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Kivesvaara rock exhibition and trail

The bedrock of Kainuu

Kainuu is a part of the Fennoscandian Shield. Its bedrock is approximately 3500-1800 million years old basement.

The bedrock of Kainuu can be divided in the older Archean and the younger Early Proterozoic areas. The Archean area is also called the old base on which many younger sediments have accumulated.

A greenschist zone runs in the east, around Kuhmo and Suomussalmi area. Greenschists are the lava and ash from the ancient volcanoes, that erupted on the seabed or dry land, and which later transformed into greenschist in the low pressure and temperature conditions of orogeny of mountain ranges. The green tint is given by chlorites, epidote and hornblende. Felspars, carbonate minerals and quartz can also be found from the rock. The greenschists of Kainuu are between 2600 and 2900 million years old. The greenschist zone is 200km long and approximately 20km wide and its thickness can be up to 2km. Greenschist was chosen as the Kainuu region's rock in 1989.

The rock types of the eastern border of the schist belt of Western Kainuu are attached on their Archean base. In the middle of the belt there are overthrust stone plates and its consistency is complex. The western border of the zone has undergone great changes in the orogenesis. In that area, the rocks are striped gneisses and migmatites with a lot of granites thrusted in them. Several overthrust and fault zones can also be found from the northern edge of the area. The Kainuu zone forms a kind of large fold which has been pressed into an almost vertical position in between three Archean sections. The zone was formed during the Early Proterozoic era 2500-1900 million years ago. Its length is 200km, widths at its widest point around Oulujärvi is 60km and depth 3km.

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The fracture zone of north-east Kainuu (2400 million years)

The Early Proterozoic era started in a quacking manner when the earth begun to tremor and fracture around the borders of Puolanka, Pudasjärvi and Suomussalmi.

Volcanoes erupted and lava and ash accumulated. Gravel, sand and volcanic products accumulated in the rift valleys.

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The Archean bedrock (3500-2500 million years)

The Archean bedrock of Kainuu is the roots of mountain ranges that can be up to 3400 million years old.

In the ancient Archean eon, the Earth's crust was thin, and the conditions were much hotter than today. Water and oceans, volcanoes and some kind of single-celled life existed on Earth.

Minerals and types of rock in commercial production

The rocks and minerals from the bedrock have been part of the history of the human kind right from its beginning. Humans have used them to make structures as well as tools and utensil already in the stone age.

Ores have valuable industrial minerals in them, such as iron in iron ore. In the industrial production, metals can be of just one chemical element, such as e.g. copper, or consist of many metals and carbon such as e.g. steel. A mineral or stone that is used to make jewellery is called a gemstone. Excavated types of construction stones can be used commercially as they are after processing.

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The Jormua Ophiolite (1950 million years)

The ophiolite means a piece of the oceanic crust which has moved far away from its birthplace.

Between Jormua of Kajaani and Leppikoski of Paltamo there is a 20km long and 5km wide area of dark intrusive rocks and volcanics. It is the crust and bed of an ancient ocean from 1950 million years ago.

The Jormua ophiolite was formed when an edge of an Archean continent fractured to a depth of several kilometres, the all the way to the Earth's mantle. A chain of volcanoes was formed to the rift, from which basalt lava erupted to the seabed. The rift widened continuously, and new oceanic crust was formed. Finally, a narrow ocean had been born.

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Magmatic rock (2700-1850 million years)

The magmatic rock, or igneous rock, is formed from melted rock. They are divided in three main groups:

- Intrusive rock or plutonic rock; crystallizes deep in the Earth's crust
- Extrusive rocks or volcanic rocks; are formed at the crust's surface
- Subvolcanic rock; crystallizes further up within the cracks of the Earth's crust

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Sedimentary rocks (2700-1960 million years)

Sedimentary rocks are types of rock in which mineral and organic particles have been accumulated by ice, wind and water and solidified into a rock during a long period of time as a result of pressure and heat.

The sediments are formed when any type of hard rock or detritus is eroded and the detached material is carried and accumulated to new places on dry land, flowing or standing waters or deserts. Sediments can also be formed when organic matter accumulates into waters or wetlands or as a result of chemical precipitation, such as the salt deposits on deserts.

The most common sedimentary rocks are mudrock and sandstones as well as soft carbonate rocks and rock salt. The sediment rocks of Kainuu have changed from their original composition when they ended up deep into a mountain range. There, many new minerals were formed.

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Volcanic conglomerate, Paljakkavaara, Puolanka
This rock in the Sariola-formation is polymictic meaning that its rock balls are from many types of stone: mainly orthogneiss of the Archean base as well as different types of lava rocks from the Kurkikylä group. The orthogneiss balls (10-15cm) are very rounded. The matrix, or the matter between the rocks, is rich in mica. Age 2400 million years.

Orthoquartzite, Haapalanmäki, Paltamo
Quartzites of many colours can be found in Kainuu. The colour of this reddish quartzite is probably caused by a low ferrous content. The rock is recrystalized quartzite which contains almost solely quartz. Age 2100 million years.

On Kivesvaara quartzite is the most common type of rock. Most of the Kainuu hills are quartzite, which is a type of rock that is resistant to wear and rises higher than the rest of the landscape. On many sites, beautiful wave markings can be seen on the quartzite bedrock. These were formed in the shallow coastal waters in the same way they do today on the sandy beaches of our lakes.

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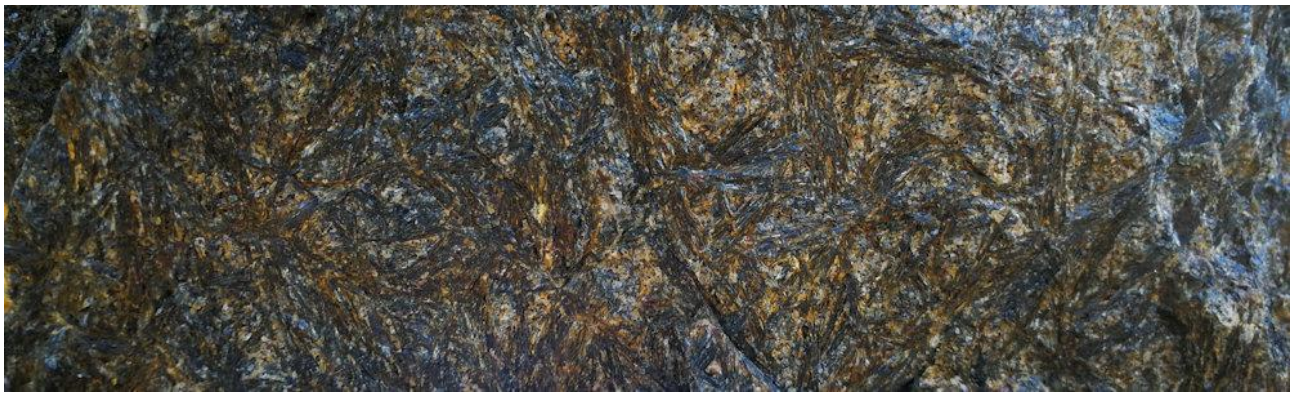
Kainuu's region's rock: greenschist, Härmänkylä, Kuhmo
In Kainuu greenschist can be found in Suomussalmi and Kuhmo among other places. It has been born 2700-2800 million years ago, when Eastern Kainuu's terrain was ocean floor. They have been formed in a relatively low pressure and temperature from dark lava, which has been turned green during hundreds of millions of years because of chlorites, epidote and hornblende.



Amphibolite, Kainuanmäki, Paltamo
The rock is also called "nuumite". It is a relatively rare dark rock that has shining mineral deposits. The stone is iridescent in different colours (blue, green, golden yellow and copper brown) which makes it a beautiful and different gemstone. It is also believed that the stone has positive health effects. Age 2500-2800 million years.

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Pegmatite granite, Kivesjävi, Paltamo

This beautiful granite with large crystals is made of red orthoclase, quartz and large mica plates. Sometimes pegmatites have rare minerals, such as beryl, in them. Age 1800 million years.

These rocks are common in the region of Kajaani and in the western border of the Kainuu zone all the way to Nothern Puolanka. The rock has been excavated in Koutaniemi, Kajaani.

Ukko's rock, Härmänmäki, Paltamo
The boulder consists almost completely of milky quartz. Quartz is a very common mineral in many types of rock and also the most common mineral in the Earth's crust. The mineral is composed of oxygen and silicon, which are also the two most common elements in the Earth's crust. Quartz is often found in quartz veins in the bedrock's cracks and these veins can also sometimes contain gold. Quartz is an important industrial mineral. It is used to make glass and wafers and is used in clocks because its piezoelectric properties.

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Mica schist, Rahikkalanvaara, Puolanka
This beautifully shimmering mica schist contains a lot of mica (biotite and muscovite) as well as quartz and feldspars in a few millimetres-thick layers. The rock is excavated as a construction stone. Age 2500-2700 million years.

Serpentine rock, Lehmivaara, Kajaani
The oldest rock in the exhibition or “Metusalem”. Its age is unknown, but the estimation is over 3000 million years. The type of rock is Jormua ophiolite. This rock originates from almost 10 kilometres under the Earth’s mantle. It consists almost exclusively of serpentine mineral, which is a silicate mineral rich in magnesium. It can be found from many places in the schist zone of Kainuu as well as in the greenschist zones of Kuhmo and Suomussalmi.

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Mica schist gneiss, Mekkomäki, Puolanka
The mica schist gneiss from the old rock quarry of Mekkomäki has undergone at least two orogenic processes, from which the latter caused the beautiful crenulation. The mica of the rock is biotite. Age 2500-2700 million years.

Lines of the ice age
Narrow striations with the direction of 310 degrees can be seen in the roché moutonnée, or “sheepback” rock, on the side. They were formed when the last glacier travelled over Kivesvaara from northwest to southeast. Even hard quartz is scratched under enormous mass.

During the last million years Finland has seen many ice ages. The most recent ice age ended around 10 000 years ago. The accumulation zones of the ice sheet were in the arctic hills of Northern Norway and Northern Sweden from where the continental glacier expanded to Finland and all the way to Central-Europe. At its strongest point, the ice sheet was two kilometres thick. The glacier eroded its base and deposited till.

In Kainuu, the moraines, or drumlins, which run in the direction of the glacial motion, were formed towards the end of the glaciation. In the ice, there was a lot of rock fragments that had been plucked from the terrain.

At its best, the glacier moved up to 100 metres a year. Its enormous mass depressed the crust of the Earth and the sand grains and rock fragments under it polished and scratched the bedrocks. This is how the numerous sheepback rocks of Finland were formed.

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No picture

Ophiolite, Metelinniemi, Paltamo
The serpentine rock boulder was a piece of the ancient ocean crust. It has moved to its current location from the bedrock of the bottom of a lake. Age over 3000 million years.

The serpentines are dark, green rocks which contain mainly serpentine minerals. The rock has solidified in the depth of almost 10 kilometres in the crust of an ocean. The serpentines of Paltamo are the oldest rocks of the region (Archean). They have risen from the deep mantle of the Earth to their current locations.

You can find this rock at the Paltamo Golf course by the 10th fairway.