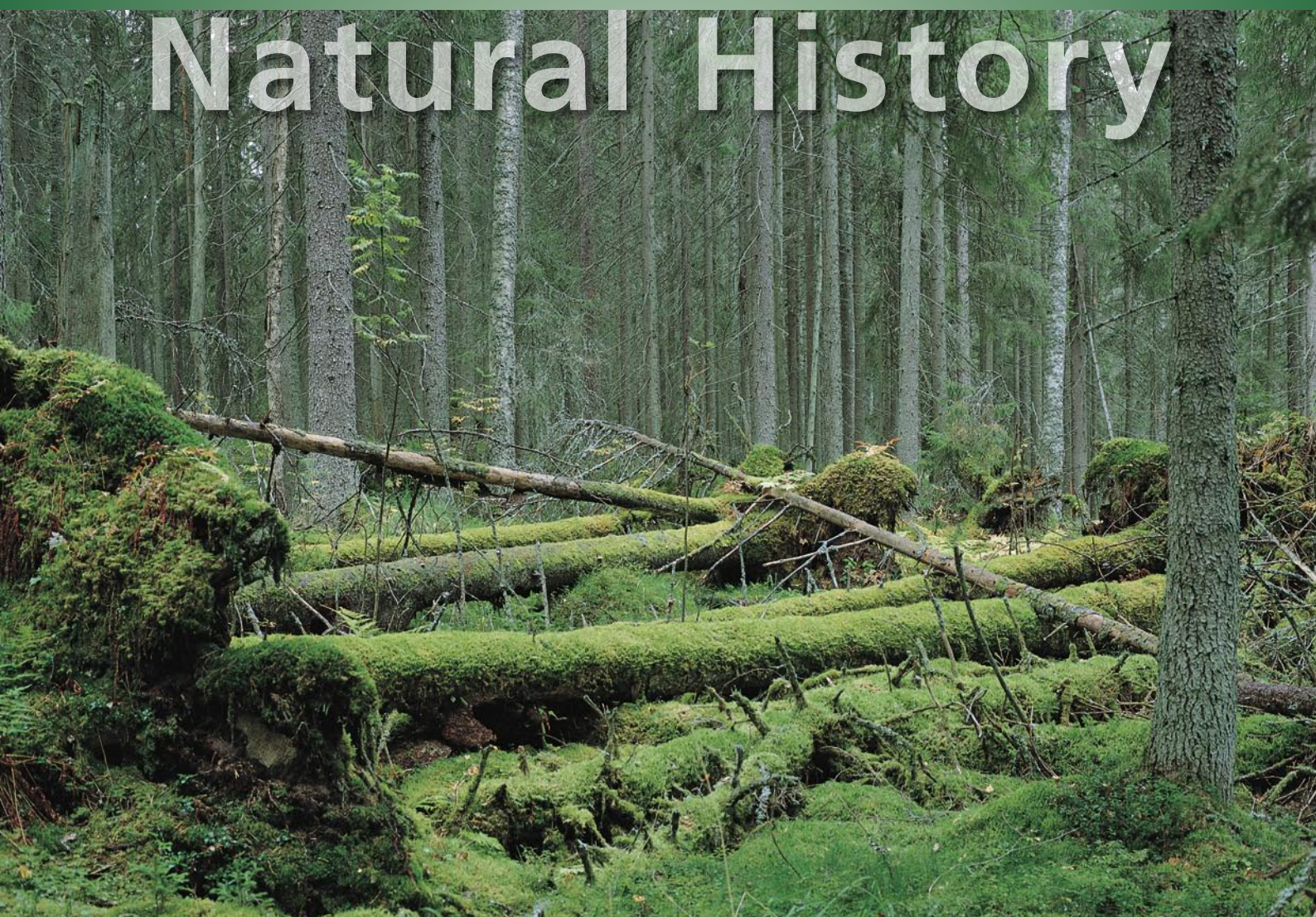
Finnish Museum of Natural History



in 2004–2005

Contents

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Atte Rusanen

Finnish Museum of Natural History

in 2004–2005

When the Botanical Museum relocated to its refurbished building in 2003, plans for the next renovation project were already well under way. Consequently, the refurbishment of the Zoological Museum was launched in 2005. In connection with the renovation, the museum's exhibition facilities will be expanded by building a state-of-the-art underground exhibition hall under the courtyard.

When the works will be finished in late 2007, the Zoological Museum and its scientific collections will enjoy appropriate facilities for the requirements of such a museum. However, the Museum of Natural History still suffers from an acute need to expand the facilities of the Botanical Museum. The plan is to place the phanerogams collection, currently located in temporary premises, into the expanded facilities of the Botanical Museum. Additional space is needed not only for the Museum's own collections, but also for the natural history collections of the Faculty of Agriculture and Forestry, which will be transferred to the Botanical and Zoological Museums in 2007.

The renovation of the Zoological Museum building will have a significant effect on the Museum's exhibitions. When we made preparations for the renovations, all exhibitions that were open to the public had to be disassembled. We are planning to open renewed and somewhat more extensive exhibitions in May 2008.

In late 2005, the University of Helsinki initiated discussions with the Ministry of Education about the future prospects for the Museum of Natural History. At the moment, it is too early to predict the outcome of these discussions, but it does seem likely that the Finnish Museum of Natural History, as an independent institute of the University of Helsinki, will play an important role in environmental administration. This arrangement will increasingly highlight the Museum's expertise on the natural environment in Finland in societal decision-making.

Juhani Lokki, Director

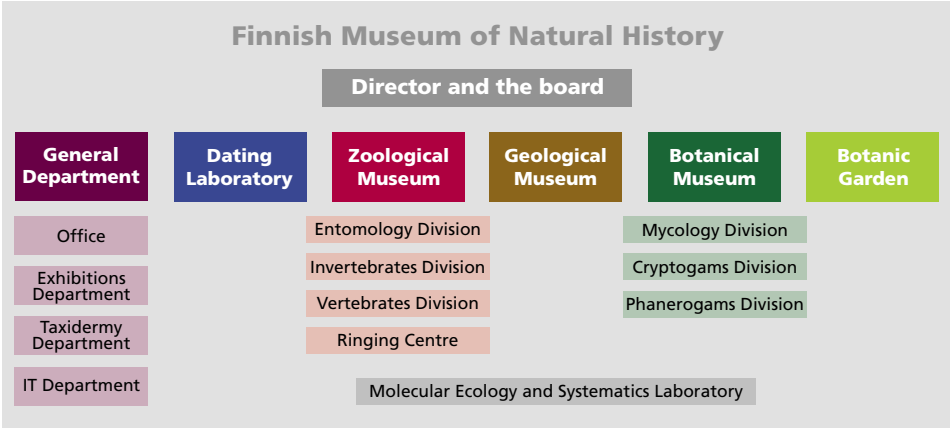
Finnish Museum of Natural History

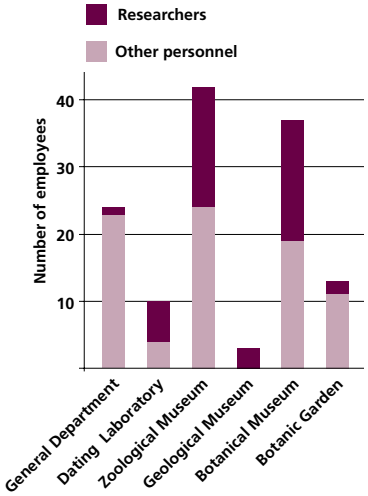
in 2004–2005

The Finnish Museum of Natural History is an independent research institute functioning under the University of Helsinki. It is also one of the three central national museums in Finland and responsible for the national collections in its field.

The collections, which include botanical, zoological, geological and paleontological specimens from all over the world, serve research in the fields of biology and geology as well as educational purposes.

The museum is divided into five sections. The general department provides services for all of them. In addition, the museum has a joint molecular ecology and systematics laboratory with the Department of Biological and Environmental Sciences. The museum employs a personnel of about 130.





Budget 2005	(€)	%
State subsidy	5 566 600	71
University's funding	532 000	6.7
Funds from previous year	268 000	3.4
Entrance fees, museum store, etc.	393 000	5
Extramural funding	1 090 000	13.9

Expenditures 2005	(€)	%
Personnel	3 606 000	45.9
Rent	2 625 000	33.4
PhD schools	25 000	0.3
Research	1 090 000	13.9
Exhibitions, public relations	152 000	1.9
Travel costs	33 500	0.4
Other costs	234 500	3.2
Funds transferred to next year	83 600	1

Responsibilities

1) to study fauna, flora, geology and paleontology, conduct research in the fields of systematics and taxonomy and teach all of the above-mentioned sciences
2) to perform datings, conduct research and teach in the field of age determinations using physical methods
3) to enlarge and maintain the present collections
4) to maintain domestic and international living botanical collections needed for educational, research and seed exchange purposes
5) to produce natural history exhibitions
6) to prepare inventories of Finnish nature and conduct long-term research
7) to make the collections available for zoological, geological and botanical research and teaching
8) to inform, instruct and publish in the field of natural history
9) to participate in international research projects in the field of natural history
10) to act as the scientific authority in Finland concerning the CITES treaty
11) to coordinate the research, scientific collecting, data gathering activities and environmental studies in natural history museums and botanical gardens in Finland
12) to prepare exhibitions for nation-wide use
13) organize training for natural history taxidermists

Mikko Heikkinen

Knocking down the elephant. All the animals, which had been on display, needed to be moved to a temporary storage facility before the renovations could begin. Unfortunately, the elephant was too big to be transported in one piece.

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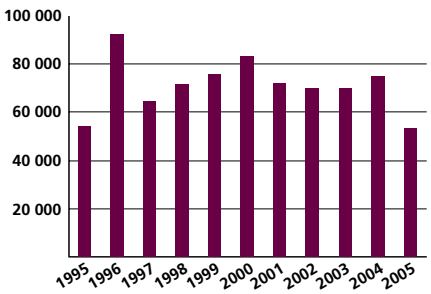
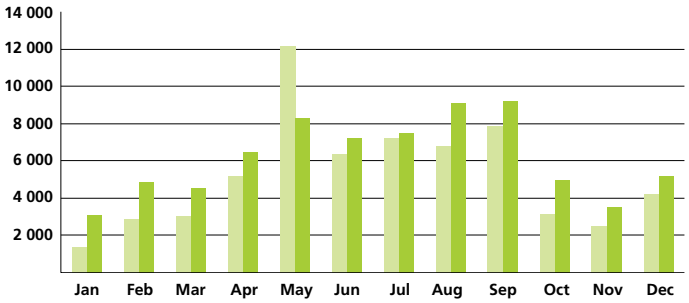
Exhibitions

In 2004, the number of visitors was 74 673. However, in 2005, the number decreased to 53 419 because the museum was closed at the end of August for major renovations. Most of the visitors (~60%) were children. Apart from permanent exhibitions, the museum produces touring exhibitions and arranges many happenings and theme days. One of the most popular events takes place simultaneously with the Night of the Arts, celebrated at the end of August in Helsinki every year. The nocturnal opening of the museum gathers crowds to the museum efficiently. In 2005, over 1 000 people came to see how animals prepare themselves for migration.



Number of visitors at the Natural History Museum in the last 10 years. The museum was closed for renovations in August 2005. It will be under renovation until May 2008.



The number of visitors at the Botanic Garden increased 18% in 2005 as compared with previous year.

Exhibitions and events in 2004

Animals' winter, 9.12.2003–31.1.2004 & 1.12.2004–30.1.2005
Finlandia. Nature pictures of 2004, 11.2.–3.3.
Fossil craftworks, 17.–22.2.
Easter happenings, 6.–13.4.
Opening of the Story of the bones exhibition, 3.6.
Zoological and botanical motifs in coins, notes and medals, 15.6–31.7.
Mushroom info, 10.8.–2.9. and 21.9.–30.10.
Digging gold, a hobby and a profession, 17.8.–12.9.2004
Fossil craftworks, 19.–24.10.
Who's out at night? Happenings, 6.11.
Museum elf's story hour, 1.–7.12.

Mikko Heikkinen

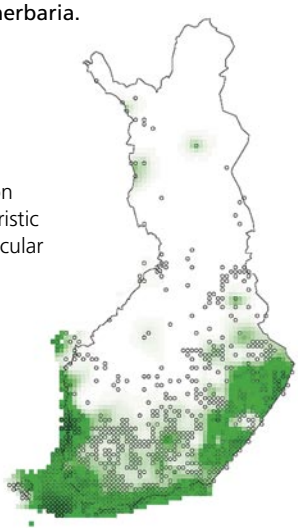
In 2005

Animals' winter 1.12.2004–30.1.2005
Arctic life in Spitzbergen, 15.1.–6.2.
Finlandia. Nature pictures of 2005, 16.2.–9.3.
Cuban Dinosaur Park photographs, 1.4.–30.4.
Winter holiday happenings, 22.2.–27.2.
Easter happenings, 22.3.–28.3.
History of the museum building exhibition, 7.6.–31.8.
Carpe fungum – mushroom paintings, 7.6.–3.7.
Mushroom info 21.8.–13.9.
Animals in the departure hall – happening on the Night of the Arts, 25.8.2005
Mineral kingdom? Plant kingdom? Animal kingdom? Public lectures, 12.1., 2.2., 2.3. and 6.4.

Botanical Museum

The Botanical Museum houses c. 3.1 million herbarium specimens, the annual growth being 15 000–29 000 specimens. The herbarium is extensively used internationally; the annual number of outgoing loans varies between 125 and 150 (3 600–7 000 specimens), and 20–50 foreign visitors (total 10–35 months) arrive each year to study the collections.

The Museum hosts a national floristic database, and in recent years much effort has been devoted to its development. Over the last two years, the number of records has almost doubled, currently being c. 4 million. Most of the records result from systematic inventories of 1 km^2 grid cells of Finland. Another major source is specimens from the main Finnish herbaria.



Distribution of *Viola tricolor* in Finland based on the national floristic database of vascular plants.

Research activity in the Botanical Museum includes both traditional taxonomic monographic work and, increasingly, phylogenetic studies using molecular techniques. Furthermore, much research is invested in the chorology and flora, on European, national and local scales.

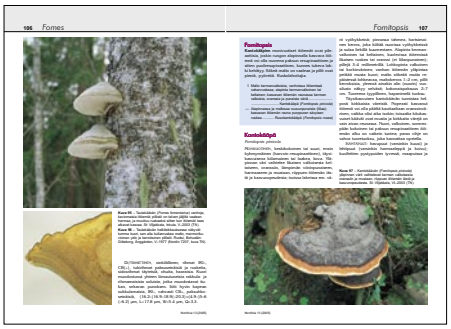
Lichen research

Although lichenization is a common strategy for fungi (about 1/5 of known fungi are lichenized), lichens are still phylogenetically understudied. Evolutionary relationships of lichenized fungi are reconstructed by combining morphological and chemical evidence with the information derived from multiple gene loci. Leena Myllys' research team, funded by the Ministry of the Environment, examines species boundaries in the genus *Bryoria*. Katileena Lohtander-Buckbee in her postdoctoral research project focuses on infrageneric relationships in the family Physciaceae. Academy Fellow Researcher Soili Stenroos' project aims to reconstruct a phylogenetic hypothesis of the fungal class Lecanoromycetes, which includes the majority of lichen species.

The phylogenies obtained from these different taxonomic levels indicate that species and genus delimitations based on gross morphology are often artificial. The results have clarified the evolution of sexual and asexual modes of propagation in fungi, and the selectivity and specificity of symbiotic partners in lichen associations.

Studies on polypores

In a forested country like Finland, mycological studies are often associated with wood-inhabiting species, e.g., those living on coarse woody debris in old-growth forests. In the Botanical Museum, poroid wood-decaying fungi, or polypores, have been studied for several decades with a full-scale approach, from the forest to the laboratory. During the past two years, fieldwork has particularly focused on the poorly studied



230 species are reported to be found in Finland in the book *Polypores, lignicolous fungi* (author Tuomo Niemelä, Norrlinia 13, 2005). Almost all the species are illustrated with colour photographs mostly taken in the field. The book is written in Finnish with an English summary.

North. Polypores are fairly well documented in the Nordic countries, but species new to the area and new to science continue to be found and described almost yearly. In a monographic study of these fungi (Norrlinia 13), a number of new taxonomical results were adopted, mostly from ongoing molecular studies of some larger genera.

A member of the team is also studying the beetles living on polypores as either larvae or adult beetles — a poorly investigated topic, especially with regard to the rare and threatened fungi. The project is funded by the Ministry of the Environment.

Origin and evolution of liverworts

In a project on the phylogeny of liverworts (Hepaticae), financed by the Academy of Finland, the Botanical Museum team investigates the evolution of the presumably oldest land plant group, i.e. liverworts. Recent studies indicate that out of the three bryophyte groups the liverworts were the land plants

Ida Pimenoff

that diverged first. They are a morphologically diverse group with approximately 8 000 species, including simple thalloid, complex thalloid and leafy forms. Since the evolutional order of these groups cannot be revealed on the basis of mere morphological studies, the Helsinki group has clarified the relationships by using DNA sequence data.

Xiaolan He-Nygrén

Schistochila philippinensis

The results suggest that the extant liverworts have diverged into three major evolutionary lines. The ancestral type of the liverworts is likely to have a simple thalloid gametophyte. Thus, it rejects the long standing theory that liverworts initiated from an erect, leafy gametophyte. Key morphological innovations based on synapomorphic morphological characters are proposed for the liverworts as a group and for various lineages within the liverworts.

■ Taxonomy of sedges

The elucidation of the taxonomy of *Cyperus* section *Arenarii* by Henry Väre and Ilkka Kukkonen is an example of taxonomic studies on phanerogams in the Botanical Museum. Most species in the group are psammophytic, adapted to survive in hot dry deserts and coastal sandy shores. The highest species diversity is in the regions around the Red Sea in north-east Africa and in the Arabian Peninsula. Currently, 26 species and two subspecies are included in the group. Seven new species were recently described. Typification of the published names and both morphological and anatomical studies are underway, laying the groundwork for phylogenetic analysis.

■ *Atlas Florae Europaeae* — Distribution of vascular plants in Europe

Atlas Florae Europaeae (*AFE*) is a pan-European project for mapping the vascular flora of the continent, with its Secretariat at the Botanical Museum in Helsinki and a network of more than one hundred collaborators in all the European countries. The mapping has proceeded to the plants of the second volume of *Flora Europaea*, which begins with the large and taxonomically complicated family Rosaceae. The family will be mapped in four volumes of *AFE*, the first one (Arto Kurtto et al., *AFE* 13) of which, comprising 303 taxa on 286 maps, was published in 2004 together with *Societas Biologica Fennica Vanamo*. The three forthcoming volumes deal with the genera *Alchemilla* and *Aphanes* (altogether c. 440 species), the genus *Rubus* (c. 710 species) and the woody subfamilies Maloideae and Prunoideae. The 13 published volumes of *AFE* include 3 556 maps of European species and subspecies. From volume 13 onwards, *AFE* uses a revised grid system, the maps being computer-generated from a database and printed in two colours.

Atlas Florae Europaeae volume 13 (first part of the family Rosaceae) was published in 2004. The map below shows the European distribution of *Geum rivale*.

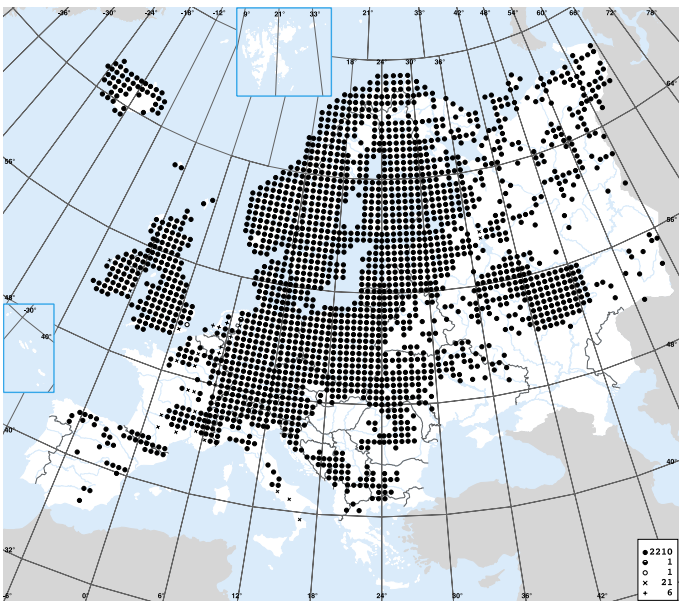


Illustration by Marja Koistinen

Botanic Garden

The Botanic Garden is the custodian of a meticulously curated living plant collection, which is a popular attraction, as well as a rising research institute and a live gene bank.

Wide-ranging tasks

The Botanic Garden has been part of the Finnish Museum of Natural History since the beginning of 2004. After having been a supporting department within the Faculty of Science since its foundation in 1678, the Garden was administratively moved to the Museum with the aim of safeguarding its public services and developing its research activities.

The Botanic Garden's mandate is as follows: (1) to maintain a scientific collection of living plants for use in research and instruction; (2) to participate in international seed exchange for scientific research; (3) to engage in botanical research and instruction; (4) to provide advice, education and information on plants to the public; and (5) to coordinate the activities of botanic gardens in Finland. The Garden also participates in international cooperation in plant conservation. As part of the national coordinator's role, the Director of the Garden serves as the Finnish representative in the EU Consortium of Botanic Gardens.

Heidi Kinnunen

Leena Helynranta

Paeonia anomala

Collections in two gardens

The collections are located in two separate areas, the old part in the city centre with an area of 5 hectares and a glasshouse complex with 11 rooms, and a new outdoor collection with an area of 6 hectares a few kilometres away from the city centre. The collections have a two-parted geographical profile. The glasshouses boast subtropical and tropical plants that mainly originate from a belt delimited by the longitudes of the western- and easternmost points of Finland. The species in the gardens are chiefly selected on the basis of the bioclimatic theory developed by Finnish scientists, which predicts the areas in the world with climates corresponding to that of Helsinki. The collection of the new garden, scheduled to open to the public in 2009, is of the highest scientific value because here only accessions of known wild origin are accepted. In total, the collections consist of c. 8 500 accessions, representing ca. 4 400 taxa (species, subspecies and some garden cultivars). The annual net increase is 400–500 accessions.

Research and Conservation combined

The systematics, biogeography and speciation of tropical American plants is one of our most important lines of research. The Director of the Garden, Dr. Leif Schulman, focuses on the family Melastomataceae and is a member of the Amazon Research Team of the University of Turku. Curator Leo Junikka is specialized in the family Annonaceae and cooperates with the Annonaceae group at Wageningen Agricultural University in the Netherlands.

Ida Pimenoff

The activities on the genus *Saintpaulia*, one of the most popular pot plants worldwide, is a combination of ecological work done at the Faculty of Biosciences and taxonomic review and applied conservation biological research carried out at the Garden. In addition, the Garden organizes *ex situ* conservation in practice in collaboration with four European gardens (see p. 13 for further information).

Associate Researcher Markku Häkkinen clarifies the taxonomy of the sections *Callimusa* and *Rhodoclamys* of the banana genus *Musa*. This study has many potential practical applications since cultivated bananas, one of the most important food crops in the world, suffer from several problems stemming from an extremely narrow genetic base. Mr Häkkinen has already described half a dozen species, and new ones are continuously being found.

Visa Lipponen

Musa laterita

The introduction of new exotic ornamentals to southern Finland is a long-term commitment that develops hand in hand with the establishment of the new garden collection. The project was launched by the former director of the Botanic Garden, Professor Emeritus Timo Koponen. Plants have been collected at locations selected on the basis of the bioclimatic theory: western Canada, easternmost China and the mountains of Hokkaido in Japan — all areas with a boreal but slightly oceanic climate. Recently, collaboration with Agrifood Research Finland, the Finnish commercial Nurseries' Association, and other Finnish botanic gardens has been initiated with the aim of commercialization of the most valuable accessions.

The *Saintpaulia* room

Leena Helynranta

Public outreach

The educational work of the Garden is developing rapidly. In 2003, the first popular scientific exhibition was organized. Since then, three others have taken place, and regular thematic displays have been included as an integral part of the Garden's strategic goals. This combined with steady development of visitors' services has borne fruit: the number of visitors in 2005 in the glasshouses was 73 000, which is 45% higher than in 2003.

Leif Schulman

▶ Challenging gardening. A giant willow (*Salix* x *rubens* 'Basfordiana'), knocked over by a storm in December, was re-erected and replanted on May 19 2005. The tree had been planted in 1924, and it was the largest of its taxon in Finland — 30 meters tall with a trunk circumference of nearly three meters — when it fell.

Zoological Museum

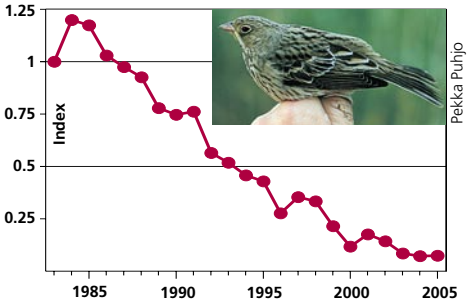
The majority of the research activity of the Zoological Museum is directed towards international biodiversity projects, as well as long-term monitoring of Finnish fauna.

■ Systematics and taxonomy of insects

Our research covers a broad range of scientific questions centred around systematics and taxonomy. These fields of science are clearly international. To describe taxonomic groups, we use morphology and anatomy, as well as molecular features.

Traditionally, the Museum's taxonomic research has focused on insects. Our expertise encompasses various insect orders, e.g. moths (Lepidoptera). Recently, we have directed our attention to the reconstruction of the evolution of the entire order. We aim to resolve the relationships between lepidopteran superfamilies.

Diane Alarukka



Pekka Puhjo

The breeding populations of Ortolan Bunting (*Emberiza hortulana*) have diminished by 95% during the past 23 years in Finland. The year 1983 received an index value of 1 depicting the starting point. The result is based on yearly bird censuses.

Considerable computing efforts and molecular biology resources have been directed to the study of hoverflies (Syrphidae). Dipterologists in Europe and USA resolve species boundaries, establishing the existence of previously unrecognized species in Finland, as well as defining new taxa. Besides hoverflies, the taxonomy and systematics of black fungus gnats (Sciaridae) have been intensively studied.

The experts on beetles (Coleoptera) have focused on the families of Dytiscidae, Chrysomelidae and Elateroidea. The BIOCLEU project hosts four PhD students studying Elateridean beetle evolution and biodiversity.

The Entomology Division is also responsible for the teaching of taxonomy and systematics at a university level in Finland. This activity ensures high national competence in these branches.

◄ Senior curator Jyrki Muona with PhD students, examining dead wood for beetle larvae from the coleopteran superfamily Elateroidea.

■ Monitoring and survey programmes

The Vertebrates Division has a lengthy tradition of bird surveys. The long-term changes in breeding bird fauna are closely monitored. Bird censuses are conducted both in winter and during the breeding season. Thousands of voluntary bird-watchers have participated in field work.

Ilpo K. Hanski

Finland is at present the only country in the European Union except for Estonia to support a viable flying squirrel (*Pteromys volans*) population. In 2003–2005, an extensive study was conducted to estimate the number of female squirrels. The field work in three consecutive springs, carried out by 80 employees, yielded an answer to this question, the estimated number of females being 143 000.

Mikko Heikkinen

The study of phenology dates back to the 1840s. Every year c. 150 volunteers gather information about the arrival dates of migrant birds, trees coming into leaf, frogs spawning, etc. In 2004, the Museum received 6 346 observations.

Mikko Heikkinen

The conservation of bivalved mollusks has occupied the Museum for a long time. Populations of the river pearl mussel (*Margaritifera margaritifera*) have been observed closely since 1978 in cooperation with the Finnish World Wide Fund for Nature. In 1996, the common river mussel (*Unio crassus*) was included in the study. Divers have mapped the distribution of the species in 70 rivers in Finland, the Baltic countries and Russia. Although the LIFE nature project led by our Museum in 1997–2002 is over, the work on mollusks continues. At present, the research on taxonomy, distribution and conservation is mainly conducted to support environmental administration.

■ Ringing provides data on bird migrations

Finland is one of the most active countries in the world in bird ringing. Since the beginning of the 20th century, over 9 million birds have been ringed and more than 900 000 have been recovered. In 2005, almost 250 000 birds got a ring around their ankle. The ringers risked their eyes and fingers by ringing over 30 000 birds of prey.

At the end of the year 2005, the threat of the bird flu virus H5N1 brought the Ringing Centre into the public eye as people wished to learn more about the migration routes of ducks and gulls.

Ilmari Valovirta

Divers looking for river mussels in Southern Finland. Even in June the water is cold.

Seppo Niiranen

Bar-tailed Godwits (*Limosa lapponica*) are getting rings put around their ankles from Aleksi Lehikoinen.

■ Molecular biology as a research instrument

The Zoological Museum is involved in a comprehensive project exploring the northern waters. The systematic and zoogeographical research employs DNA tools to explore the evolution, invasion history, cryptic species diversity and hybridization in circumboreal freshwater crustaceans, brackish-water mollusks, benthic fish and landlocked seals. The project also addresses the evolution of endemic diversity in ancient Eurasian lakes (Baikal, Caspian). Three doctoral dissertations have been completed in recent years.

In addition to aquatic animals, soil fauna is also examined at the laboratory. The biogeography of parthenogenic worms, the distribution history and the structures of the clone pools have been studied using enzyme electrophoresis.

Dating Laboratory

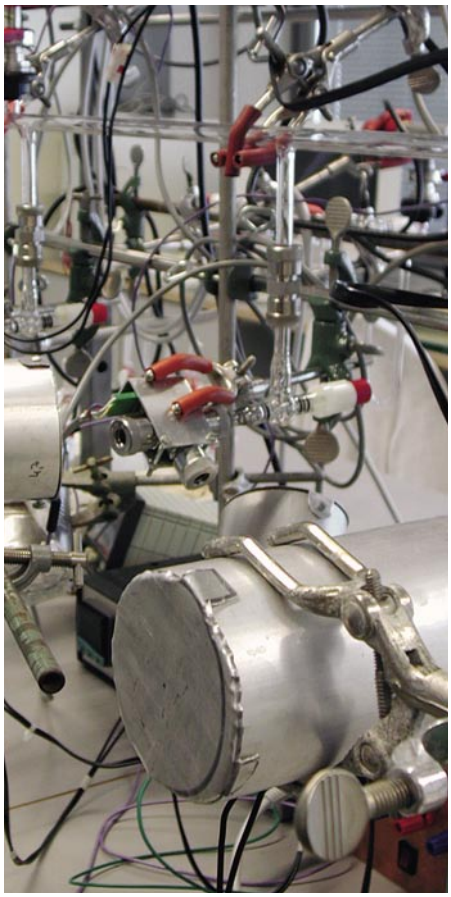

Mikko Heikkinen

Activity at the Dating Laboratory can be divided mainly into dating and the application of stable isotopes in research on climate change and environmental studies.

Radiocarbon method serves archaeology and paleontology

The dating methods in use are based on radiocarbon and luminescence techniques. In the last two years, the accelerator mass-spectrometry (AMS) method has solely been used for radiocarbon dating, with the conventional method being set aside.

Radiocarbon dating has been applied mainly to archaeology. The number of submitted samples related to geosciences has shown a decreasing tendency for many years. Samples submitted from The National Board of Antiquities were from Finland, whereas research projects performed at the University departments have brought samples from outside our country. Finnish archaeologists have been active in the regions east of Finland but also for instance in South America.


Mikko Heikkinen


Solveig Bergholm

Mammoth's tooth

Dates on a few Finnish mammoth finds in recent years have indicated a possible ice-free period about 30 000 years ago. This has initiated an intensive search for sediments to support this finding and shed more light on the climatic conditions after the Eemian period. Organic material is virtually absent in the sediments from these periods, and the age can be assumed to be too old to be measured by the radiocarbon method. Luminescence dating is used in a few projects.

Climatic and environmental studies

The most important part of research activities in the Dating Laboratory is the use of stable isotopes in climatic and environmental studies. This research field has increased rapidly in the past few years.

Researchers at the Laboratory are involved in a number of national and international projects. In the article on page 15, a short description of the use of isotopes utilizing tree rings in search of information on past climate is presented. The work is part of an EU-funded project where isotopic data from tree rings from different parts of Europe are connected to a network. Investigating annual rings provides the possibility of uncovering high-frequency climatic events and longer-term trends in synoptic and site-specific climates, across Europe.


Mikko Heikkinen

Another example of a stable isotope application is the project "Bireme", which deals with the transport of water and nutrients in a river-lake system leading to the Baltic Sea.

Geological Museum


Mikko Heikkinen

The first Finnish chair in the field of Geology was established as early as 1852, but the post remained unfilled until 1877, when F. J. Wiik was appointed as the first Professor of Geology and Mineralogy. Professor Wiik estimated in 1890 that the collections known as the Mineral Cabinet contained about 20 000 mineral and rock specimens.

The collections have long been maintained and arranged by professors and assistants in the field. The Museum did not hire its first employee until 1961, when the post of museum curator was established. In 1968, an administrator was hired to look after the paleontological collections, and when the Museum was merged with the Finnish Museum of Natural History, the administrator's title was changed to that of curator. The post of senior museum caretaker was established in 1999. At present, Martti Lehtinen, Head of the Museum, oversees the Kumpula Laboratory at the Department of Geology. Curator (Paleontology Division) Anneli Uutela and Senior Museum Caretaker Jaana Halla are located on the premises containing the Mineral Cabinet, in the centre of Helsinki.


Jaana Halla

Dr. Anneli Uutela handling fossil specimens of the paleontological collections.


Pekka Kivimäki

◄ Dr. Jaana Halla and MSc. Anja Arkonsuo cleaning an outcrop for detailed geological mapping. Island of Kärppäsaari, Lake Inari.

■ Research

During the last 20–25 years research of the Geological Museum has concentrated on minerals, the Finnish meteorites and impact craters and recently the Neoarchean granitoids (called sanukitoids) in eastern and northern Finland.

Since 1969, eleven meteorite impact craters or impact sites have been identified in Finland. The Geological Museum has participated in finding and researching almost all of them. Finnish crater research consists of a short reconnaissance, when the field work concentrates on possible shatter cones and uncommon loose blocks in the local glacial drift. If promising marks are found, more detailed field work is conducted followed by geophysical measurements. Finally, deep drillings are made to verify the impact origin of the crater. In the laboratory, we have concentrated on searching for planar deformation features (PDFs) in quartz of such rocks as impact melts, breccias and suevites. In the Paleontology Division, research has focused on Paleozoic micro- and macrofossils from the Åland Islands and from sedimentary rocks of Finnish meteorite impact craters.

■ International congresses and popular science

In 2005, the Geological Museum arranged (in cooperation with the Department of Geology and the Geological Survey of Finland) two international geological conferences: 1) EBGA Spring Meeting dealing with the transition from Archean to modern-style plate tectonics within the Karelian craton and 2) EUROGRANITES 2005 field conference with a six-day field trip attended by 40 delegates from 13 European countries as well as from Japan and the United States.

During the last three years the Geological Museum has arranged introductory courses on mineral and rock identification for mineral collectors and amateurs.

Epibryophytic microfungi

Evolution of a highly specialized life strategy

Close associations of fungi and plants can be found in the oldest lineages of embryophytes. The ascomycetes associated with bryophytes are among the least known groups of fungi, and their role in the evolution of the embryophytes is unknown. The epibryophytic ascomycetes show diverse life strategies. These strategies range from pathogenicity to associations where the fungi merely take advantage of their microhabitat without causing harm, even though up to one thousand fruitbodies may cover a single leaf of the host. Many epibryophytic fungi have been observed on both mosses (Bryophyta) and hepatics (Marchantiophyta) but not yet on hornworts (Anthocerotophyta). Many of these fungi seem to be highly specific to their host. Some bryophytes, such as *Sphagnum* and *Polytrichum*, are clearly more favoured as hosts than others; up to six different ascomycetes have been observed on a single individual of hairy cap mosses such as *Dawsonia grandis*. Some of these fungi are abundant and have been found on every collected specimen of a particular bryophyte, showing systemic infection. Epibryophytic microfungi are tiny, generally ranging from 20 to 100 µm in size, and the smallest can easily fit between the leaf lamellae of hairy cap mosses.

***Hymenoscyphus* sp. (~120 x)**

Tomi Laukka

The Ministry of the Environment currently supports our research project, which screens epibryophytic microfungi in Finland. In addition to basic screening of species diversity, the evolutionary relationships of the fungi, selectivity and specificity, coevolution and -speciation between the fungi and their hosts are studied. The total number of known epibryophytic microfungi is about 350 species (worldwide). This number is, however, expected to increase dramatically. Old growth forests with high air moisture are ideal hiding places for these microfungi.

Major changes in the taxonomy of epibryophytic microfungi are expected to take place. Phylogenetic analyses based on DNA sequence data show that adaptation to the peculiar microhabitat has evolved multiple times during the evolutionary history of the ascomycetes. Fungi from diverse lineages, such as the Lecanoromycetes, Chaetothyriomycetes, Dothideomycetes and Leotiomycetes, have been reduced to simple forms of similar appearance that cannot be reliably identified or classified without sophisticated culturing methods and DNA sequence analyses.

One of the central themes of our future work is to study in a phylogenetic framework how "epibryophytism" evolved and what life strategies were possessed by the ancestors of epibryophytes.

The evolution of pathogen-host interactions and their molecular mechanisms provide new insights into pathogen resistance in vascular plants. These issues are studied in our collaborative projects.

Soili Stenroos
Botanical Museum

***"Lizoniella" sphagni* (~220 x)**

Tomi Laukka

Teija Alanko

http://www.ascomycete.net

Saving Wild African Violets

Ex situ collections in Europe

The role of the botanic gardens in the conservation of endangered flora has strengthened in recent years. The Global Strategy for Plant Conservation was adopted by the parties of the Convention on Biological Diversity in 2002. Several of the strategy's ambitious targets for 2010 have direct bearing on the work of botanic gardens worldwide. Target 8 states that 60% of threatened plant species should be in *ex situ* collections by 2010. An *ex situ* (off-site) collection is a collection of plants outside their native ranges, the most famous such entities being botanic gardens.

The Finnish Saintpaulia Society

The Finnish Saintpaulia Society

▲ *Saintpaulia ionantha* at Amboni caves, Tanga, Tanzania.

◄ *Saintpaulia grotei* growing on huge boulders in Nilo Forest Reserve, East Usambara, Tanzania.

The Botanic Garden of the Finnish Museum of Natural History has taken on the challenge by focusing on one of the most popular potted plants of the world, the African violet (genus *Saintpaulia*). In contrast to the tremendous popularity and ubiquity of these plants in western homes and offices, their natural populations are severely endangered. All of the ca. 30 known taxa are endemic to Kenya (3 or 4 species) or Tanzania (the remaining taxa), where they have local, often scattered distributions and exhibit narrow ecological amplitudes. Hence, they are vulnerable to habitat alterations, which occur regularly due to the growth of the human population.

The Botanic Garden has formed a collaborative network with four other European gardens: University of Uppsala Botanic Garden, Sweden; National Botanic Garden, Belgium; Conservatoire et Jardin Botanique, Geneva, Switzerland; and Royal Botanic Garden, Edinburgh, UK. The aim is to organize an *ex situ* collection to be shared by these institutions in order to save space, to ensure the continued survival of the accessions included in the collection, and to disseminate information on the fate of these plants to the widest possible audience. The project is entitled Saving Wild African Violets (*Saintpaulia*) — SAVES.

SAVES was launched in 2004. The *Saintpaulia* collections of the participating gardens have now been revised, and their accompanying data cross-checked, with the aim of identifying all unique accessions, in particular those with the greatest value for conservation. Funding is currently sought to start the duplication and distribution of the accessions to the participating gardens. In the future, collaboration with Kenyan and Tanzanian authorities will be established to replenish the *ex situ* collection and also to enable its use in re-introduction programmes in the field.

Leif Schulman
Botanic Garden

http://www.saintpaulia.fi

Continental mysid crustaceans

Diversity and zoogeography

Mysid crustaceans are predominantly marine organisms with poor dispersal abilities. They, nevertheless, include two important continental exceptions — 'glacial relict' descendants of Arctic marine *Mysis* in circumboreal lakes and the Baltic Sea as well as in the Caspian Sea, and autochthonous Ponto-Caspian mysids, with about 20 species in the Black, Azov and Caspian Seas. Morphological, molecular and physiological data were applied to analyse the long-debated evolutionary history of the continental mysids and the importance of various factors that have generated and maintained their diversity. Also examined were how and when the marine organisms invaded the inland waters and what evolutionary changes occurred in the new habitats.

The study demonstrated higher than traditionally assumed species diversity of continental mysids. The 'glacial relicts' in European lakes and the Baltic Sea include two common cryptic species (*Mysis relicta* species group) that have variable morphological, ecological and visual characteristics and colonized European waters at different times. Generally,

Mikko Heikkinen

different *Mysis* taxa in Europe, North America and the Caspian Sea seem to have colonized continental waters independently and asynchronously. Species in these geographic areas possibly had independent evolutionary histories for several million years. They therefore would have been separated from each other before the onset of major Pleistocene glaciations, about one million years ago, often thought of as the main factor generating the 'glacial relict' diversity.

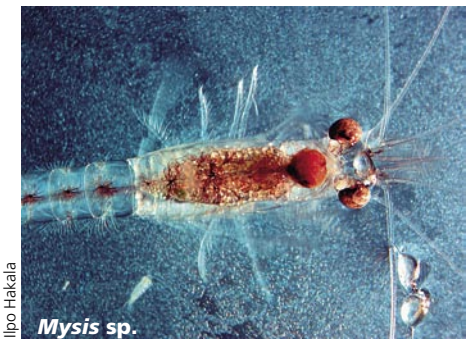
The environmental changes caused by Pleistocene glaciations nevertheless played a major role in shaping genetic subdivisions of continental mysids at the intra-specific level, both in the northern areas that were glaciated directly, but also in the more southern Ponto-Caspian region. Changing paleogeographic settings and transiently established waterway connections facilitated long-distance migrations of the supposedly weakly dispersing crustaceans. At the same time, however, responses of different mysid taxa to paleoenvironmental conditions and the ability to utilize newly available dispersal routes was controlled by ecological characteristics of the species, such as salinity tolerance and vagility. For instance, in the Ponto-Caspian region, long-distance Late-Pleistocene dispersals across the Caspian, Azov and Black Seas were inferred for three species, whereas other species showed distinct inter-basin structuring.

***Gammaracanthus* sp.**

Ilpo Hakala

Comparative analysis of continental mysids and other co-distributed invertebrate and vertebrate taxa revealed startling lack of congruence in the extent of molecular divergence. In different animal groups similar zoogeographical patterns have been created repeatedly at different times. It is therefore crucial that biogeographic analyses utilize methods that allow at least approximate inferences of the time component.

Asta Audzijonytė
Zoological Museum



***Mysis* sp.**

Ilpo Hakala

http://ethesis.helsinki.fi/julkaisut/bio/bioja/vk/audzijonyte/

Stable isotopes in tree rings

Indicators of climatic conditions

Tree rings have been widely used for climatic reconstructions because they provide exact dating and annual resolution. The most commonly used proxies are ring width and wood density. Natural abundance of stable isotopes in cellulose of tree rings has been investigated as a source of additional information on past climate and plant responses.

A difference in mass causes isotopes to behave differently in biological and physical processes and chemical reactions. In plants, isotopic fractionation occurs during both photosynthesis and transpiration. The stable carbon isotope ratio in tree ring cellulose records the balance between stomatal conductance and rate of photosynthesis in plants' leaves while cellulose is produced. Photosynthesis discriminates against the heavier carbon dioxide but is forced to use it during rapid photosynthesis. Stable oxygen and hydrogen isotopic ratios in tree ring cellulose are recorders of source water, which contains a temperature signal, and also contain a fractionation signal during leaf transpiration.

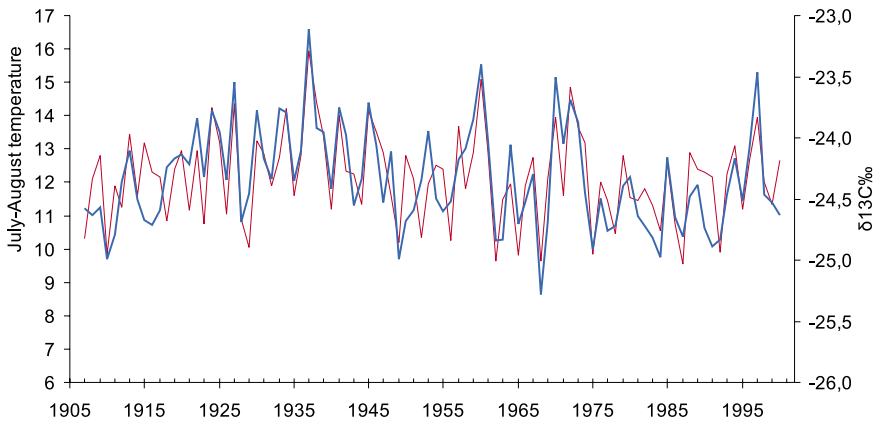
For isotope analysis, trees are sampled with an increment borer. Tree ring widths are measured under a light microscope to the nearest 0.01 mm and carefully cross-dated. The tree rings are separated and small samples of cellulose are prepared. Stable isotope ratios of $^{13}C/^{12}C$, $^{18}O/^{16}O$ or $^{2}H/^{1}H$ are measured relative to international standards.

As part of the EU-funded project "Isonet", stable isotope ratios were measured from living 400-year-old trees, and an annual isotope chronology was produced from three sites across Finland. The figure below shows an example of the correlation between the $^{13}C/^{12}C$ isotope ratio in tree ring cellulose and measured mean temperature for July–August in the last century.

Emmi Hilasvuori and *Eloni Sonninen*
Dating Laboratory

Högne Jungner

◄ Sampling from a pine in Kessi National park (68°56'N 28°19'E) in northern Finland.



$^{13}C/^{12}C$ isotope ratio (blue line) in tree ring cellulose from a Scots pine living close to the present tree limit in northernmost Finland, and measured mean temperature (red line) for July–August in the last century.

Old rocks beneath our feet

How were they formed over 2.5 billions of years ago?

The bedrock research at the Geological Museum focuses on crust-formation processes on the early Earth. Continental crust rising above sea level is a prerequisite for our existence on Earth. In the beginning, Earth was covered by water and continents did not exist. Formation of the continents over time made life possible, first in shallow seas on continental shelves and then on dynamic continents.

Plate tectonics is a fundamental theory explaining how the Earth's crust is forming today as a consequence of the movements of the rigid lithospheric plates on the Earth's spherical surface. But how did the continents form and evolve in Archean times over 2.5 billion years ago? When and how did plate tectonics — as we know it today — begin? Our research at the Geological Museum approaches these questions by studying crust-formation processes that prevailed in the late Archean period 2.8–2.5 billion years ago. At that time, the rates of magma production and continental growth were especially rapid, indicating major changes in the function of Earth's systems.

One important manifestation of a change in the crust-formation mechanisms in the late Archean is a series of special-type granitoids (enriched in both potassium and magnesium) known as *sanukitoids*. These granitoids have been found in all Archean cratons in the world. Our most important achievement was recognizing and documenting the existence of sanukitoids in central and eastern Finland. Sanukitoid series granitoids have been known for only two decades, so in this respect this project belongs to an internationally new field of geological research. The state of current international knowledge of the genesis of Archean granitoids, including the outcome of the research carried out at the Geological Museum (Halla, 2005), is provided in a Special Issue of Lithos (volume 79) "Geodynamic controls on adakites, TTG and sanukitoid genesis; implications for models of crust formation".

Tapani Rämö

Looks fresh! EUROGRANITES 2005 participants at a sanukitoid stop in Lieksa. The age of the rocks, 2.73 billion years was astounding to most of the participants, who had never seen such old rocks. Sanukitoids represent a special type of granitoid rock that has recently been recognized as essential to the broader understanding of changes in crust-formation mechanisms in the late Archean.

We actively organize international meetings on the subject of Earth's early evolution. During 2004–2005 we organized two EBGA (Evolution of Baltica and Greenland in the Archean) spring meetings funded by NordForsk participants from Denmark, Norway, Sweden, Finland, Estonia, Russia and France at our museum, with presentations and discussions on the early evolution of the Fennoscandian Shield and Greenland. The EUROGRANITES 2005 field conference "Proterozoic and Archean Granites and Related Rocks of the Finnish Precambrian" was arranged in southern and east-central Finland in September 2005 by the Department of Geology at the University of Helsinki, the Geological Museum of the Finnish Museum of Natural History and the Geological Survey of Finland.

Jaana Halla
Geological Museum

Publications

- Halla, J., 2005: Late Archean high-Mg granitoids (sanukitoids) in southern Karelian Domain, eastern Finland: Pb and Nd isotopic constraints on crust-mantle interactions. Lithos 79, 161–178.
- Rämö, O.T., Halla, J., Nironen, M., Lauri, L.S., Kurhila, M.I., Käpyaho, A., Sorjonen-Ward, P., Äikäs, O., 2005: EUROGRANITES 2005 – Proterozoic and Archean Granites and Related Rocks of the Finnish Precambrian. Eurogranites Field Conference, September 11–17, 2005. Publications of the Department of Geology A1, 130 p. http://www.helsinki.fi/geologia/files/Eurogranites2005.pdf

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Cover pictures
Front cover: The Metsäksensoidinmaa primeval forest in Lammi, Central Finland. – Tuomo Niemelä.
Back cover from top to bottom: *Postia caesia* – Tuomo Niemelä, *Trollius chinensis* – Visa Lipponen, *Luscinia svecica* – Seppo Niiranen, *Phocoena phocoena* – Solveig Bergholm, *Alethopteris* – Heidi Kinnunen.

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