Estonian geoparks

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During last decade in 19 countries 66 geoparks (in Europe 13 geoparks in 13 countries) have been established and geotourism has been developed worldwide in recent years. Areas certified as geoparks should have a geological, archeological, cultural and environmental heritage of special importance, rarity or beauty. The task of a geopark is to bring this heritage to life for visitors and local people and to raise awareness for the significance of the landscapes and geological objects and to explain how they were formed.

Established in 2000, the European Geoparks Network aims to protect geodiversity, to promote geological heritage to the public and to support sustainable economic development of geopark territories through the development of geotourism. Geoturism is defined as tourism that sustains or enchances the geographical character of a place – its environment, culture, aesthetics, heritage, and the well-being of its residents. Geoturism supports sustainable tourism, meaning that destinations should remain unspolled for future generations.

The joint collaborative project "Fostering geotourism on Central Baltic islands" for 2007–2013, funded by ERDF through Central Baltic INTERREG IV and implemented by the Department of Earth Sciences at Uppsala University in Sweden and NGO Geoguide Baltoscandia in Estonia, aims at preparing a solid foundation for nature tourism development on major Central Baltic islands and coastal areas. Recently were published two well-illustrated books: 1) "Geotourism highlights of the Saaremaa and Hiiumaa islands" and 2) "Meteorite impact structures – geotourism in the central Baltic". At the end of 2010 the third monograph – "Geotourism highlights on Estonian small islands" will be published. Islands are important parts of two Estonian geoparks being under formation.

In June 1, 2010 North-West Estonian Geopark was founded on the teritories of Harku, Keila, Padise Nõva, Noarootsi communes and Paldiski town. In the mentioned area several landscape reserves are located, as Osmussaar, Pakri, Türisalu, Rannamõisa, Väänа and Naage. The most monumental landform here is the North-Estonian Klint, high escarpment with numerous klint bays and capes of variable shape and size. In the mouth of rivers the klint is deeply abraded and klint valleys have formed, which creates good preconditions for the formation of waterfalls. Most remarkable is Keila-Joa waterfall, over 6 metres high and up to 70 m wide (Fig. 1). Area is rich in plant communities, the klint plateaus are characterized by alvars with very thin soil cover and specific vegetation, in front of the

Figure 1. Keila-Joa waterfall. Photo by Avo Miidel.

Kuva 1. Keila-Joa vesiputous. Kuva Avo Miidel.

klint is a peculiar microclimate and water regime, here and therefore a local "jungle" with broad-leave trees is distributed. The rocks of the klint contain abundant skeletal fragments of trilobite, echinoderms, brachiopods a.o.The lowest portion of the klint is composed on soft Cambrian clay-, silt- and sandstones, upper part of stronger Ordovivian limestones. Different resistance of the rocks to abrading and the joint systems dissecting the bedrock are the main reason why the klint retreats landward and huge rock blocks have fallen down along the klint, most effectively in the Pakri Peninsula, where the tallest lighthouse of the Baltic Sea area (54 m) stands. In April 22, 1966 downfallen material was some 1500–2000 tonnes, several downfalls were in the beginning of March, 2008.

Very interesting for tourists is Osmussaar Island, locating on the line of about 20 km wide circular fault surrounding the Neugrund Meteorite Crater, formed in Early Cambrian some 535 million years ago. The centre of the crater lies about 9 km northeast of the island. Numerous Neugrund breccia boulders are found in the central and southern parts of Osmussaar, carried here from the circular ridges of the crater by continental glacier. The most remarkable of these are megaboulders Skarvan and the Osmussaar Twins on the western coast of the island. On the seabed Toodrikivi, the biggest erratic boulder in the entire North European glaciation area (height 10,5 m, circumference 54 m, volume over 1000 cubic metres), rests. The Neugrund structure has a rim diameter about 7 km whereas its depth is unknown. The Swedish name for Osmussaar, Odensholm, translates as "Odin`s

grave". Here can be the tomb of Odin, the chief god and war god of the ancient Germanic and Scandinavian people. Here in October 25, 1976 the epicentre of the Osmussaar earthquake, the strongest known earthquake in the Baltic States (7 magnitudes on Richter`s scale), was located.

The islands of Pakri were used as a practice bombing range of the Commonwealth countries, Pakri Peninsula had the strongest concentration of the military units of the former Soviet Union in Estonia, where the nuclear reactors of the Submarine Training Centre, two missile bases and military harbours were located. Shocking military objects are scattered all over the territory, one of the most interesting is missile base in Keila-Joa, where rockets with nuclear heads were located (Fig. 2). On the other side many cultural objects can be visited, as, for example, Padise cloister, the oldest preserved building in the area, which construction started already in 1254.

In the stage of formation is Saaremaa geopark, which offers the most spectacular geological sights in the Baltic Sea area. The most unique geological monuments on the island are Kaali meteorite craters, forming a field with nine meteorite impacts (Fig. 3). In 2010 the crater field had about 70 000 visitors.There are also attractive coastal cliffs (Fig. 4), large erratic boulders, alvars and unique glacial and marine landforms. Limestone cliffs and shingle beaches abound with Silurian fossils and offer lots of excitement to friends of fossils. Several Silurian limestone and dolostone varieties are not only as good building stones but also high-

Figure 2. Missile base in Keila-Joa. Photo by Anto Raukas.

Kuva 2. Ohjustukikohta Keila-Joassa. Kuva Anto Raukas.

ly valued as an excellent source material for making natural finished stone products. For instance, the Upper Silurian Selgase mottled, easily handled limestone is widely used not only for limestone carvings (cups, plates, candlesticks) but also to make such finished natural stone products as fireplace parts, wall blocks and wall veneers. For centuries, impurity-free, chemically pure limestone has been used for burning high-quality lime. This kind of limestone was mined at Jaagarahu limestone quarry north of Kihelkonna village in NW Saaremaa.

The most magnifient glacial landform is the West-Saaremaa Upland – a huge end moraine height, composed mainly of till and rising 20–35 metres above its surroundings. The upland formed between two ice flows, which moved in different directions and were not simultaneous. The most recent glacier moved from northwest to southeast and this one brought to western Saaremaa erratic boulders which differ in composition from those found in eastern Saaremaa.

Saaremaa has good sandy beaches and different other shore types (cliffed, rocky, morainic, shingle, silty) and big variety of coastal relief forms (spits, bars, coastal dunes a.o.). The island has a rich flora and fauna. 80% of the plant species found in Estonia are represented in Saaremaa, altogether 1200 species of vascular plants can be found here, about 120 species are rare ones which have received special protection status. The island lies within the East-Atlantic path of birds. If to add numerous architectural monuments – medieval chur-

Figure 3. In the Kaali main crater small lake is located. Photo by Reet Tiirmaa.

Kuva 3. Pieni järvi Kaalin pääkraaterissa. Kuva Reet Tiirmaa.

ches and Kuressaare Castle, will be understandable, that Island of Saaremaa is not only a good place for a new geopark, but also for different branches of geoturism, includig water tourism. In north-west Estonia and around Island of Saaremaa are located hundreds of small islands, which can be visited by boats and yachts.

Geosites can be: 1) Stratigraphical (stratotypes, buried peat etc); 2) Structural (meteoritic craters, faults, landslides etc); 3) Mineralogical and petrographical (rare and well-expressed typical rocks and minerals); 4) Palaeontological (animal and plant fossils); 5) Geomorphological (picturesque landscapes and scientifically interesting relief forms); 6) Anthropogenic (Soviet military objects etc). In both planned geoparks a great variety of the mentioned groups of geosites exist.

Figure 4. Ninase cliff at the northern shore of Saaremaa. Photo by Heikki Bauert.

Kuva 4. Ninase jyrkänne Saarenmaan pohjoisrannikolla. Kuva Heikki Bauert.

Lyhennelmä

Eestin geopuistot

Viimeisten kymmenen vuoden aikana on maailmanlaajuisesti perustettu geopuistoja 19 maassa yhteensä 66 kappaletta, joista 13 sijaitsee Euroopassa 13 eri maassa. Geopuistojen tarkoituksena on säilyttää geologista, arkeologista, kultuurista ja ympäristöperintöä tuleville sukupolville sekä edistää kestävää geoturismia. Vuonna 2000 perustettu eurooppalainen geopuistoverkosto (European Geopark Network) sertifioi geopuistohankkeita. Vuonna 2010 avattiin Luoteis-Eestin geopuisto ja toinen puisto on suunnitteilla avattavaksi Saarenmaalle.

Geologisiin geopuistokohteisiin voi kuulua stratigrafisia stratotyyppejä, rakenteita (esim. siirrokset, kraaterit), mineralogisia tai petrologisia kohteita (paljastumat), paleontologisia, geomorfologisia tai antropogeenisia kohteita. Näistä kohdetyypeistä useimpia löytyy Eestin kahdesta geopuistosta. Saaret ja rannikkokohteet ovat erityisen tärkeitä Eestin geopuistoissa. Kuvissa 1–4 on esimerkkejä muutamista mielenkiintoisista kohteista.

Lähiaikoina on julkaistu kaksi hienosti kuvitettua kirjaa geoturismin tiimoilta 1) “Geotourism highlights of the Saaremaa and Hiiumaa islands” (“Hienoimmat geoturismikohteet Hiidenmaan ja Saarenmaan saarilla”) ja 2) “Meteorite impact structures – geotourism in the central Baltic” (”Meteoriitti kraaterit – Geoturismi keski-itämeren alueella”). Vuoden 2010 loppuun mennessä tullaan julkaisemaan vielä kolmas monografia – “Geotourism highlights on Estonian small islands” (”Eestin pienempien saarten geoturismikohteiden kohokohtia”).

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