

NEED Project
WP4 Inspiring Environments for Education
Action 19

Report of Designing and Producing
the Pilot Learning Environments
in Norway

Learning environment 1



Learning environment 2



Learning environment 3



a) Summary of pilot learning environments in Norway

1.1 Short description of NEED target area

The work of the NEED project in Norway are placed to the protected areas of Junkerdal and Saltfjellet-Svartisen national parks, mostly located on Storjord. These areas are located in northern Norway on the polar circle. The parks are known among other things for its limestone, and the high density of limestone caves. Between these two national parks lies Nordland National Park Center, which is a visitor centre that offers both nature knowledge and thrills. It provides information about all the national parks in Nordland County and the surrounding areas. The centre has a lot of geological information about the area, and offers among other things a free walking map with highlighted geological events in close surroundings.

Findings from the Stone Age indicate that there were permanent settlements on Storjord in Saltdal municipality already during late Stone Age (from 3000 BC to 200 AD). Ancient charred remains and stone objects have been found here, together with animal traps. Later Storjord became the centre of activities of the forest commission in Saltdal and the river Saltdalselva was used for log rafting.

Waterfalls, majestic mountains and a rich fauna and flora: Storjord has a varied nature with many exiting biological and geological features and places to visit for tourists and locals. The area also offers exiting learning environments for schools.

1.2 Short introduction to Norwegian pilot learning environments

The piloted learning environments in Norway are:

A. Nordland National Park Centre

The centre itself holds both inside and outside several geological exhibitions and activities. The study module "Good and Bad Geology" takes place within the centre.

B. Learning environments in the local area

There are many good learning environments in the area as described below. The

learning environments that are connected to study modules are described in separate sections.

Junkerdal Canyon and Nature reserve

The gorge Junderdalsura offers rich vegetation, that one could not expect this far north. This is due to its wind-protected location, the abundance of water and the lime-rich soil. Along the path you can find numerous orchids, among them lady's slipper and dark-red helleborine. The botanical value of the area was already discovered in the 1820's.

The path starts at the national Park Centre and leads you into the gorge. On one side of the river valley you have deciduous forest and on the other side, the river Junkerdalselva. Large parts of the gorge are filled up with rocks and gravel coming down from the very steep mountain sides. The mountains contain layers of marble and mica-shale that is easily weathered into nutritious soil. The river also erodes sideways, leaving parts of the riverbanks unstable. After periods with rain, during winter and in spring time, there is a high risk for rock-fall, slides and avalanches, and people are not advised to go into the gorge.

Futhellern ("The Tax Collector's Boulders")

The place called Futhellarn consists of several boulders that have been transported there by the glacier during the last ice-age. They fell straight down when the ice melted and landed on top of each other to form a large roofed space. It is said that in old times the tax collector spent his nights here when he was in the area and was not welcome at the villagers.

Pot Hole

In Norway many pot holes were formed at the end of the last ice age, when they were eroded into bedrock along the coast where the water level was much higher than today. They were also often carved out by high energy glacial rivers below or in front of the ice-age glaciers, which are long gone today. Many pot holes are therefore found above sea level and often far from today's rivers and coastline. Smaller pot holes are still continuously forming at the present coastline and in some rivers. The cause of pot hole formation is mechanical erosion by whirling water that may carry sand, gravel or boulders. Loose stones whirling in strong rapids or waterfalls create a deep round hole. Hardness of pebbles must be the same or higher than the bottom of the stream where the hole is eroding.

Dead Ice Hollow

Along one of the trails is a 10 meter deep dead ice hollow which is 75 x 100 meter in space. As the glaciers melted and withdrew from the landscape after the last ice age, blocks of ice sometimes broke off from the main ice body and were over time covered with glacio-fluvial sand and gravel from the glaciers further up the valley. When the buried ice-block (or in this case; almost an *ice-berg*) finally melted, the sand and gravel on top of it subsided, forming a dead ice hollow. These may be up to 30m deep and more than 1.6 km in diameter. Some of the hollows are completely dry, but it is most common to find water or peat in the bottom of the depression. The name, dead ice hollow, originates from that the buried ice block was a piece of "dead" glacial ice without movement in any direction.

Plateau Hestbrinken (gravel pit)

The plateau is a flat stretch of land of about 1 km² west of the National Park Centre. The plateau is sharply delimited by 20 meter high erosion banks where the rivers have eroded into the masses. In the southern part of the plateau there is a gravel pit in commercial use. The walls of the gravel pit displays deposits with 2-3 thick layers of unsorted sand, rock and boulders, and one thin layer of sorted sand. Most of the unsorted masses are rounded and consist of different rock types. Over 1000 large sharpe-edged boulder are found scattered in a fan-like shape on top of the deposit. The pattern of deposition of the masses, and the boulders on top of the plateau, indicate that the plateau is formed by masses that came out of the mouth of the Junkerdal Canyon in the last part of the last Ice Age. The masses probably came in episodic large events of debris-flow type, released by some form of dam-breaks triggered by the deglaciation of the Junkerdalen valley.

Small Glacial Striations and Large Glacial Grooves/Plastic Shapes

On polished rounded bedrock-hills you can sometimes find straight striations of different depth carved into the rock. These are called glacial striations and were formed by pieces of rocks that were frozen into glaciers during the ice-age and dragged under hard pressure over the bedrock surface. On the western side of the highest bedrock knoll on Kvanneshaugen, plastic shapes are carved into the bedrock. They consist of large rounded and streamlined hollows etched into the side

of the hill. This was due to the, also lateral, pressure under the glacier during the last ice-age that made the glacial erosion act also sideways in a direction normal to the main movement of the ice.

Avalanche in 2002

In 2002 a period of snow melting and rain caused a large landslide, 112 meters wide and 100 meters long. The avalanche deposits now form a ridge at the base of the hillside.

Limestone Precipitation (stalactites) under Boulders

Under at least three large boulders along the path there are irregular grey-white “stalactites” that hang 1-2 cm down from the rocks. These are formed when rain water with dissolved lime from marble in the canyon drips along the boulders and precipitates when the water vaporizes or drips from the surface of the boulder.

Doline (imploded cave)

This doline was formed when a small cave collapsed and created a pit 10x15 meters wide. A small river still runs into the pit and disappears in the ground. The cave was made slowly by water that dissolved the lime in the marble. It is not known how large hollows there might exist in the mountain on the north side of the canyon.

Round Boulder

A round boulder of a granite bedrock lies just on the edge of the canyon. Because the mountain itself consists of marble and mica schist, we know that the boulder must come elsewhere from. The only way it can have been transported here is by a glacier that lifted it and deposited it here when the ice melted. The shape of the boulder tells us that it, at one time, must have rolled down a very large glacial river, polishing off the sharp edges. This must have happened long before the glacier lifted it to its present position, where it lies in wait, perhaps, before the next ice-age to carry it onwards.

Additional value achieved by NEED in the Norwegian target area

Services:

1. Models for organizing business oriented education services
2. Marketing website www.geoneed.org
3. Project website www.uef.fi/need (for disseminating NEED products)
4. Publishing a new website for Nordland National Park Centre, highlighting NEED.
5. Developing three study modules for schools
6. Brochure (z-card) to market Nordland National Park Centre (for study modules, learning environments and tourists)
7. Geo-scientific course for several of the SMEs, State Rangers and local people
8. Geo-scientific course for several of the local teachers
9. Participating in "The National Day of Geology" (promoting the geology surrounding Nordland national park Centre)

Products:

1. Study modules aimed at schools visiting Nordland National Park Centre:
 - a. Good and Bad Geology hver sin
 - b. River Processes
 - c. Hollows in the Ground
2. A new trail map for Storjord area (z-card)
3. A geo-lab (physical installation illustrating how river beds are made in the landscape)
4. An animation about the making of Storjord (for educational use)
5. A 2 meter high roll up for educational use (showing the ground under the gravel pit which is too dangerous to visit)
6. Bedrock map of Storjord, made by Norwegian Geological Survey (Google earth and paper based)
7. Developing learning environments

Reports, reviews and case studies:

1. Curriculum analysis
2. Geological review of target area
3. Case study about learning results from one of the study module

4. Conference proceedings from WP4 conference in Norway
5. Survey report (customer demand and satisfaction Summer 2010 Nordland National Park Centre)
6. Case study about the social capital in educational tourism (implementation of geology Storjord Hotel, one of the SMEs)

b) Designing and producing the learning environments

a) LE1 The National Park Centre

General information about the learning environment

- Nordland National Park Centre is located in Storjord, Saltdal municipality, Nordland County. It was founded in 2005. Its mandate is to be an information and visitor centre which shall document and impart knowledge about national parks, other protected areas, nature, and Norwegian and Sami culture in Nordland. The activities in total shall be a window for Nordlands natural values and stimulate to active outdoor life.
- The visitor center has traditional exhibitions and some activity based learning sites. Before the NEED project the centre miss the systematical connections to the nearby surroundings and more hand on activities explaining geological processes.
- Target groups are both schools and visitors (tourists). The centre also houses different cultural events for the local community during the year.

Development work done in NEED

- Geo laboratory: Better knowledge about the surrounding geology. Better connections to examples of geological processes close to the center and the national parks.
- Photos



From the exhibitions inside



From the yard (1)



From the yard (2)



From the yard (3)

b) LE 2 The geological landscape surrounding Nordland National Park Centre

(Study module: Hollows in the Ground, trail)

General information about the learning environment

- The geological landscape at Storjord consists of many interesting features. The study module makes use of these by pointing out strange hollows in the ground. When pupils have finished the trail, they will have a better understanding of the landscape and how to interpret geological features.
- Before NEED there existed a map showing the different features and physical signs at the locations. The study module pieces together the information and gives a better overview over Storjord.
- The main target group is pupils from schools. The study module contains several theoretical and practical tasks to be executed in the field. Visitors at the National Park Centre can use the z-card (map) to find and visit the same locations.

Development work done in NEED

- The geological features have been there to visit if people used the map or went just by themselves. The new z-card (map) gives more information about the different locations.
- Photo



One of the trapping pits

b) LE3 The river, Junkerdalselva

(Study module: River Processes, trail)

General information about the learning environment

- Junkerdalselva comes down through the Junkerdal gorge and passes right by the National Park Centre. A bit further down it merges with the river Saltdalselva. The river is exposed to flooding due to snow melting and heavy rains every year. Active processes can be observed and measured. The module is aimed at understanding a geological phenomenon in nature, river terraces, and their formation based upon using a Geo Lab installation. The valley, Saltdalen, has very many river terraces which is easy to see and access.
- Before NEED there existed no educational study module connected to the river as a modifier of the landscape.
- The main target group is pupils from schools. The study module contains several theoretical and practical tasks to be executed in the field.
- Photos



River terrace at Roparneset



The river Junkerdalselva



The river Junkerdalselva. Photo: Marianne Karbøl Hanssen