Geotouristic attractions of the Saaremaa Island according to the opinions of tourists

Atrakcje geoturystyczne wyspy Sarema w opinii turystów

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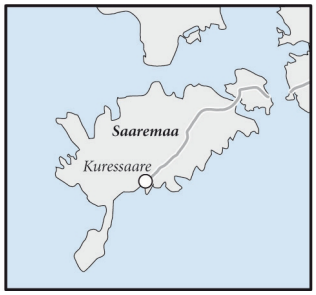

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Abstract: *The article presents chosen geotouristic attractions of Saaremaa. High landscape values and touristic attractiveness are typical of the island. They may be observed in the Vilsandi National Park with rich fauna and flora, and geological and morphological forms, together with historic mills, houses, military objects from the 1st and 2nd world wars and industrial objects connected with recent fishing in the area. Rocky cliffs and the highest cliff in Saaremaa – Panga – as well as the meteorite lake Kaali are other objects with high touristic attractiveness located on a geotouristic trail. Medieval churches from the 12th and 13th centuries and the impressive Kuressaare castle also draw tourists' attention. The architecture of those buildings reflects the geological history of the island. As a result of field works, the an understanding of the motivation behind the visitors to the Saarte Geopark was obtained. As such, the author was able to determine their touristic profile. On the basis of their opinions, an analysis and evaluation of touristic development and touristic attractions influencing geotouristic attractiveness of the island was conducted.*

Key words: *Estonia, Saaremaa, Saarte Geopark, geotouristic object, Kaali meteorite lake, Panga Cliff*

Treść: *W artykule przedstawiono wybrane miejsca geoturystyczne Saaremy, które obok dużych walorów krajobrazowych wyróżniają się znaczną atrakcyjnością turystyczną. Należą do nich m.in. Vilsandi National Park, z bogatą florą i fauną, formami geologicznymi i morfologicznymi, z zabytkowymi wiatrakami, domami, obiektami militarnymi z I i II wojny światowej oraz obiektami przemysłowymi związanymi z niedawno jeszcze praktykowanym rybołówstwem. Następnymi obiektami o wyróżniającej się atrakcyjności turystycznej, położonymi na szlaku geoturystycznym, są skalne klify z najwyższym klifem Saremy, Pangą, oraz wielka osobliwość przyrodnicza, którą jest jezioro meteorytowe Kaali. Na uwagę zasługują pochodzące z XII i XIII wieku średniowieczne kościoły oraz imponujący zamek w Kuressaare, zbudowane ze skał reprezentujących elementy budowy geologicznej wyspy. W wyniku prac terenowych uzyskano wiedzę dotyczącą motywacji odwiedzających Saarte Geopark. W ten sposób określono ich profil turystyczny. Na podstawie opinii turystów dokonano analizy i oceny zagospodarowania turystycznego oraz walorów turystycznych wpływających na atrakcyjność geoturystyczną wyspy.*

Słowa kluczowe: *Estonia, Sarema, Saarte Geopark, obiekt geoturystyczny, jezioro meteorytowe Kaali, klif Panga*

Introduction

Estonia, with the area of 45 227 km² lies on the eastern shore of the Baltic sea, between 57°34'N and 59°45'N and 20°30'E and 28°15'E. It is bordered to the west by the Gulf of Riga, to the north by the Gulf of Finland, to the east by Russia, to the south by Latvia. The Estonian Archipelago is a part of Estonia. It comprises more than 1521 islands with the biggest being Saaremaa, Hiuma, Muhu, Vormsi and Naissaar.

As a whole, the area of Estonia comprises northern and western parts of the East European Plain, representing landscapes of young glacial type with visible land forms from the last glaciation – the Vistulian glaciation. In the landscape, postglacial forms are represented by lakes (1450 objects), swamps, peat bogs, moraine hills up to 300 m a.s.l. with the highest peak Munamagi (318 m a.s.l.) and areas with erratic boulders. Those last forms are typical of the shores of northern Estonia. They are high up to 8 meters, especially in the area of the Lahemaa National Park. The shores of Estonia represent mainly one specific type skerry coast, shaped by the Scandinavian land glacier. Other elements of the landscape include wide river valleys with the system of beds with meandering structures, which undergo changes on the fluvial system of channels with straight structure, on the areas of the moraine hills. where rivers create gorges and waterfalls with the biggest waterfall in Estonia – Jagala – reaching up to 8 meters. The biggest rivers in Estonia are Parnava (144 km), Ema (101 km) and Narva (78 km) (Mydel & Groch, 2000).

In the early stage of research, the essence of geotourism (geological tourism) which is the recognition of objects, geological and morphological processes in the surrounding landscape in the context of aesthetic experiences (as analyzed by Osadczuk & Osadczuk, 2008; Słomka & Kicińska-Świderska, 2004; Kowalczyk, 2010), was presented. There are forms of recognition of nature and use of geological wealth in architecture, history, culture and economy. A wide range of the subject of geotouristic research allowed the author to place it in cultural and qualified tourism, and at the same time it gave place for free interpretation and choice of objects for analysis. During the analysis, it was vital to pay attention to the definition of a geotouristic object which, according to Słomka and Kicińska-Świderska (2004), is a subject of touristic interest which becomes a touristic attraction with the use of touristic accommodation. Inventory of 32 geotouristic objects Saaremaa presents the work of Duda *et al.* (2008), in which the tourism-educational fight takes place.

The subjects of the author's interest during a stay on Saaremaa were the following geotouristic objects listed as important and fundamental in the geotourism offer (Bubukin & Poldemaa, 2015). These are among others:

- geological depth profile on the example of the Panga cliff;
- forms connected with glacial activity (erratic boulders, appearances glacier, on the shore of Vilsandi NP);
- concave forms made during a collision of a meteorite with earth in the town of Kaali;
- the above three items are highly rated by Duda *et al.* (2008) due to their tourist-educational value;
- places and objects connected with human activity, whose existence depended on the local stone source (Fig. 1).

The aim of the article is to describe the geotourism attractions of Saaremaa and their rating in the opinions of tourists. The intention was to carry out research on the knowledge of the Saarte Geopark among tourists and on their motivation to visit. This later allowed the author to determine the visitor profile (especially before the high tourism season). In the paper, the analysis of secondary information referring to popular science materials obtained in the Saarte Geopark Education Center in Kaali and in the touristic information point in Kuressaare was conducted. To gain some understand of the nature and organization of Saarte Geopark, community interviews with the tourism promoters were conducted. To obtain the tourists' opinion on the park touristic attractiveness, the surveys were conducted among tourists staying on Saaremaa (174 toustist). The obtained material was elaborated with the use and modification of the point evaluation by Sołowiej (1992).

Geographical characteristic of the Saaremaa Island

Saaremaa (Osel) is the biggest island in West Estonian archipelago (Moonsund archipelago). It is located in the Baltic Sea, at the entry to the Gulf of Riga. The area of the island is 2922 km². The coastline is developed, with numerous peninsulas, bays and small islands. Saaremaa is located on the southern slope of the Fennoscandian Shield, which is composed of crystalline rocks that actually form a southward extension of the Precambrian complexes that crop out in southern Finland. Based on borehole data and geophysical evidence, the crystalline rocks occur in Saaremaa at a depth of several hundreds of meters; the 500 m isobath runs through the central part of Saaremaa in a roughly W-E direction. The Proterozoic formations are represented by several types of magmatic and metamorphic rocks (Perens, 1996, 2002).

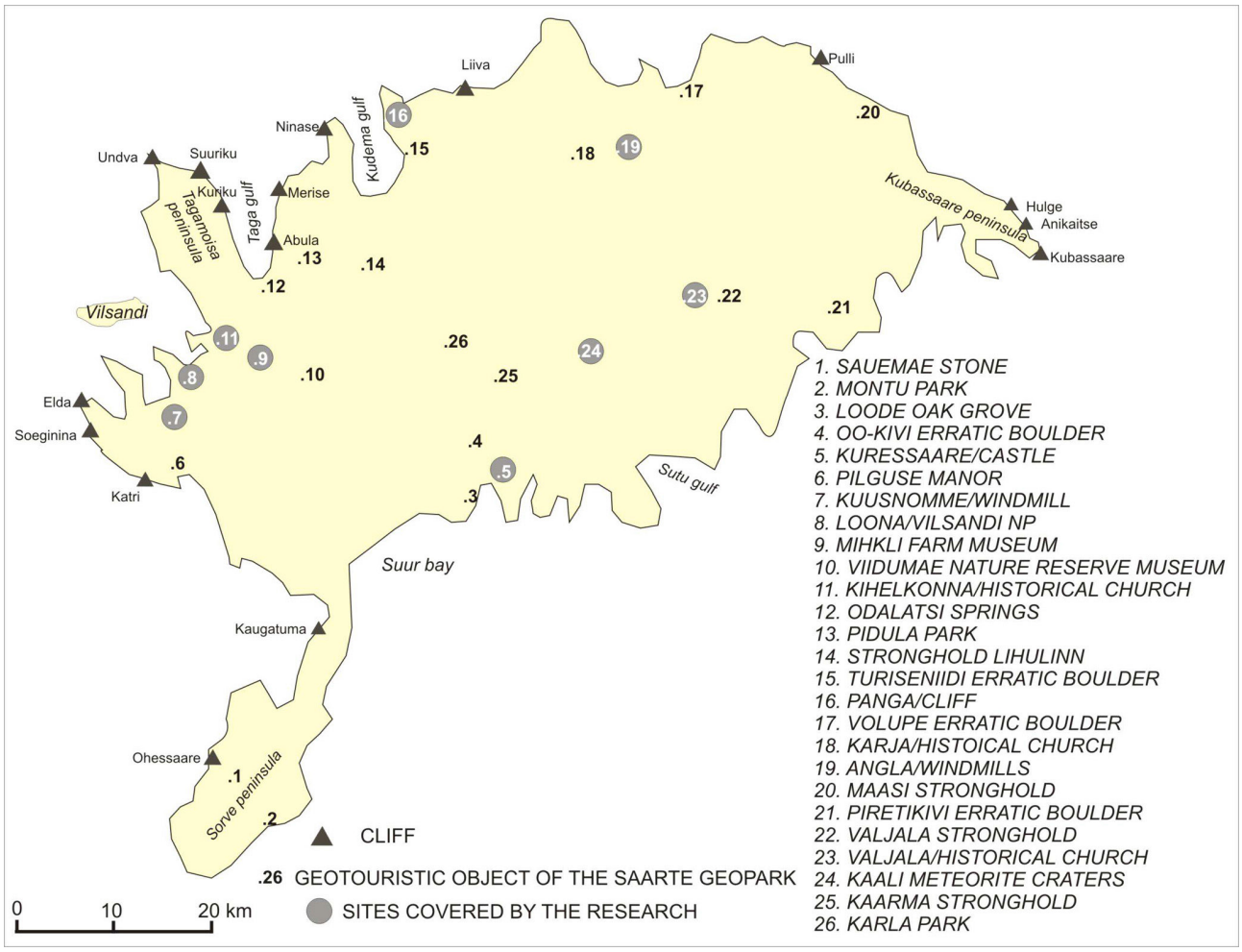

Fig. 1. Map of geotourism sites covered by the research (own compilation)

Most of Saaremaa is located within the folded Latvian-Estonian basement complex, which is 1.9–1.8 Ga old. The northern edge of this complex is marked by the somewhat younger (1.6–1.55 Ga) Riga rapakivi pluton, which extends to the south-western corner of the island. Eastern Saaremaa consists predominately of metamorphic rocks, while acid igneous rocks (mostly different types of granites) dominate in the western part of the island (Raukas & Stankowski, 2010). Cambrian rocks are not exposed anywhere but are known from drilling cores. The exposed limestones and dolostones are of Silurian age (Łomniewski *et al.*, 1975). The boundary between Lower and Upper Silurian carbonate rocks (between the Rootsiküla and Paadla regional stages) runs through central Saaremaa. The youngest Silurian rocks – limestones of the Ohesaare Stage, which formed approx. 417 Ma – crop out in the south-western cliffs of the Sõrve peninsula, southernmost Saaremaa. The total thickness of the Silurian succession is impressive, reaching 445.7 m according to core data from the Ohesaare drill site (Perens, 2002). It consists of 10 chronostratigraphical units (stages). The Juuru, Raikküla, Adavere, Jaani, Jaagarahu and Rootsiküla stages belong to the Lower Silurian (443,7–416 Ma) succession, whereas the Paadla, Kuressaare, Kaugatuma and Ohesaare stages constitute the Upper Silurian succession (Hints *et al.*, 2008; Raukas & Stankowski, 2010; Novek, 2011) (Fig. 2).

Significant internal diversity typical of the flat landscape of the island is made of rocky cliffs in the north the island, sandy beaches in the south and rocky beaches and numerous erratic boulders on the west and north. Lakes, swamps and peat bogs are important elements of the terrain. The climate there is moderate warm, transitional between oceanic and continental with medium temperature −3°C in January and 16°C in July. Average annual amount of rainfall are 500–600 mm. The vegetation is represented with sparse sward, brushes of juniper, coniferous forests, mixed forests, and peat bogs (Encyclopedia, 1997).

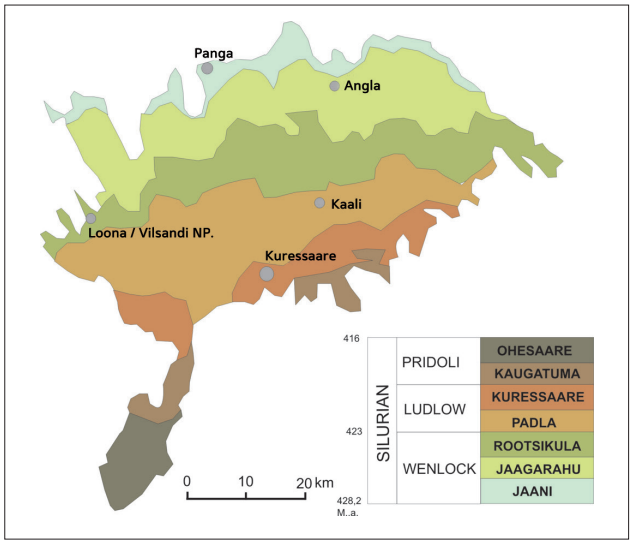

Fig. 2. Geological draft of Saaremaa boundaries of Silurian rocks (own compilation based on Bedrock Geological Map of Estonia 1 : 400 000, 1997)

The concept of the Saarte Geopark

The Saarte Geopark established in 2010 is dedicated to introducing and preserving the local geology, cultural heritage and nature of Saaremaa and Muhu. The geopark is trying to use the area's geological scene in order to promote tourism, environmental awareness and local development. The Saarte Geopark centre is located at the Kaali Tourist Centre and provides information on all the sights in the Saarte Geopark area. Key sights in the geopark include the internationally well-known Kaali meteorite craters. The fragments that fell to earth at Kaali managed to create not only the main crater 110 m in diameter, but eight smaller ones as well.

Other important symbols of the park are cliffs: Uugu, Puli, Ninase, Panga, Soeginina, Ohessaare, Kaugatuma, Kubassaare and the skerry of the west coast.

In addition to the presentation of unique natural values, the objective of the park is to show cultural values strongly linked to the geological origin of the island. The Episcopal Castle is a manmade gem of international standing, constructed mainly from the island's own limestone. The churches on Saaremaa and Muhu Islands are in: Liiva (St. Catherine's Church on Muhu from 13th century), Karja Katariina (St. Catherine's Church from 13th century), Kilhelkonna (St. Michael's Church from 13th century), Valjala (St. Martin's Church from 13th – 14th century), Manors are in Pidula, Pilguse, Padaste, Loona, and festivals such as Orchid Festival, Maritime Days, Opera Days, Food Festival, are all worth a visit to gain understanding of the island's culture. The Lumanda's Limestone Park and the Angla Heritage Culture Centre can provide insight into traditional walks of life (Bauert & Raukas, 2010; Bubkin & Poldemaa, 2015).

The starting point of the idea of the geopark is the Silurian period, which is an era in earth's history that began approximately 444 and ended 416 million years ago. Back then, the area of Estonia and the Baltic Sea used to be situated in the equatorial region. Compared to today, the warm seawater allowed for the formation of barrier reefs – a type of coral reefs. The average temperature of the Silurian period was 10 degrees warmer than it is nowadays. This made it possible for new evolutionary strands to develop, e.g. sea scorpions that could grow to staggering sizes. Due to its peculiarity, the sea scorpion, or Eurypterus, also serves as the symbol of the Saarte Geopark. The Silurian period is monumental in that it marks the emergence of the first definite signs of terrestrial animals and plants. The Laurentia (North America) and Baltica (Northern Europe) continents collided during the Silurian period, resulting in the Caledonide orogeny that is nowadays marked by mountains in Scotland and Scandinavia. As the land rose due to the collision of Laurentia and Baltica, the paleo-Baltic Sea grew shallower and a nearly 400 km long terrace belt – the Silurian Klint – was formed. The vast terrace stretches from Gotland through the Baltic Sea, rising to the surface on the west coast of Saaremaa, moving along Saareemaa's north coast across Muhu Island and the smaller islands towards the coast of Estonia, where it can be seen at Läänemaa as the Saluvere and Salumäe terrace, and then disappears in Central Estonia under layers of Devon sediments. The lime sediments and invertebrate animals that settled at the bottom of the sea during the Silurian period have formed sedimentary rock – limestone, dolomite, etc. The period's sedimentary rock is colloquially known as slate. The changing depths of the Silurian period sea caused the formation of cliffs and terraces. Outcrops can be noted throughout the geopark. The cliffs at Saaremaa do not awe with height, but depicts a detailed picture of the changes and development of the Silurian period sea. The sea is constantly renewing the cliffs and uncovering fossils from the ancient seabed. One does not have to be a geologist to realize that the seabed of the Silurian period was rich in various forms of life (Märss *et al.*, 2007).

Chosen geotouristic objects in the Saarte Geopark

Vilsandi National Park

The Vilsandi National Park is located in Kihelkonna and Lumanda Rural Municipalities Saare Country on the western seaside. The history of the national park started already in 1910, when the Vaika Special Protection Area for

Birds, the first SPA in the Baltic countries, was founded. The main objective of the Vilsandi National Park is to protect the coastal landscape and sea, the bird-rich islets and the cultural heritage. The national park covers about 24 000 hectares of land and sea area. The coastline of West-Saaremaa is well jointed and involves numerous terraces, beach ridges, spits and coastal dunes. There are more than 150 islands, islets, reefs and shelves in the national park. The Vilsandi National Park is known as the "Birds' Kingdom". About 250 species of wild birds, out of which 114 are nesting species, have been recorded here. The area is an important nesting, stop-over and wintering site for birds. Different species of gulls, ducks and terns nest on the islets and coast. The rare species include the white-tailed eagle (Haliaeetus albicilla), Euroasian eagle-owl (Budo budo), ruff (Philomachus pugnax) and Baltic dunlin (Calidris alpina schinzii). The most common large mammals are the elk (Alces alces), red deer (Cervus elaphus), European roe deer (Capreolus capreolus), wild boar (Sus scrofa) and grey seal (Halichoerus grypus). The fish fauna is varied due to different marine habitats. The species of European importance are the whitefish (Coregonus lavaretus), salmon (Salmo salar), river lamprey (Lampetra fluviatilis) nad bullhead (Cottus gobio). The coastal areas are favorable habitats for the rare natterjack toad (Bufo calamita) and the shallow fresh water bodies for the medicinal leech (Hirudo medicinalis). The mild maritime climate and the limestone soil have created preconditions for varied plant cover. The prevailing plant communities are alvars and alvar forests. The region is the edge of the habitat range for numerous species of plants. More than 520 species of vascular plants have been found in the national park, the shoreweed (Littorella uniflora), which grows in temporary shallow brackish water puddles, being probably the most unique (Kallavus *et al*., 2016).

To geotouristic objects in the park include: cliff shores represented by the Soeginina Cliff, Elda Cliff and Panga Cliff. The Soeginina cliff is up to 3 m tall and 500 m long. Due to its peculiar structure, the Soeginina rock is often called "bulb limestone". The Soeginina cliff looks rather special – the roots of the birch trees growing on top of the cliff wiggle out from the cracks in the cliff wall, some so long that they reach the sea. A view opens from Soeginina cliff to Innarahu, where grey seals haul-out and breed during mild winters (Kallavus *et al.*, 2016). Numerous postglacial lakes appear in the shore zone. They are kettle genesis, moraine-dammed lakes and shoreline lakes (Laialepa). Overgrowing lakes create swamps and peat bogs. The western shore of Saaremaa, within the national park, is characterized with a diversified coastline (Fig. 3) made of numerous peninsulas: Elda, Eeriksaare, Kuusnomme, Papisaare, Harilaid, islands with the biggest Vilsandi and gulfs: Alta, Kuusnomme, Kiirassaare, Kihelkonna, Haagi Lougas, Uudepanga. Many granites and gneisses erratic boulders form the diversity of the landscape of the western coast.

Fig. 3. Diversified coastline of the Vilsandi NP shore – numerous bays, rocky islands and beaches with numerous erratic boulders, photo J. Łach

The largest are in the eastern and southeastern part of the dump: Piretikivi, Aavakivi, Tollukivi, Ookivi bouldrers.

All the erraties have been transported from their original situation by glaciers from Finland, Sweden and from the bottom of the Gulf of Bothnia between Finland and Sweden (Lundqvist, 1986). The erraties are the natural monuments of the last Ice Age about 11 300 – 13 300 years ago (Raukas, 1995). Cultivation of land, cattle breeding and sea-related activities have played an essential part in the formation of the landscapes of the Vilsandi National Park. Windmills, sparsely populated villages and the lighthouses of Vilsandi, Oju and Kiipsaare have been preserved in the landscape. The villages are usually small with rows of stone fences around and inside. The example of former larger villages were – Loona, Kuusnomme and Alta. Several military objects, dating back to World War I and World War II as well as the later Soviet occupation period, lie in the national park. Hangars of float planes, the officers' casino and several other historical buildings have been preserved in the Papissaare Port (Kallavus *et al.*, 2016).

Cliffs

In the Silurian Klint, there is a system of escarpments in Silurian rocks running southward from Baltic Klint. This begins from northwestern coast of Gotland Island, continues eastward on the seafloor, and runs along the northern coast of Saaremaa, Muhu and Koinastu islands and southern coast of Matsalu Bay (Marss *et al.*, 2007). Cliffs in Saaremaa island are characterized by vertical walls. Some are dissected by wave-cut notches, and other retreat landwards as several steps. Active cliffs rise directly from the sea and are washed by waves, while the extinct ones are located away from the present-day shoreline. The latter are coastal escarpments of earlier stages of the Baltic Sea. The heights of the cliffs are different as well. The highest cliff in West Estonian Archipelago is Panga Cliff (Mustjala) 21,3 m high on Saaremaa (Fig. 4). Actually there is also an approximately 10 m high underwater escarpment, marked by an active surf zone that borders a wide wave-cut platform north of the shore cliff. The underwater cliff is cut into highly argillaceous, dolomitized limestones and dolomitic marlstones (Tuuling *et al.,* 2011).

Vertical cliffs are formed when the rocks are of similar resistance. Wave-cut notches occur when the rocks forming cliff's lower part are less resistant to abrasion than those in cliff's upper part. Currently, the appearance of cliffs changes constantly, especially during storms when the sea level rises and the intensity of wave activity increases considerably.

The Panga pank (cliff) is the highest bluff of Western-Estonia, with the maximum height of 21,3 m and length of about 3 km. The cliff is running underwater and is more than 12 m high. The rocks formed as a result of tropical sea sediments from the Silurian period settling about 416–443 million years ago, known as Jaani lade (Klaamann, 1959; Märss *et al.*, 2007).

Fig. 4. Panga Cliff, photo J. Łach

Panga Cliff (also called Mustjala cliff) is located along the northwestern coast of Saaremaa. The cliff exposes the Jaani Stage 428,2–427 mln (www1) and the lower portion of the Jaagarahu Stage 427–424 mln (www2). The Jaani Stage represented mostly by marlstones. Their occurrence as well as the presence of clayey bioclastic limenstones proves that the deepening and shallowing of the sea took place gradually. A limenstone consisting of fragmented skeletal remains of organisms was divided into biomiovitic limestone, if lime mud was deposited between skeletal particles during sendimentation, It became biosparitic limestone if initially there was no mud between skeletal practices which acted as a skeletal sand. In the first case, sedimentation took place under deeper, calm-water conditions. In the latter case, sedimentation occurred in the shallow zone of wave (Hints *et al.*, 2008).

Jaagarahu Stage is marked by an abrupt shallowing of the sea. At the northern margin of the Paleaobaltic basin, a reef belt about 400 km long formed. It began at the Island of Gotland and continued in bottom of the Baltic Sea, as well as along the northern coast of Saaremaa and Muhu islands and southern border of the Kasari-Matsalu lowland for Kasima. In eastern Saaremaa, on Muhu Island, the reef rock is dolomitized and displays irregular hollows. The reef belt is interrupted and represented by isolated reef hillrocks up to a kilometer in diameter. In Estonia, shallow-water conditions that alternated with temporary deepenings continued throughout the Jaagarahu, Rootsikula and Paadla times (Märss *et at.*, 2007). Hints *et al.* (2008) allocate three different formations: Mustjala Member, Ninase Member, Paramaja Member and Jaagarahu Formations (Fig. 5).

All three development phases of the cliff can be distinguished: subwater cliff at the wave breaking area, active marine cliff and remnants of lateral cliffs from marine erosion (abrasion). Due to the process of abrasion, the abrasion recess is created at the height of around 5 meters, together with narrow wave-cut platform called shore platform (Migoń, 2006, p. 399) because of its origin. Heavy cracked stone walls of the cliff undergo process of mass movements – mainly of falling away – which results in the creation of the heap of blocks at the feet of the wall. Those blocks have sharp edges, and the heap is of chaotic layout. Moving westwards, the cliff is getting lower, the recess is not very visible, but the wide sphere of wave-cut platform is. It is mainly covered with tossed material, due to the transport process in the oceanic environment. The level of this platform is raised around 2 meters high against the sea level. Due to geomorphologic processes, which shape the Panga cliff it may be defined as an active cliff. Actually there is an approximately 10 m high underwater escarpment, marked by an active surf zone that borders a wide wave-cut platform north of the shore cliff.

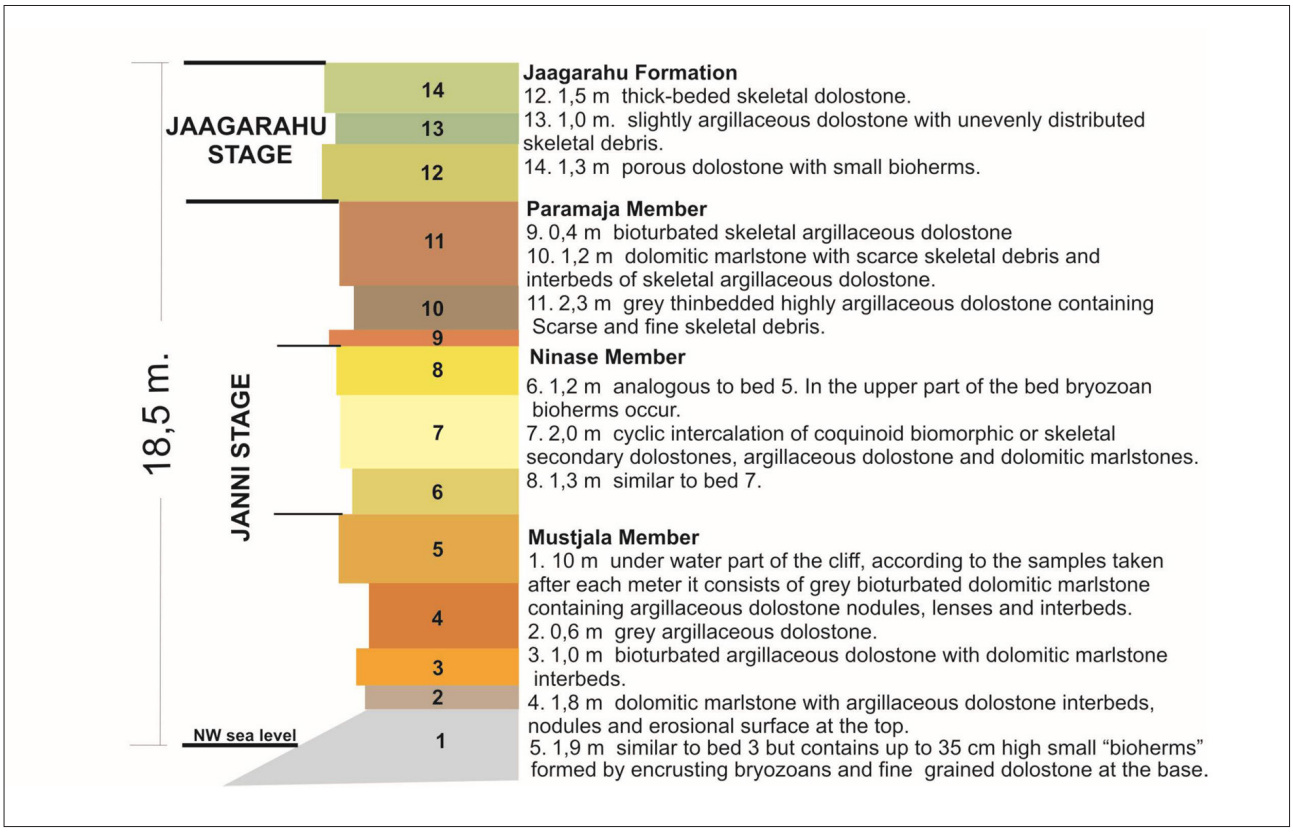

Fig. 5. Stratigraphic column of Panga Cliff (adapted from Hints *et al.*, 2008)

The underwater cliff is cut into highly argillaceous, dolomitized limestone and dolomitic marlstones.

The Kaali meteorite crater

In Estonia, there are five craters or groups of craters besides the Kaali meteorite: Ilumetsa, Tsoorikmae, Kardla, Simuma and gigantic Neugrund in the bottom of the sea, northeast of Osmussaare Island. The most well-known of Saaremaa is the Kaali meteorite, the largest crater form 9 craters in Kaali village, with a diameter of 105–110 m and the depth to 22 m (Raukas & Stankowski, 2010). The diameter of Lake Kaali depends on the water level. When it rains 30–60 m, the depth of the lake is 1–6 m. Analyses of pollen and peat in Lake Kaali suggest that the craters may be at least 3700 years old, however radiocarbon dating has yielded an age of about 4000 years (Raukas *et al.*, 2005). The mass of the meteorite that formed the crater was probably about 1000 tons. The Kaali meteorite belongs to the class of coarse octahedrites, containing 91,5% of Fe and 8,3% of Ni with Co, Ge and Ir as admixtures, and contains minerals characteristic of iron meteorites such as shreibersite, kamasite and taenite (Marini *et al.*, 2004; Raukas & Stankowski, 2010). The meteorite impact site of Kaali was put under national protection in 1938 and was included in territorial protection area in 1979. The main conservation purpose is the protection of the meteor crater and the surrounding landscape. The landscape is unique, because it is surrounded by a cultural landscape. The surface area of the landscape reserve in total is 83,7 hectares. Altogether, there are 9 craters, of which the biggest is as lake. Secondary craters, also called dry lakes, are located in the adjacent fields of Kaali (Fig. 6). There are smaller relatively flat circular depressions mostly without a rim.

Fig. 6. The lake created in the crater after the fall of the Kaali meteorite, photo J. Łach

Cultural geoheritage

Architectural and cultural heritage using local geological sources has been a vital element of the Saarte Geopark for 200 years. Wooden buildings, buildings of residential and economic functions made of stone, buildings made of stone used for residential and sacral purposes belong to this kind of heritage. Stone fences (made mainly of granite pebbles) surrounding the above buildings and areas of agriculture activity are vital elements of the Saaremaa landscape. Those fences are around one meter thick. There were built up to 1,5 meters high. Nowadays they are covered with moss and lichens.

Windmills

In the past, Saaremaa was called the Island of 500 windmills. Nowadays most of them have not survived. To the most interesting belong to those from following towns: Angla, Kuusnomme, Arandi, Kirikukula, Aste, Kahtla, Kakuma. Windmills are still very important symbols of Saaremaa. The post windmill built of stones and standing on a high post, the oldest type of windmills in Europe is characteristic of the West-Estonian islands. In the 19th century, nearly each bigger farm in Saaremaa and Muhumaa had its own windmill.

Fig. 7. Windmill in Kuusnomme – Ilastel, photo J. Łach

In the Kuusnomme – Ilaste village, there is a wooden wind-driven milling structure from medieval times that was introduced in Saaremaa in the mid-16th century. The post mill was built in 1891. For decades, the miller was Sass of Ilaste (Aleksander Helm 1902–1980), who was the last traditional miller in Saaremaa and a wholehearted windmill expert. The wooden structure of the corps is placed on stone foundations made of limestone blocks and granite erratic boulder. The main quern was made of red Scandinavian granite. Now the object is restored and available for visitors (Fig. 7). Nearby, there is a sign with information of the history of the windmill. The next village is Angla. Four of five Angla windmills are trestle windmills typical of the island of Saaremaa. They were built at the beginning of the 20th century. Just like the windmill described above, they are also built of local rock and wood. A Dutch-style windmill, slightly taller than the others and built in 1927, stands in the middle of the group (Fig. 8).

Fig. 8. Angla windmills, photo J. Łach

Churches in Valjala and Kihelkonna Mihkli

The Valjala Church was initially built as a chapel immediately after conquering the Valjala hillfort in 1227 to mark the victory. The church started to take shape a century later – and as was customary in Saaremaa – as a fortress church. A tower was added in the 17th century. Valjala Church is the oldest preserved rural church in Estonia (Fig. 9).

The Kihelkonna Mihkli Church was built in the 2nd half of the 13th century and is the tallest church in Saaremaa. The church's arch murals from the 13th century can still be seen today. The oldest organ in Estonia with 14 registers was built in 1805. The bell tower that is situated a few hundred meters from the main building was constructed in 1638. The bell tower is unique in all of the Baltic States, as it is the oldest remaining separate bell tower. A new bell was fitted in the tower in 2009 and it now rings again at noon. The current tower was added to the initial church at the end of the 19th century (Fig. 10).

Fig. 9. Valjala Church with visible stone wall made of granite erratic boulders, photo J. Łach

Fig. 10. Kihelkonna Mihkli Church with visible stone wall made of limestone and granites blocks, photo J. Łach

Mihkli Farm Museum

Mihkli Farm Museum is an open air-museum. Mihkli farm is a typical Western-Saareemaa farm, which is interesting from the point of view of various planned buildings. The dwelling-house and other houses form a circle round the farmyard that is divided into two by a rail fence forming a nice flower garden. The farm is surrounded by old white ashes, which branches were used to feed sheep in winter. Local materials such as spruce and pine trees, limestone and granite blocks from nearby exposures or overlying ground (erratic boulders) were used for the construction of all buildings.

Fig. 11. The main dwelling-house, photo T. Raukas

The main dwelling-house was built in 1834 (Fig. 11). The dwelling-house has no foundation and is built of beam. The roof is half hipped. This kind of village architecture appears only in the western and northern parts of Saaremaa. Next to the dwelling-house, there is a small house built of stone and wood, called the house of wheels. Woodwork was done here and the machines produced kept, hence the name. Among the products you see two prams; one bought and the other one self-made. On the southern side of the yard, there is a barn-house erected in 1840–1843. The biggest building of the farm consists of a large room with stone walls. The room was used for threshing grain. The barn-room and the stables are built of beams. Opposite the barn-house there is a stone house with a wooden plank roof from 1854 where there are a summer kitchen, a smithy and a wooden brewery. Some pieces of tiles have been put into the walls of the house of wheels already in 1849. It is possible that the stones come from the old Kärla Church, that was taken down in 1836. There are two storehouses on the farm: the old and the new building. The oldest of the preserved buildings is the storehouse in the orchard dating evidently from the turn of the 18th and the 19th century. It was built when a saw was not known as a tool yet. This storehouse was used for storing grain and apples. The new storehouse was probably built in 1842. The proof is the date on the doorjamb of the clothes storehouse and on the wall of the fish-house. The new storehouse has several chambers: in the middle, there were special rooms for storing grain, meat, fish and clothes. In the side chambers, girls used to sleep in the summer. In 1846, a sauna-bath was built in the orchard, its wooden parts and interior design date from 1910. Some hundred meters away from the group of buildings you may see the farm's windmill, that could be turned as the wind blew (www3).

Kuressaare Castle

The Kuressaare Castle-Fortress (Figs 12, 13) is one of the most interesting and best preserved fortification structures in Estonia. Contrary to numerous other Estonian medieval castles, Arensburg survived the Livonian War (1558–1583) and continued to develop under its new owners. In the early 17th century at the latest, the medieval Konventhaus and the surrounding walls became a fortress with rampart fortifications and bastions, which was gradually modernized during the following couple of centuries. Fortunately this process proceeded relatively peacefully and very rationally (Fig. 13). Wherever possible everything that had been built earlier was used and not demolished. As a result, the Kuressaaare fortress has become a peculiar crosscut of the development of different fortification ideas and theories from the 14th to the 19th century, which is noticeable in the whole Northern Europe context. The building of the oldest part of the fortress, the Konventhaus – type main castle, started some time during the first third of the 14th century, and it was completed along with the first surrounding wall towards the end of the same century (www4). The walls were built of limestone and partly of granite (Fig. 12).

Fig. 12. The structure of the defensive wall of the castle in Kuressaare, photo J. Łach

Fig. 13. Kuressaare Castle**,** photo J. Łach

The touristic attractiveness of the chosen geotouristic objects in the Saarte Geopark in the opinions of tourists

Duringthe research (may 2016), the Saarte Geopark was visited by tourists from seven neighboring countries (Fig. 14). People from Finland and Russia were the majority, and came there for group tourism. The group from Estonia was represented by family tourism linked to a weekend stays which aim was to relax. Polish, Swedish, Lithuanian and Latvian tourists represented individual tourism of one or two people. Only two families from Poland and Latvia were met, and one from Sweden.

The aim of the all tourists staying on Saaremaa was to see the landscape aspect, referring mainly to the flora, fauna, young glacial type of the shore zone, unique crater lake and rural and town architecture. For several tourists, the stay had an ideological aim referring to a visit at a mysterious crater lake and staying on the edge of the highest cliff on the biggest island on the Estonia. For several of them (18%), the arrival was tightly connected with a visit in to the Saarte Geopark. The concept of the Geopark was not clear for more than 77% of tourists. It had smaller value (mainly among organized groups which aim was to integrate with others). Thirty-three percent of tourist understood the value and geotouristic attractiveness described on information signs, but not always understand the relationship between cultural objects and geology (for example, in the case of windmills).

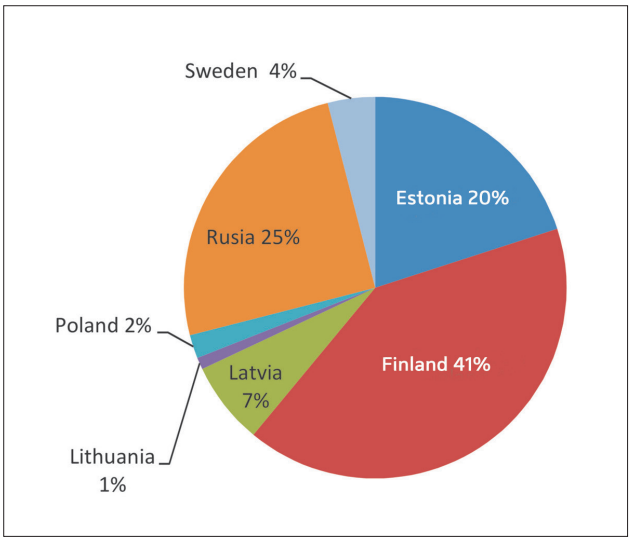

Fig. 14. National structure of tourists visiting Saaremaa Saarte Geopark (own research)

Tab.1. Tourism base of Saarte Geopark (own compilation)

Objects		Nutritional base	Accommodation base	Accompanying base								
				Information point	Parking	Information board	Observation tower	Toilet	Resting place	Campfire and camping site	Souvenir	Other
Vilsandi NP		Loona (1) Alta (1) Kihelkonna (1)	Loona (1)	Loona (1) Vikali (1)	3	5	1	3	2	4	1	harbor – cruise
Panga Cliff		–	–	–	1	1	–	1	1	1	–	–
Kaali meteorite craters		Kaali (1)	Kaali (1)	–	2	3	–	1	1	–	1	educational centre
Kuressaare Castel		1	113 Kuressaare (city)	1 Kuressaare (city)	1	2	–	1	1	1	2	castel's museum, guide
Mihkli Farm Museum		–	–	–	1	1	–	1	1	–	1	guide
Historical churches	Valjala	–	–	–	1	1	–	–	–	–	–	–
	Kihelkonna	1	–	–	1	1	–	–	1	–	–	–
Historical windmills	Kuusnomme	–	–	–	–	1	–	–	–	–	–	–
	Angla	1	–	–	1	1	–	1	1	–	1	–

For the majority, information presented on sings located near every object was not clear, especially as far as characteristics of geologic time, structure and geologic names, which are addressed to specialized audiences. From the inventory of the touristic accommodation (Tab. 1), it may be concluded that it is well-organized and coexists with the landscape, what was noticed by tourists. The accommodation allows them to get vital information, to relax, and to reach geotouristic points fast and without complications due to network of signs and tourist trails (both for cycling and hiking).

In the opinion of tourists, the tourists development was evaluated in two ways: as very good for organized tourists and as good for individual tourists. Good grades resulted from problems with accommodation and catering (out of Kuressaare), which in smaller towns are closed until June. Communication availability made up of a thick network of mainly asphalt roads of good technical condition was rated highly.

On the basis of the opinion, about three compound geotouristic objects create touristic attractiveness. This was rated very highly (Tab. 2). The aesthetic valor of varied terrain and correct elaboration of information on objects and geological and morphological processes had influence on such good result. The tourists paid attention to the cognitive value of cultural objects and geological history was a component of this value. The Kaali meteorite crater lake was rated the highest, together with Kuressaare Castle, where there was an easy access to touristic services, beginning from accommodation and catering, up to the elements of accompanying accommodation. A modern Kaali Visitor Centre in Kaali village gains recognition, while introducing tourists to geotouristic issues. Low grades of touristic accommodations near chosen objects resulted from the existence of information signs only, as well as benches or road signs. The lack of catering did not allow one to spend more time near the object.

Tab. 2. Table of the evaluation of the attractiveness of chosen geotouristic objects in the Saarte Geopark (own compilation)

Objects		Aestethic value *	Tourist accomodation*	Transport availability* (state of roads)	Touristic attractiveness ∑ (values+base+ communication)	Attractiveness rating**
Vilsandi NP		5	4	4	13	III
Panga Cliff		5	2	5	12	II
Kaali meteorite craters		5	5	5	15	III
Kuressaare Castel		5	5	5	15	III
Mihkli Farm Museum		4	2	4	10	II
Historical churches	Valjala	4	1	5	10	II
	Kihelkonna	3	1	5	9	I
Historical windmills	Kuusnomme	4	1	2	7	I
	Angla	5	3	5	13	III

* In the scale between 1–5, 1 is a low grade, and 5 very good one.
** 15–13 huge attractiveness (III), 12–10 high attractiveness (II), 9–7 low attractiveness (I)

Summary

The material presented in the above paper presents the interesting, diversified geotouristic offer of Saaremaa Island. In addition, the idea of the Saarte Geopark, based on the history of Silurian Klint, made us familiar with the geotouristic history of the region visible in natural exposures and forms of terrain, as well as in the architecture of cultural objects. The geotouristic trail was designed according to the rule of balanced development, organized by good and very good grades of touristic attractiveness (Fig. 15).

From the analysis of the touristic movement, it may be concluded that it is an offer used by habitants of the Baltic Sea region. This conclusion may not be objective, as the research was conducted before tourist season, which on Saareama begins in June, but it shows the state and directions of potential development – more widely should be promoted among the international tourist offer. The touristic offer of the Sarate Geopark is aimed at a broad group of tourists visiting Saaremaa, but usually the ones who use the geotouristic trail are those who have specific education and travel plans alone, or with family and friends.

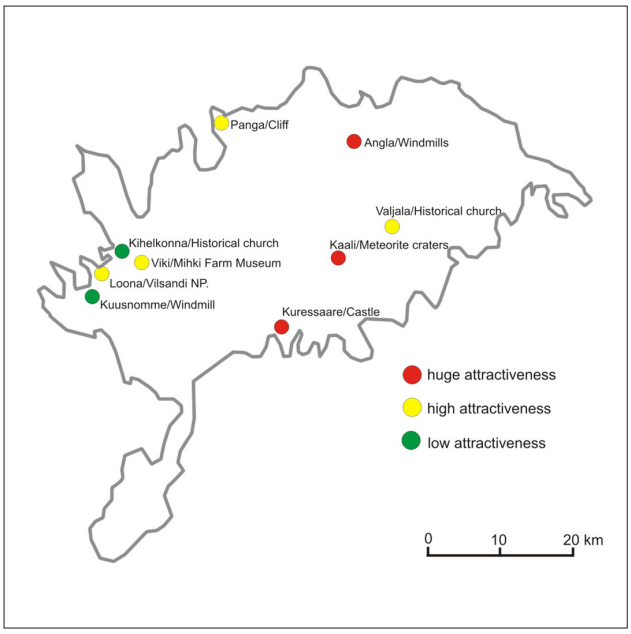

Fig. 15. Map of the tourist attraction of Saaremaa for the low tourist season (own research)

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