XXIX CONGRESS
LAHTI FINLAND
8 -14 AUGUST 2004

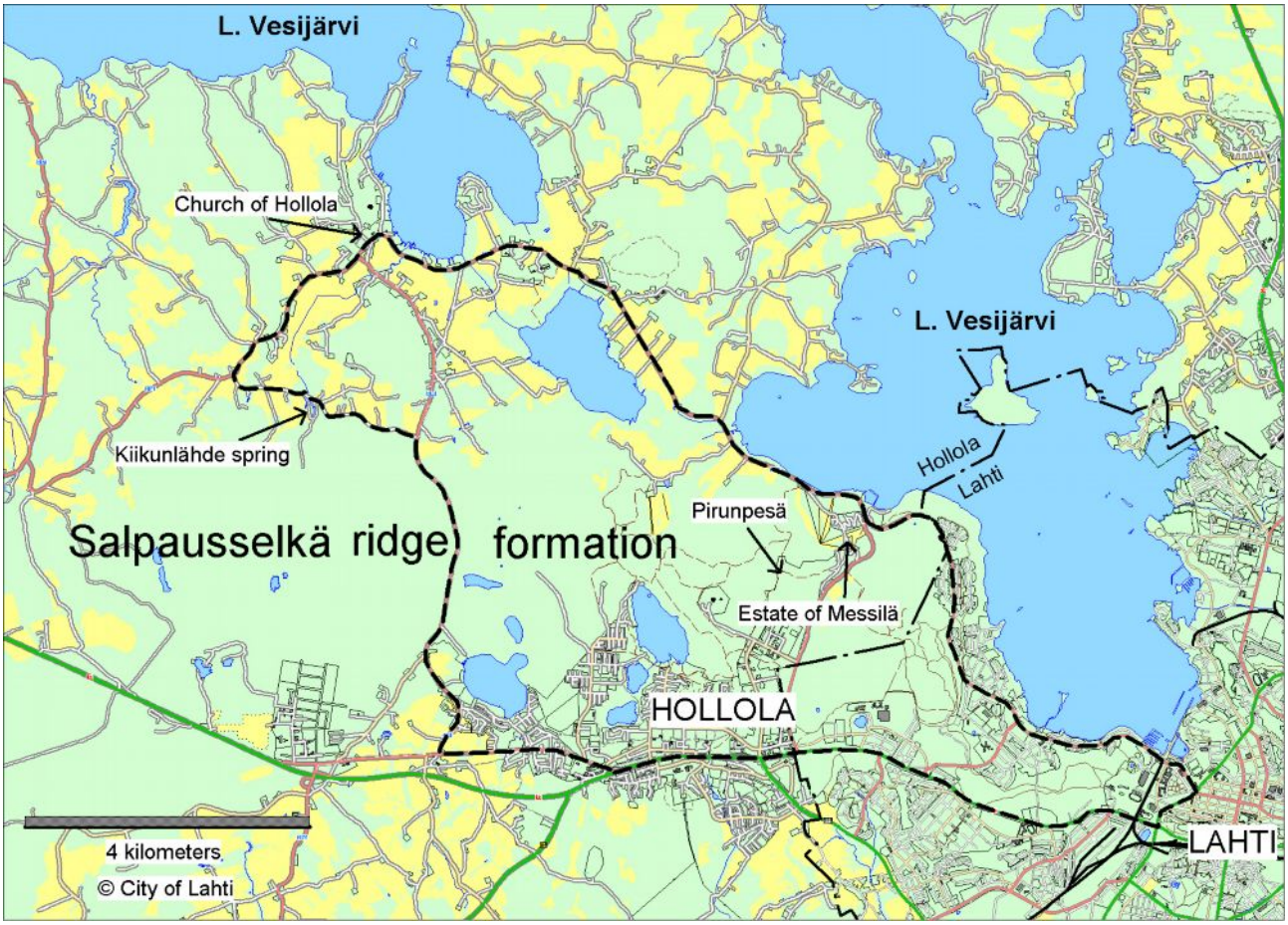
Mid-congress excursion E7.

SALPAUSSELKÄ RIDGE

Excursion leader: Mr Kyösti Toivonen

Programme

08.30 Departure from Lahti
08.45 Arrival at Messilä estate in Hollola county
09.00 Introduction to the flow model of ground waters in Lahti and Hollola by geologist Sara Kajander in the restaurant Markkinaravintola. Coffee.
10.00 Hiking around walking trails around Messilä in Salpausselkä ridge formation. A visit to the rocky formation called Pirunpesä ("The Devil's Nest").
12.00 Departure to the old village center of Hollola.
12.30 Lunch in the restaurant Kunnantupa
14.00 Visit to the old stone church of Hollola. Thereafter, possibility to climb the steep ascent to the top of the Kapatuosianmäki hill and walk around the village.
15.30 Departure to Lahti. On the way, a visit to the Kiikunlähde spring, the largest spring in Finland: length 400 m and width 100 m. Introduction by Engineer Juha Määttä from the Science and Business Park of Lahti.
16.30 Arrival in Lahti.



Salpausselkä ridge formation

Salpausselkä geological formation has developed during the latest ice age about 10 000 years ago. Continental glacier and its melted ice have carried, collected and separated soil in the Salpausselkä area and in the areas south of Salpausselkä. The continental glacier has drawn back about 50-80 kilometres from the Salpausselkä region and after that continued collecting soil in front of it. The edge of glacier was located in Salpausselkä region for about 200 years. Big blocks of ice have stayed inside the geological formation after melting and there have developed huge steep-edged pits in the ground. The structure of the geological formation varies considerably in different parts of the formation. The soil types of the top layer of the soil are usually more gravel, in the northern than in the southern part of the formation. Furthermore, the structure of soil types inside the formation can also vary. As a result, occurence of layers, which carry water may vary in a small geographical area.

Ground waters of Salpausselkä

Salpausselkä ridge formation is the most important groundwater area in Finland. Most of the crystal clear springs, charasteristic to the ridge formation, have been used in raw water production. We first get acquainted with current issues concerning groundwater protection and research in the Lahti region.

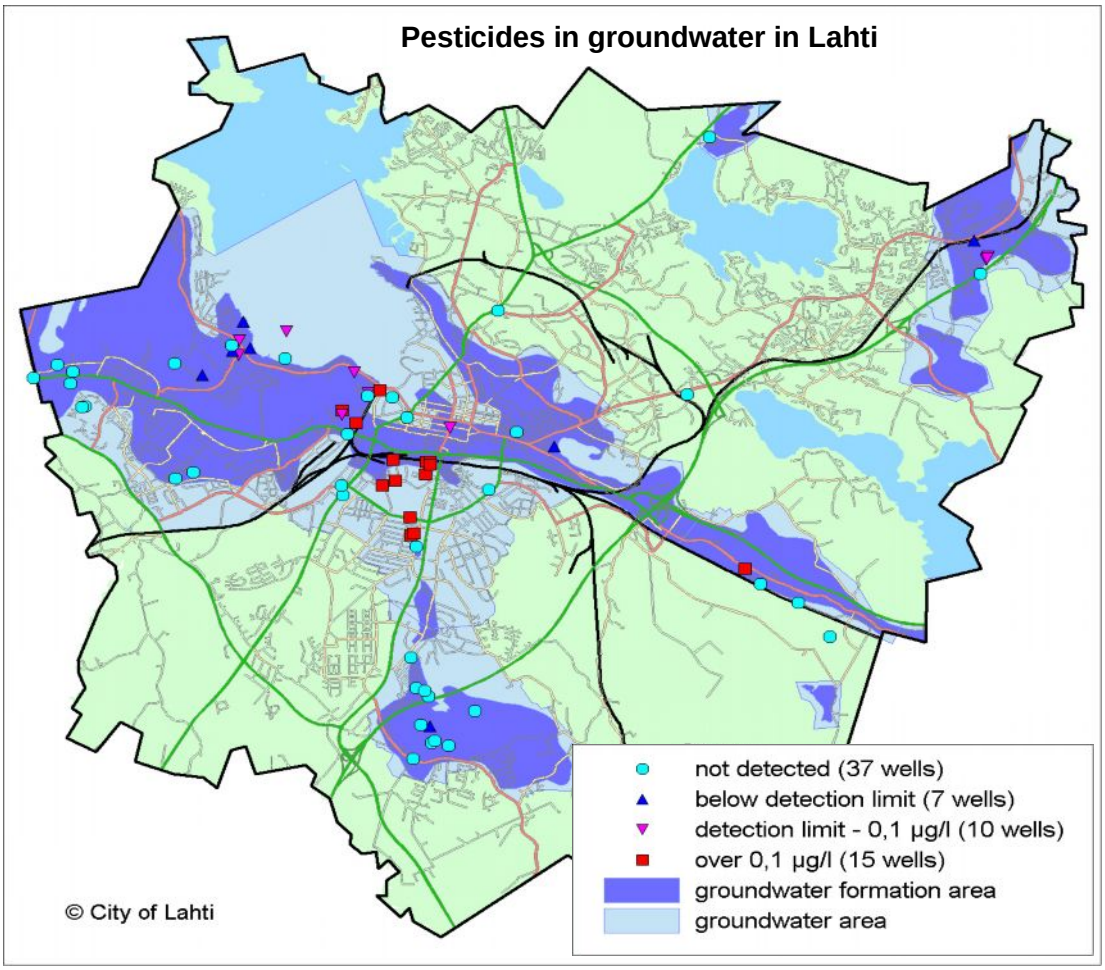
The groundwater research is emphasized in the study serving groundwater intake and groundwater protection. There are good preconditions for groundwater formation in the Salpausselkä area. From 40 to 60, even to 70 percent of precipitation comes into groundwater (the average precipitation in the southern Finland is about 630 mm per year). However, evaporation has a strong diminishing effect on groundwater formation. The groundwater layer is usually 10 to 20 m high and from 20 to 40 m in the hollows of the bed rock. In the city of Lahti the surface area of groundwater area is 30 percent of the city surface area. In Hollola municipality groundwater area covers 18 percent of the surface area.

The tap water of the city of Lahti and Hollola municipality consists of groundwater only. The average consumption of tap water is a little bit over 200 litres per person per day. In Lahti 8,5 million cubic meters of groundwater is being used through the network of water pipes per year and in Hollola municipality a little bit less than one million cubic meters. Lahti Water Ltd. takes it’s raw water from six groundwater intake plants and in Hollola there are five intake plants. In addition, the municipalities have two shared intake plants. In Lahti, about 70 percent of the water of the biggest intake plant sweeps through the Lake Vesijärvi shore line and therefore it is called artificial groundwater. Groundwater resources in Lahti region last rather well considering the water consumption of the society. For example, in Hollola municipality it has been estimated that the supply of the most important groundwater area is about 12 times larger than the average consumption of the inhabitants.

Protection of the groundwater

Significant groundwater resources require protection and continuous study of water quality. A water protection plan has been prepared during 1994 and 1998 in Lahti and Hollola region. The most important groundwater areas and groundwater formation areas have been analysed in detail during this process. The industrial plants, the storage and use of fossil fuels and lubricants, the transportation of hazardous liquids, maintenance of roads (salting during the winter) and absorption of wastewater (of settlements situated outside the sewage system and old pipelines)

cause risks of groundwater contamination. In the protection plans, there has been made zoning and classification based on emission risks. The zoning is based on water-carrying capacity of the soil, flow direction and the thickness of the soil structure protecting groundwater. The amount of hazardous liquids and processing/handling methods, water solubility, biological and chemical decomposition, transformation and absorption of compounds and elements have been considered when classifying the risks. Also the general susceptibility to accidents has been taken into consideration. The protection plan of oil and chemical accidents of the city rescue officials is closely connected to the groundwater protection programme.



In winter, the salting of roads in order to keep them unfrozened, may increase the chloride content of groundwater, particularly in the groundwater formation areas. As a result of road salting an increase in chloride content has been discovered in Kukonkoivu-Hatsina, Lahti and Salpakangas groundwater areas. For example, in Kukonkoivu-Hatsina area the highest chloride content discovered has been 67 mg/l, the natural level being about 3-20 mg/l. Furthermore, the chloride content of the groundwater in Lahti's Sport Centre groundwater intake plant has increased as a result of a road salt storage situated close to the intake plant. As the salt storage has now been relocated the chloride content is expected to decrease during the next years. Groundwater shielding along the highways in Lahti region started in 1994 and will continue in 2004-05.

There are many gas stations situated in groundwater areas in Lahti region. Due to the gas stations there are small contents of fuels and lubricants found in the soil. The slow contamination of soil has been going on for several decades. Contaminated soil has been transferred to licensed waste management plants when discovered. There is also a risk concerning groundwaters related to the oil heating of houses. The risk has been decreased by continuous oil tank inspections and by

crowing the network of district heating. However, the production of district heating is not without risk, because most of the district heating plants are located in groundwater areas. Also the industrial plants cause a risk to the groundwaters. For example, two of the largest industrial areas of Hollola are situated in groundwater formation areas. The risk is decreased when the upper level of the soil is very thick, but the industrial activity requires continues groundwater quality control.

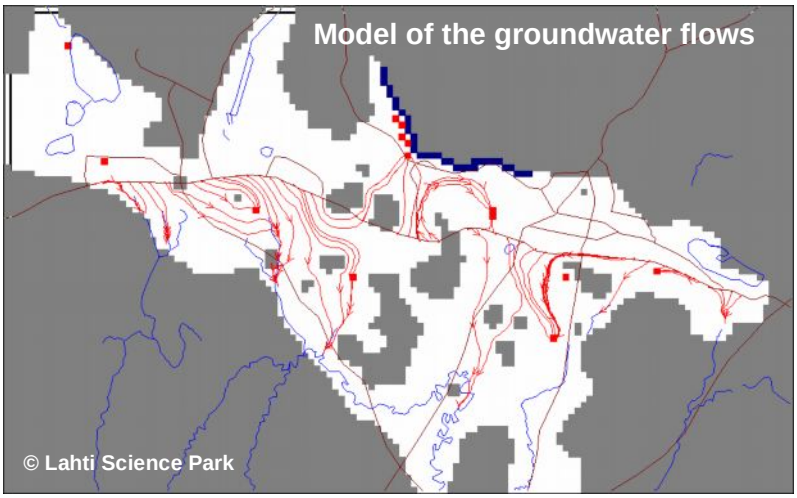
Water quality is continuously studied according to the groundwater and tap water control programme, which consists of an effective control of groundwater and also use control of processed and unprocessed tap water. Water samples are taken every week and the total amount of samples analysed per year grows upto 500. The following contents are analysed: pH, conductivity, alkalinity, turbidity, nitrate, TOC, microbes, about 20 elements, solvents, pesticides, chlorine phenols and PAHs. In Lahti region, the unprocessed groundwater has met the quality requirements of the Finnish Social and Health Ministry. The pH of water is being adjusted by natrium hydroxide or lime in order to decrease the corrosive effect of water on pipelines. In addition, the growth of bacteria in the pipelines is being prevented by light chlorination (natriumhypochlorite).

Over the past five years pesticides or their transformation products have been detected in groundwaters of Salpausselkä ridge in Lahti. So far, five pesticides (atrazine, bromacil, hexazinone, simazine and terbutylazine) and four transformation products have been detected. All pesticide compounds are herbicides or their transformation products. The use of all these pesticides is now banned. For example, the use of bromacil was banned in 1986, but the highest consentrations found in groundwater are still 1,6 µg/l. There is a low level of organic matter in the soil to slow down the movement of pesticides to groundwater and only few bacteria present to break down pesticides in the ground water.

The compounds that have been detected more frequently, are atrazine and it’s transformation products (DEA, DIA, DEDIA). Also degradiation product of dichlobenil (2,6-dichlorobenzamide, called BAM) has been foud, but not the parent product itself.

Pesticides and their transformation products are commonly present at low concentrations in ground water and have not exceeded water-quality standard (0,1 µg/l) in drinking water. Pesticide concentrations were over 0,1 micrograms per litre in 15 of the 69 monitoring tubes sampled during years 2000-2003. The highest concentrations have been detected near the former or current railway bed. The other possible sources of contamination are road areas, cemeteries and public gardens.

Groundwater modelling



in 2003-04, a groundwater model was designed for Lahti and Hollola groundwater area. The modelled area (8*13 km) is considered the largest and the most significant in terms of groundwater content in Finland. Most of the groundwater used in Lahti and Hollola water network is formed in this area. The model is being used in groundwater intake planning and groundwater protection. With this model one can simulate and illustrate, for example, the amount of groundwater pumping as well as flows of groundwater. The model has been based on data collected from the soil and groundwater during the past decades. Some new gravity scalings and drillings have been made and some new observation tubes installed for this modelling process. The modelling has been carried out by using finite difference -method based on MODFLOW-calculation code. Furthermore, PMWIN- and PMPATH- programmes have been used in data input and illustrations.

Old medieval sites and the stonechurch of Hollola

The architecturally and historically important church with its surroundings, the cultural route that follows the shores of Lake Vesijärvi and leads from Lahti to Hollola church together with the landscape of archaeological interest afforded by the seven villages of Vainio provide memorable experiences. The medieval greystone church of Hollola is situated on the shore of lake Vesijärvi. The special features of the church include two aisles, star vaults with embossed ring ornaments and wooden carvings of historical importance. Entry to the church is through an Empire-style bell tower designed by C.L. Engel. The decoration of the west gable is among the most beautiful in Finland.