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Word Natural Heritage and Geopark Sites and Possible Candidates in Finland

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Finnland
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Inlandeis
UNESCO-Weltnaturerbe
Geopark
Geotourismus

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Weltnaturerbe und Geoparks und mögliche Kandidaten in Finnland

Zusammenfassung

Zurzeit gilt Tourismus als weltweit am schnellsten wachsender Wirtschaftszweig. In Finnland sind Geologie und geologische Sehenswürdigkeiten als Touristenziele sowie als Informationsquellen relativ neu und daher selten.

Das Geologische Forschungszentrum von Finnland (GTK) arbeitet bereits seit etlichen Jahren daran, der Bevölkerung, der Tourismusbranche und Bildungsanstalten Wissen über das geologische Erbe zur Verfügung zu stellen. Eine wichtige Aufgabe ist ebenfalls gewesen, das geologische Wissen in der Grundschulausbildung zu erhöhen.

Beispiele dieser Arbeit sind geologische Ausstellungen in Informationszentren finnischer Nationalparks, geologische Lehrpfade in Parks, geologische Zentren, geologische Wanderkarten sowie geologisches Unterrichtsmaterial für Schulen. Das hat eine erhöhte Anzahl von Besuchern geologischer Sehenswürdigkeiten und Routen nach sich gezogen.

Bis jetzt ist viel Arbeit investiert worden, um neue Weltnaturerbestätten und Geoparks in Finnland zu planen und zu gründen. In diesem Artikel werden einige dieser geologischen Stätten detaillierter beschrieben: ein Weltnaturerbe (Kvarken Archipelago), ein Anwärter zur Liste der Weltnaturerbestätten (Seengebiet von Saimaa-Pielinen) und zwei mögliche Kandidaten für das Geopark Netzwerk. Von Letzteren müssen wissenschaftliche Daten und Geologische Karten gesammelt und untersucht werden.

Abstract

At present tourism is considered to be the fastest growing industry worldwide. In Finland, the use of geology and geological sites as a promoter of tourism and as a producer of further information is rather new and therefore rare.

The Geological Survey of Finland (GTK) has already worked for several years to offer knowledge about geological heritage to the public, to the tourism sector, and to places of education. The key task has also been the increase of geological knowledge in basic school education.

Examples of this work are geological exhibitions in the information centres of the national parks in Finland, geological trails in parks, geological centres, geological outdoor maps and geological tuition materials for schools. The influence of this work can be seen in an increased number of visitors in geological sites and routes.

Up to now a lot of work has been done to plan and realise new World Natural Heritage sites and Geoparks in Finland. In this paper some of these geological sites are described in more detail, one World Natural Heritage site (Kvarken Archipelago), one tentative to the World Natural Heritage List (Saimaa-Pielinen Lake District) and two possible Geopark network candidates, from which scientific facts and geological maps have to be gathered and investigated.

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1. Saimaa-Pielinen Lakeland District

The purpose of the UNESCO World Heritage Convention is to protect the common cultural and natural heritage of mankind. On the World Heritage List there are, at present, seven sites from Finland and one of these is a joint natural heritage site with Sweden: The Kvarken Archipelago – High Coast.

In 2004 Finland proposed the Saimaa-Pielinen Lake District for inclusion in the World Heritage Project List. The district forms a coherent sub-regional whole (i.e. a so-called serial target) of 16 places situated in South Karelia, Southern Savo, Northern Karelia and Northern Savo.

The Saimaa – Pielinen Lake System has been accepted to the UNESCO World Heritage tentative list for its natural properties in 2004. It consists of a cluster (total 16 places) of legally established national parks and areas under national conservation programmes.

It fulfils UNESCO natural criterion viii to

" ... be outstanding examples representing major stages of the earth's history, including the record of life, significant ongoing geological processes in the development of landform, or significant geomorphic or physiographic features ... "

and criterion vii to

" ... contain superlative natural phenomena on areas of exceptional natural beauty and aesthetic importance ... "

The Saimaa – Pielinen Lake System is an outstanding example of a glaciated terrain with unique features and exceptional beauty. The current lake system reflects the complex interplay of:

1) Ancient plate tectonic processes (structures and fracturing of the bedrock).
2) Erosion and deposition underneath the ice-sheets ("roches-moutonnees", drumlins etc.).
3) Deposition related to the final deglaciation (eskers, end-moraines etc.).
4) The impact of the postglacial uplift to the tilting of the basin of the great lake of Saimaa and its isolation from the Baltic sea.

One of the best investigated and promoted sites of the Saimaa – Pielinen district is the Koli National Park in North Karelia, eastern Finland, on the western shore of Lake Pielinen. Established in 1991, the national park is administered by the Finnish Forest Research Institute (Metla) and it is 3,000 hectares in size. The purpose in conserving this area is to ensure the preservation of Koli's heritage landscape and the forests of the Koli highlands as well as maintaining the plant communities created in the past by cultivation. The Park is also a member of the Europarc network.

Koli's highlands are what remains today of the ancient Karelidian mountain chain. The Karelidiens were formed nearly 2,000 million years ago, when thick sandstone sediments were transformed into rock and then folded as the continental plates collided. The quartzites formed in this episode have withstood the wear and tear of the Ice Ages and other weathering agents better than the surrounding rock layers. The highest part of the string of highland rock hills, and the highest summit of the whole of Southern Finland, Ukko-Koli top, rise to a height of 347 m above sea level and 253 m above the nearby Lake Pielinen.

The views to the east from Koli over Lake Pielinen and to the west in the direction of Lake Höytiäinen are recognized to be among Finland's loveliest. Indeed, Koli is one of Finland's heritage landscapes (Text-Fig.1; http://www.metla.fi/koli/index-en.htm).

2. Rokua – a Geological Puzzle

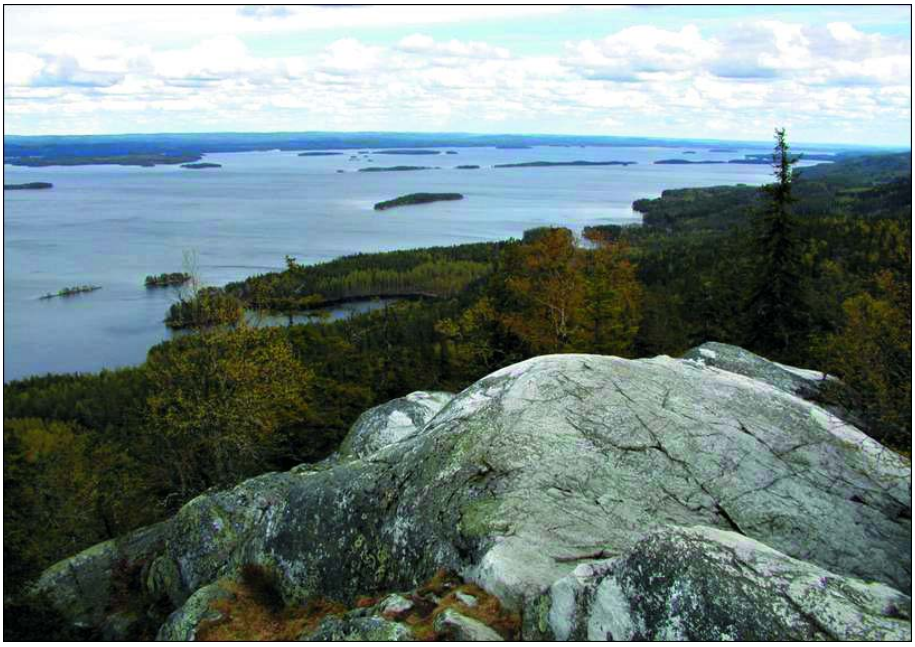
Rokua is situated in north-western Finland, about 80 km SE of Oulu city. The esker landscape of Rokuanvaara is a combination of landforms produced by geological processes, which are linked to one another in a puzzle-like manner. From the pieces a complete, unique natural feature has been formed, which records in its details the stages of development from the compression of the glacier ice-sheet until the present day.

Rokua is part of a 400 km long esker formation that continues from Hailuoto to Ilomantsi and which developed as glacial river deposit during the period of 12,000–1,0000 years ago.

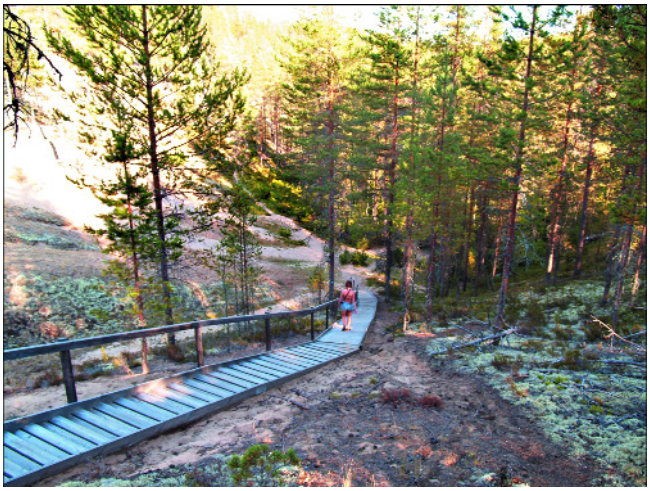
The esker core, which consists of gravel, and overlying delta sand form together the first piece of the Rokua landscape puzzle. The esker core and delta sand were formed in glacial tunnels from rock and sand material transported by flowing melt waters 11,000–10,400 years ago.

A formation developed from the melting of ice from the coarse esker core and the overlying delta sand flowed onto the bottom of the ancient Ancylus lake. The pieces of ice buried by the sand mass began to melt. Due to the melting of the sand formations the level surface subsided forming multi-shaped kettle holes (Text-Fig. 2) and hummocky terrain. It forms the second piece of the Rokua landscape puzzle (NENONEN & TERVO, 2007).

Land uplift was rapid. In a few centuries the summit of the hill rose to form a bank (sandbank) in the open sea of the Ancylus lake. During the following 1,000 years, from the exposure of the summit, wave-action worked systematically through the sandy ridges of Rokua forming them into a series of beach ridges. They form the third piece of the landscape puzzle.



Text-Fig. 1.
Koli is one of Finland's best known national landscapes with marvellous views.



Text-Fig. 2.
"The Well of Depth" is Finland's deepest kettlehole.

The waves followed the wind. It transported material of even quality from sandy beaches lacking in vegetation that had been freed from the water, heaping it into dunes elongated parallel to the shoreline and curved parabolic dunes. Finally, the vegetation bound to the sand and from the dunes was fossilised. The dunes form the fourth piece of the puzzle.

Peat lands form the last piece of the Rokua landscape puzzle. Peat began to form in the damp depressions of the lower ridges immediately as soon as these were raised above the water surface.

The original esker plain, kettles and esker mounds, shore features, wind deposits and bogs form together the landscape puzzle of Rokua, and at the same time the framework (or skeleton) of the landscape (Text-Fig. 3). The quality of the surface deposits, both water permeability and thickness, and varying surface features, the position of the groundwater surface and climate determine the natural growth conditions of the fauna at Rokua, and through this its range of species.

Text-Fig. 3.
Aerial landscape of Rokua Formation.

3. Pyhä-Luosto National Park

Concurrent with geological work, the GTK has mapped geologically valuable natural sites. As a result of the mapping work, a geological outdoor map series has been developed for people interested in nature. On the maps, geological sites in the areas are shown and an explanation is given of their development and their effect on the existing nature and landscape. Maps have been made of the larger national park areas of Finland. The field work for the newest map has been made from the Pyhä-Luosto National Park area in Lapland where geology is one of the most important themes. In this area, the GTK has worked in cooperation with Metsähallitus – The National Forest and Park Service in mapping and making an inventory of geo-

Text-Fig. 4.
Rugged canyons from Pyhä-Luosto.

Text-Fig. 5.
Wooden pathway leading hikers in Pyhä-Luosto National Park.

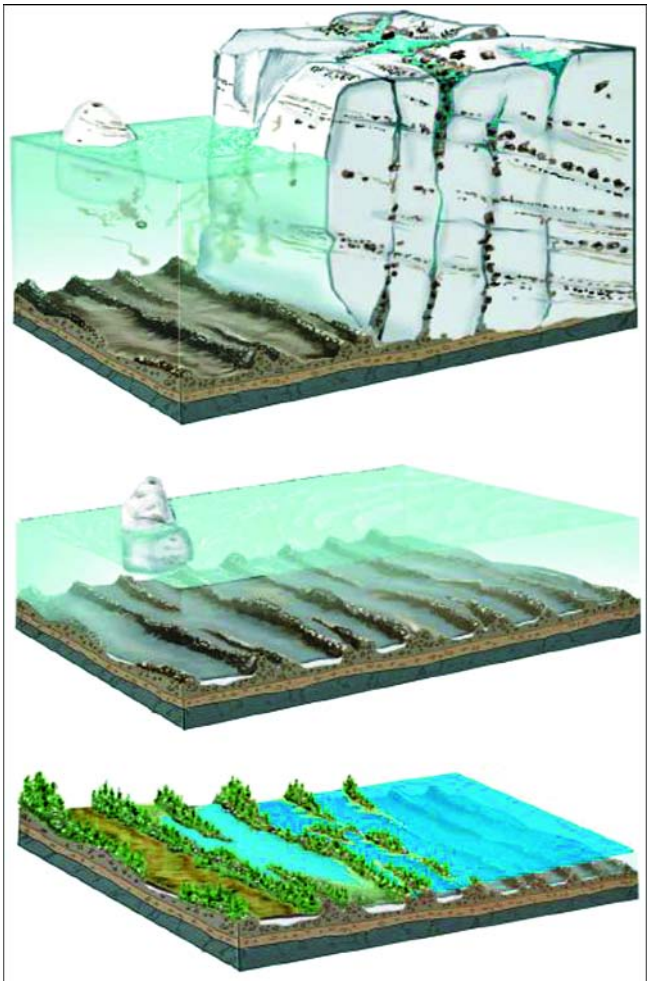
Text-Fig. 6.
Ancient ripple-marks in 2,000 million years old quartzite.

logical sites. A joint objective is to link Pyhä-Luosto National Park and the surrounding tourist area to the international Geopark network (NENONEN & JOHANSSON, 2006).

The Pyhätunturi – Luosto range of fells with surrounding low moraine hills and wet aapa mires form a national park of 142 km^2. Due to its geological features it is one of the finest tourist attractions in Finnish Lapland (Text-Fig. 4). The fell range, consisting of about 2,000 million year old quartzite and conglomerate, is actually a residual mountain that has resisted millions of years of erosion better than the surrounding rock types. The highest felltops (over 500 m) dominate the landscape of central Lapland for tens of kilometres. Originally the quartzite was quartz sand, sorted by running water, then got its present appearance by undergoing metamorphism. The quartzite layers form about one metre-thick beds, locally turned into a near-vertical position (Text-Fig. 5). Often surprisingly well-preserved sedimentary structures, such as ripple marks (Text-Fig 6), occur on their surfaces. Dendrites can also be found. They are branched precipitations of iron and manganese, earlier mistakenly believed to be fossils of ancient plants. Some quartz veins contain more unusual colour varieties, including rosy quartz, smoky quartz, rock crystal and amethyst (JOHANSSON, 2005).

4. Kvarken

The nature of the Kvarken Archipelago is special – and the geomorphology, i.e. the moraine ridges, is extraordinary. The flat archipelago of Kvarken, and the steep High Coast in Sweden together constitute a complete example



Text-Fig. 7.
The origin and genesis of De Geer Moraines in Kvarken (H. KUTVONEN, 2003).

Text-Fig. 8.
Washboard moraines (DeGeer moraines) from Björköby.

on how the land uplift forms the landscape and influences biological processes. In July 2006, the Kvarken Archipelago was included in the UNESCO World Heritage List. The area is the first Natural Heritage Site in Finland. (www.environment.fi, The Kvarken Archipelago, http://www.kvarken-guide.org/geologide.html)

The landscape and landforms of the area are mostly built up by the glacial events and formations of the last Ice Age. The geomorphologic feature that makes the Kvarken Archipelago unique is the spectacular De Geer moraines, showing the gradual deglaciation of the continental ice sheet (Text-Fig. 7). De Geer moraines are exceptionally well formed and frequently appear in large fields within the site. Also, hummocky moraines and other types of transversal moraine ridges occur. The geology has been very well mapped during the nomination process (BREILIN et al., 2004).

The Kvarken Archipelago, with a land uplift rate of 8 mm per year, is the most representative site in the world for the study of the land uplift process in flat and shallow moraine archipelagos. The land area of Kvarken Archipelago grows by 1 km^2/year. The shallow Kvarken area will rise above sea level within 2000 years, forming a land bridge between Finland and Sweden.

The first reefs emerged from the sea about 2000 years ago and people started to settle in the area a thousand years later. Humans have adapted their living to the land uplift. The rapid decrease of extensive bays, the cutting off from the sea of inlets between moraine ridges and the development of coastal lakes into swamps are all effects that can be experienced during a single human lifetime. Harbours, boat channels and settlements have to change places continuously (Text-Fig. 8).

Several species in the area are relicts or remnants from the glacial and postglacial periods. There are about 15 shoreline species in the Kvarken Archipelago that probably originate from the Barents Sea and the most important species of the water ecosystem are glacial relicts from the Siberian area. There are 24 endemic plant taxa restricted to the shores of the Baltic Sea, of which 16 are found in the Kvarken Archipelago. The occurrence of endemic species in the area reflects the evolutionary process resulting from land uplift.

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