl-Göran & Juntunen, Risto
1133 10	Raasinkorpi	Kielosto, Sakari; Stén, Carl-Göran & Juntunen, Risto
1133 11	Yläne	Kielosto, Sakari; Stén, Carl-Göran & Juntunen, Risto
1133 12	Säkyän Pyhäjoki	Kielosto, Sakari; Stén, Carl-Göran & Juntunen, Risto
2111 01	Tanskila (2002)	Kielosto, Sakari; Stén, Carl, Göran & Juntunen, Risto
2123 09	Tampere	Kukkonen, Marjatta; Mäkilä, Markku; Grundström, Ale & Juntunen, Risto
2244 02	Tuhmalampi	Kukkonen, Esa
2244 03	Karstula	Kukkonen, Esa
2244 04	Muittari	Kukkonen, Esa
2244 05	Kalmari	Kukkonen, Esa
2244 10	Linna	Kukkonen, Esa
2313 09	Kärnäsaari	Kukkonen, Esa
2313 10	Alajärvi	Kukkonen, Esa
2313 12	Vimpeli	Kukkonen, Esa
2322 10	Ytterbrätö	Kukkonen, Esa
2342 12	Ypyä	Kukkonen, Esa
2533 04	Virpiniemi	Putkinen, Niko
2533 05	Laitakari	Putkinen, Niko
2533 06	Satakari	Putkinen, Niko
2533 07	Kello	Putkinen, Niko
2533 08	Haukipudas	Putkinen, Niko
2543 01	Simo	Nenonen, Jari; Muurinen, Tapio & Väisänen, Ulpu
3233 04	Paatela	Huttunen, Timo
3244 05	Vehmersalmi	Saarelainen, Jouko
3311 08	Viitasaari	Putkinen, Niko
3332 01	Tuovilanlahti	Kejonen, Aimo
3332 02	Lappetelä	Saarelainen, Jouko
3332 05	Lapinlahti	Kejonen, Aimo
3423 06	Utajärvi	Johansson, Peter; Pajunen, Hannu & Väisänen, Ulpu
3432 10	Paltaniemi	Saarelainen, Jouko
3613 09	Vanttauskoski	Väisänen, Ulpu & Muurinen, Tapio
3613 11	Piittisjärvi	Väisänen, Ulpu; Nenonen, Jari & Maunu, Matti
3613 12	Pekkala	Väisänen, Ulpu; Nenonen, Jari & Muurinen, Tapio
4222 07	Outokumpu	Kejonen, Aimo
4222 08	Lietukka	Kejonen, Aimo
4222 09	Maarianvaara	Kejonen, Aimo
4222 10	Harmaansalo	Kejonen, Aimo
4222 12	Mutkanvaara	Kejonen, Aimo
4224 03	Polvijärvi	Saarelainen, Jouko
4224 07	Puntarikoski	Saarelainen, Jouko
4224 10	Paihola	Saarelainen, Jouko
4323 03	Lipinlahti	Saarelainen, Jouko
4722 2 & 4724 1		Talkkunapää & Korvatunturi Johansson, Peter & Väisänen, Ulpu

Digital Quaternary maps 1:20 000 released in 2003 (name of responsible geologist in brackets):

- 1012 02 Båkensjärvi (Carl-Göran Stén)
 1012 04 Kobbarklintar (Carl-Göran Stén)
 1133 02 Malko (Sakari Kielosto)
 1133 03 Pato (Sakari Kielosto)
 1133 04 Karjalankylä (Sakari Kielosto)
 1133 05 Vaaljoki (Sakari Kielosto)
 1133 06 Hinnerjoki (Sakari Kielosto)
 1142 06 Ouran saaristo (Sakari Kielosto)
 1142 08+05 Saantee (Sakari Kielosto)
 1142 09 Köörttilä (Sakari Kielosto)
 1143 10 Kynsikangas (Aimo Kejonen)
 1143 11 Sääksjärvi (Aimo Kejonen)
 1143 12 Kivijärvenmaa (Aimo Kejonen)
 1144 02 Isojärvi (Sakari Kielosto)
 1144 03 Leväsjoki (Sakari Kielosto)
 1144 06 Petkele (Sakari Kielosto)
 1144 09 Venesjärvi (Sakari Kielosto)
 1144 12 Kankaanpää (Sakari Kielosto)
 1244 01 Niemenkylä (Timo Huttunen)
 1244 02 Sarvijoki (Timo Huttunen)
 1244 04 Jurva (Timo Huttunen)
 1244 06 Kyläinpää (Timo Huttunen)
 1333 04 Laihia (Pentti Lindroos / Maija Haavisto-Hyvärinen)
 1333 10+2311 01 Ylistaro (Esa Kukkonen)
 1333 11+2311 02 Lehmäjoki (Esa Kukkonen)
 1333 12+2311 03 Kaurajärvi (Esa Kukkonen)
 1343 08 Frösön (Timo Huttunen)
 1343 10+2421 01 Nykarleby (Timo Huttunen)
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GTK's international cooperation network

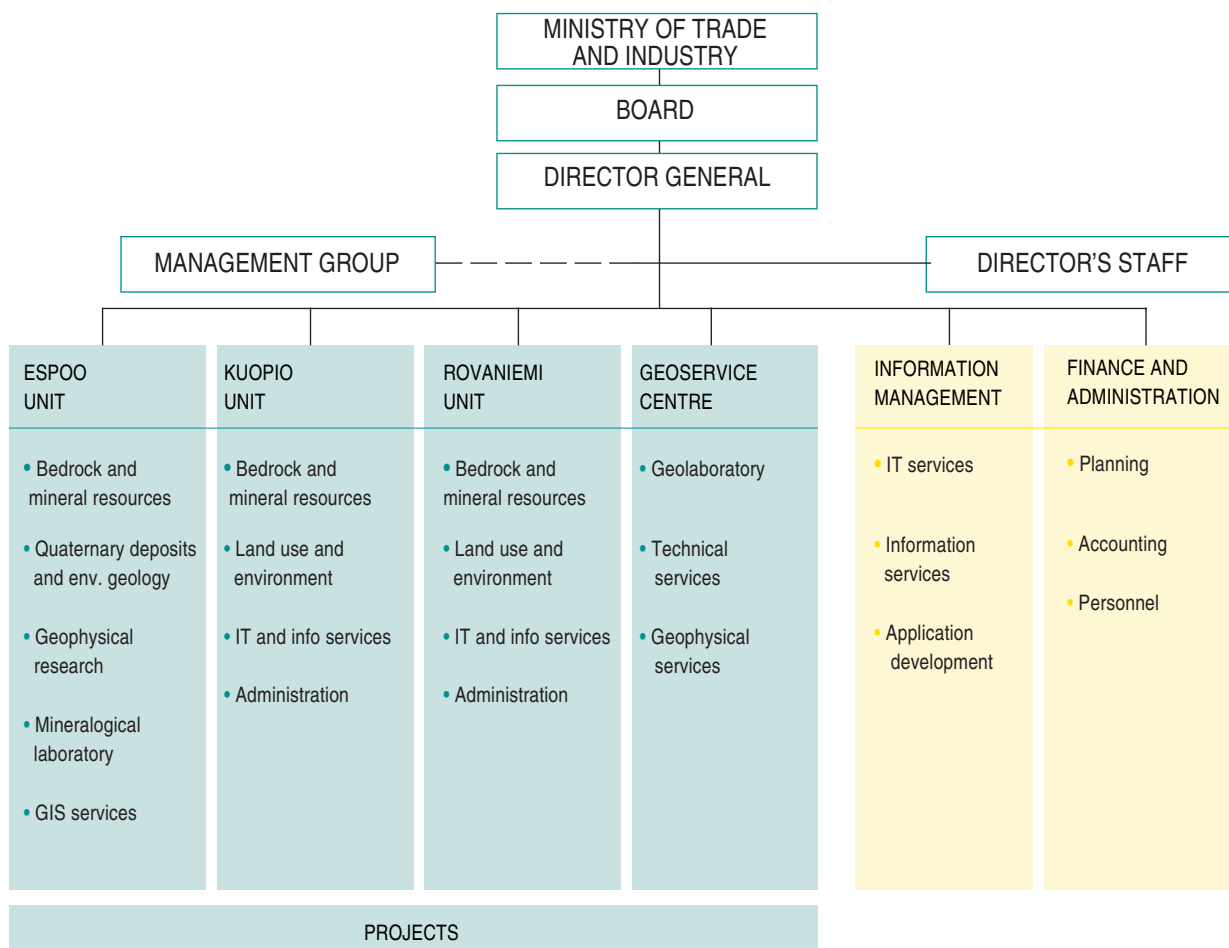
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GTK's domestic cooperation network

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Association of Finnish Peat Industries
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Continental Shelf Working Group
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Organization and management

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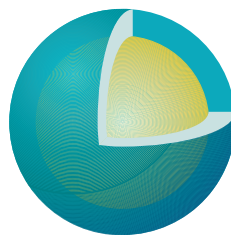
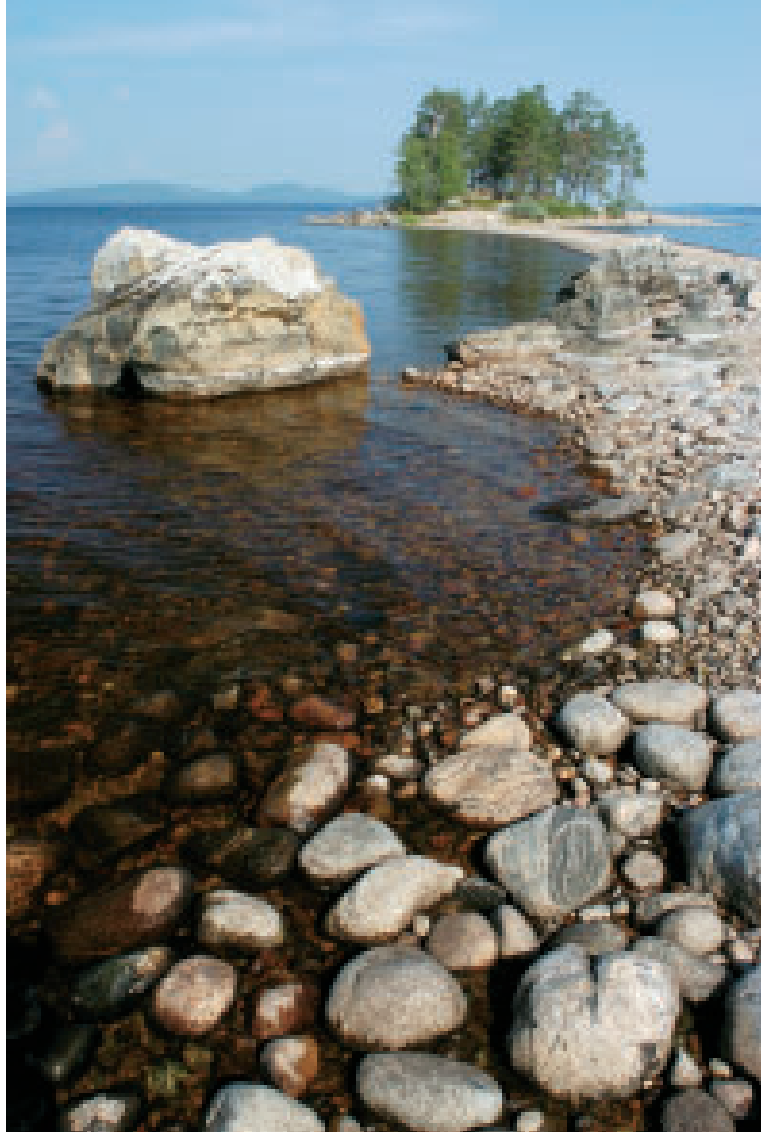
Jorma Järvinen
Director of Administration
Secretary
GTK

The GTK Board of Directors, from the left, Helena Korhonen, Paula Nyberg (Deputy Chair), Raimo Matikainen, Christer Sundström (Chair), Jorma Järvinen (Secretary), Markku Isohanni, Jukka Noponen and Seija Silvennoinen. Photo: Jari Väätäinen

A portrait of Director General Raimo Matikainen, by Alexandre Bakharev, was unveiled in December. At the unveiling ceremony, Elias Ekdahl (left), who will be taking office as the new Director General in 2004, met Raimo Matikainen and former DGs Veikko Lappalainen (right) and Kalevi Kauranne (second from right). Photo: Jari Väätäinen



Hiekkapakka island is part of a wave-washed esker ridge that rises out of the water in the southwestern part of Lake Pielinen, eastern Finland. The Koli quartzite fells are dimly visible in the background.
Photo: Jari Väätäinen



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