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GEOTOURIST ASSETS OF COASTAL ZONE BETWEEN WŁADYSŁAWOWO AND JASTRZĘBIA GÓRA

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Abstract

Polish Baltic coast, especially in summer season, is one of the most attractive, in terms of tourism, regions of the country. From a geotourist viewpoint, particularly attractive are the cliff sections. The attractiveness of a given coast fragment is also determined by tourist facilities provided there and anthropogenic objects which are of interest to tourists. The coast section between Władysławowo and Jastrzębia Góra is particularly attractive. This is thanks to its diverse geological structure visible in cliff outcrops, and varied cliff relief cut by deep gullies. The geological sediments to be observed there include brown coal outcrops. The attractiveness of the coast is enhanced by its geographical location. It is the northernmost fragment of Poland's territory. An additional attraction is provided by anthropogenic objects, e.g. the lighthouse in Rozewie or various forms of technical shore defence against abrasion.

Key words: geotourism, cliff, Chłapowo, Jastrzębia Góra, Rozewie

INTRODUCTION

The Baltic coast is one of the main places of tourist traffic concentration in Poland. This certainly concerns the summer period. The concentration of tourist traffic varies by location. The decisive criterion is nature attractiveness of a given area and tourist infrastructure offered there. The Polish coast of the Baltic represents a levelled, abrasive-accumulation type (Bołdyriew et al. 1982), with a clear domination of accumulation sections. Cliffs account for only about 20% of the whole Polish coast. They occur in contact zones between morainic plateaux and the sea. On the Polish coast they are grouped in several regions: Gdynia–Swarzewo, Władysławowo–

Jastrzębia Góra, Rowy–Ustka, Jarosławiec, Sarbinowo–Kołobrzeg, Niechorze–Łukęcin and Wolin Isle. The total length of Polish cliff shores is about 95 km. The length of particular sections differs significantly, ranging from 150 m – Gnieżdżewo and Rowy cliffs to almost 11 km – Ustroń Cliff. Maximum heights of particular cliffs differ as well, ranging from 5 m – Rowy Cliff, to 70 m – western part of Wolin Cliff (Subotowicz 1982).

Cliffs are the most visually attractive type of sea coasts. Cliffs are erosion forms and are never reconstructed. Hence, slopes of dunes on spit shores which are cut by erosion cannot be classified as cliffs (Subotowicz 1982), as they are periodically cut and reconstructed. The development of cliffs always consists in subsequent stages of their destruction. The formation and degree of development of a cliff are conditioned by two main factors: geological structure of sea shore and hydrodynamic conditions of the shore zone.

Polish cliffs are built mainly of the Pleistocene sediments, such as till sand and fluvioglacial gravel and heavily pressed clays and silts. In the bases of cliff walls there are also the Miocene sediments. In many sections of the coast, the cliff crowns are covered with aeolian sands (Olszak 1996, Olszak et al. 2011, Dullek and Olszak 2013). Such a geological structure makes the cliffs relatively poorly resistant to mass movements, hence their form changes on a scale of a year and of multi-year periods. In geodynamic terms, on the Polish coast, there are three types of cliff: scree, slump and slide-flow (Subotowicz 1990). The geodynamic type of cliff affects the type of management of its direct hinterland as well as its landscape value.

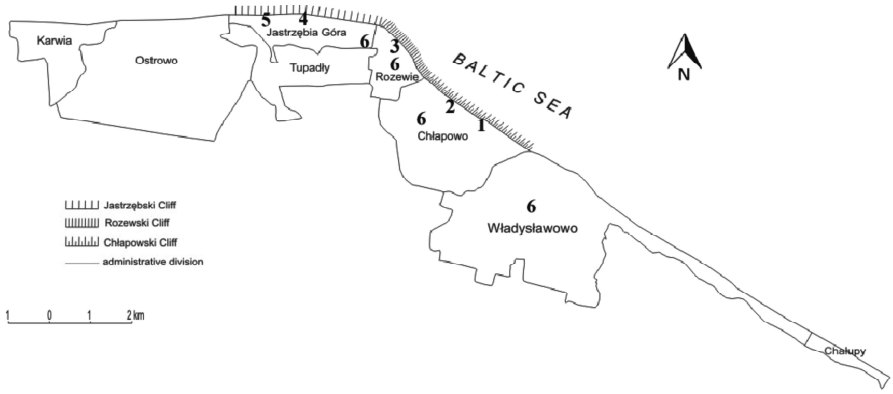
Another frequent division of cliffs is into active and dead. Active cliffs are modelled mainly as a result of sea abrasion, leading to the cliff crown retreat. The retreat rate varies solely according to the resistance of the geological material building the cliff.

Dead cliffs are cliffs in which the abrasion process ceased due to changes in hydrodynamic conditions within the sea shore zone or as a result of human protection. Slopes of such cliffs can still be transformed due to the action of precipitation waters. This may lead to a slight retreat of the cliff crown without a change in the location of the sea shoreline.

RESEARCH AREA

According to the physical-geographical division by J. Kondracki (1994), the analysed fragment of the Polish coast is located in the northern part of the Kashubian Coastland mesoregion. The seashore here is the northern edge of Swarzewo isolated morainic plateau. The length of the whole shore section is about 8.5 km. It can be divided into two parts: Chłapowo Cliff and Jastrzębia Góra Cliff (Fig. 1). This division is based on morphological criteria. In some studies, Rozewie Cliff is additionally distinguished from Jastrzębia Góra Cliff (Subotowicz 1977). This is the only, in this area, fragment of seashore protected by a concrete band.

Chłapowo Cliff is about 4.5 km long. It is active in its whole length, i.e. is subject to continuous modelling. It stretches from Cetniewo in the east to Łebski Gully in the west, near Rozewie.



1 – Miocene sands and silts with brown coal,
2 – Chłapowo Valley, 3 – Lighthouse in Rozewie
4 – Monument „North Star", 5 – Construction enforcing the cliff Wall,
6 – Basalt surface of road Władysławowo-Jastrzębia Góra

Fig. 1. Location of research area
Source: own study on the basis of administrative map of the town of Władysławowo

The eastern part of Chłapowo Cliff, in geodynamic terms, is the slump type while its western part – scree type (Subotowicz 1990). This difference results from the degree of diversity of the geological structure of particular sections of the cliff. It is an active cliff, though the activity of particular parts varies significantly. Markedly least active is the eastern section. This is due to two reasons. Firstly, the cliff base here is built of sediments relatively resistant to abrasion. Secondly, the fishing port built in Władysławowo in the 1930s, and especially its western breakwater, stopped the movement of debris transported along the shore. This resulted in widening of the beach at the base of the cliff, which additionally weakened the abrasion process.
The base of the eastern part of Chłapowo Cliff, up to about 10-13 m above the sea level is built by strongly pressed fine-grain the Miocene sands and silts (Fig. 2) (Wagner 2007). The upper part of the wall of this cliff section is built of the Quaternary sediments. The base of these sediments is made of moraine debris, above which there is a series of fluvioglacial sands. These sands underlie till of the Wisła glaciation covered with outwash sands. The crown of the cliff is made of the aeolian Holocene sands with levels of buried soils (Rudowski 1965, Olszak 1996).
The western part of the Chłapowo Cliff is built mainly of the Quaternary sediments, identical as the eastern one. The top of the Miocene sediments is much lower here. Such a geological structure gives the cliff a scree character. In this section there are clearly 2-3 scree steps.
Such a diverse geological structure of the cliff results is varying degree of its activity. The mean retreat rate of Chłapowo Cliff, calculated for years 1957-1977 is about 0.55 m/year (Subotowicz 1982).

Fig. 2. The Miocene sediments building the base of eastern part of Chłapowo Cliff (photo I.J. Olszak)

The term Rozewie Cliff is not defined unambiguously. Most often it is applied to about a kilometre-long shore section in the area of Cape Rozewie, fully protected from the sea by a concrete band. This band starts at Łebski Gully and stretches westwards. In contrast to Chłapowo and Jastrzębia Góra cliffs, Rozewie Cliff used to be regarded dead until recently. Rozewski Cliff is built only of the Quaternary sediments. There are two series of tills there. The base of the cliff is built of grey till. It is covered with fine and medium grain fluvioglacial sands. In the upper part of the wall there is a strongly reduced layer of brown till. The cliff crown is built of fine-grain the Holocene sands (Subotowicz 1991).

Jastrzębia Góra Cliff is about 2.8 km long and stretches from Rozewie to Jastrzębia Góra. In geodynamic terms, it is the slide-flow type in the greater part of its length. Only small sections can be classified as the slump type (Subotowicz 1990). Of the analysed cliffs, Jastrzębia Góra Cliff has the most complex geological structure. Differences in geological structure concern especially the lower and central part of the cliff wall.

In the eastern part, the base of the wall is made of grey till of the Świecie stadial of Wisła glaciation. Above, there are fine-grain sands containing thin interbeddings of silts (Fig. 3). The cliff crown is made of brown till (Masłowska et al. 2002, Olszak et al. 2007).

In the western part, almost the whole lower and central part of the wall is made of glacilimnic clays. The thickness of the clayey series is over 20 m. The clays are covered with a series of fluvioglacial sands and a thin layer of brown till. The cliff crown, in its whole length, is made of fine-grain the Holocene sands, including

a level of podzolic buried soil (Olszak 1998). The mean retreat rate of the cliff retreat in its particular sections ranges from 0.35 to 0.47 m/year. In some years however the value can reach even 2.0 m/year (Subotowicz 1982).

Fig. 3. The Jastrzębia Góra Cliff – eastern part (photo A. Marek)

FORMS OF SEASHORE PROTECION

Protection of sea shore environment should be analysed in two aspects. The first is technical shore defence. The other is protection of natural resources of the shore zone.
Technical defence is aimed at protecting the nearshore belt both from destructive action of the sea and from wrong management by man. These actions are in the competence of Maritime Authorities. In the case of the analysed cliffs this is the Maritime Office in Gdynia. In 2003 an act was enforced introducing a multi-year "Programme for the protection of sea shores". This programme, within the section Władysławowo-Jastrzębia Góra, involves supplying the beach with sand material, taken mainly from the deepening of the water route to the port in Władysławowo (Chłapowo Cliff), drainage of cliff (Jastrzębia Góra Cliff) and modernisation of shore enforcements (Rozewie and Jastrzębia Góra cliffs).
Chłapowo Cliff lacks any hydrotechnical defence constructions. The first protected cliff section in this area was Rozewie Cliff. The history of its protections goes back to 1905, when a band of stones and fascine was constructed at its base (Basiński 1963). It was aimed at slowing down the process of cliff destruction by the sea and consequently protecting the lighthouse and other navigation facilities present there. In 1927 a concrete band was built. It has been renovated several times. The last reconstruction took place in 2012-2013, when it was elevated and a stone layer was added at its foreground (Fig. 4). Additionally, a system of drains was constructed here to drain the cliff wall.

Fig. 4. Rozewie. Concrete band with stone layer at the cliff base (photo I.J. Olszak)

The beginnings of the technical defence of Jastrzębia Góra Cliff go back to the 1990s. The need to protect this fragment of the coastland resulted mainly from the fact that the hinterland of the cliff has dense building development. In the last twenty years the retreat rate of the cliff in Jastrzębia Góra was about 1.20 m/year (Kramarska et al. 2011). This endangered the buildings located near the upper edge of the cliff. An example of a building which was partially destroyed as a result of sliding of cliff wall is the so-called Beck Villa (Fig. 5).

Fig. 5. Jastrzębia Góra Cliff. Landslide near Beck Villa (photo A. Marek)

The geological structure, especially the presence of a clayey series here, resulted in large landslide niches. This concerns especially the western part of the cliff. The reason for the slides is related mainly to the effect of precipitation waters, human activity, and only to a small degree to sea abrasion. A lack of regulation of water-sewage management in Jastrzębia Góra caused that both precipitation waters and some of the sewage was discharged directly to the ground. When sinking they reached the clays, soaking them and consequently causing mud flows and landslides. As a result of these processes, geological material was deposited at the cliff base, providing a short-term stabilisation. After removal, as a result of abrasion, the process of cliff destruction went on.

The first applied form of cliff protection in 1993-1998 was a band of gabions (baskets of wire mesh filled with material) placed at its base. This provided a short-term stabilisation of the cliff (Kistowski et al. 2001). Unfortunately, after a few years it turned out, as expected, that this protection does not make much sense due to the above described factors destroying the cliff. Flow-slide material covered the band and the process of cliff destruction accelerated again.

In such a situation, a decision was made to introduce another protective measure for Jastrzębia Góra Cliff. In its western part a wall was built in 2010-2011 to protect the cliff in its whole height. Additionally, the landslide niches occurring in it were reclaimed, making the angle of their walls gentler and enforcing them with turf.

The protection of natural environment is carried out on the basis of the act on nature preservation. The whole analysed shore section is covered by protection within the Seaside Landscape Park, and two fragments additionally by reserve protection. This concerns Chłapowo Valley and Cape Rozewie. It is also planned to establish several documentation sites.

The Seaside Landscape Park was established in 1978 pursuant to the Resolution of the Provincial National Council in Gdańsk. Its area is 18,804 ha. NPK was established to protect and shape the environment as well as to develop its recreational function, preserving those elements of landscape which determine its natural and cultural value. This is the only landscape park in Poland which covers not only a land area but also a water body, i.e. Puck Bay. In the analysed area, within the Park, there are two nature reserves "Cape Rozewie" and "Chłapowo Valley" (Kamiński 2002).

The first of the above mentioned reserves to be established was "Cape Rozewie", set up in 1959 pursuant to the resolution of the Minister of Forestry and Timber Industry. The area of the reserve is 12.15 ha. It is a floristic and landscape reserve established to protect the cliff shore covered by mixed forest including the beech (*Fagus silvatica*) and to protect a site of the Swedish whitebeam (*Sorbus intermedia*). The age of the tree stand is estimated at over 100 years, and locally even 160 years (Herbich and Meissner 1997). There are also other protected plant species in the reserve, such as the common ivy (*Hedera helix*), European wild ginger (*Asarum europaeum*) and sweetscented bedstraw (*Galium odoratum*) (Herbich et al. 1997).

The other reserve in this area is "Chłapowo Valley". It is a landscape reserve. It was established in 2000 and has an area of 24.83 ha. It is aimed at preserving the landscape of the seaside erosion valley within the edge zone of the Swarzewo isolated morainic plateau together with its characteristic vegetation. Species protection co-

vers here the common broom (*Cytisus scoparius*), common sea-buckthorn (*Hippophae rhamnoides*), harebell (*Campanula rotundifolia*) and black crowberry (*Empetrum nigrum*) (Herbich et al. 1997).

GEOTOURIST ATTRACTIVENESS OF CLIFFS OF SWARZEWO MORAINIC PLATEAU

Attractiveness of a cliff coast is determined by two factors: its morphological forms and geological structure. It should be added that both these factors are changeable with time. The state of the geological structure and morphology of the cliff changes practically after each storm. As a result of cliff retreat, new layers of sediments are uncovered, which were invisible before. New forms are created, such landslide niches and tongues, scree and flow cones. The width and character of the beach changes as well.

Chłapowo Cliff

The attractiveness of Chłapowo Cliff, especially its eastern part, consists in its geological structure and a wide sandy beach lying at its base. In the cliff wall, there can be seen the oldest geological sediments in Pomerania that can be observed directly in outcrops, without the need of drilling. Their age is estimated at about 20 million years. The attractiveness of these sediments is increased by the fact that they contain plant remains, including tree trunks of e.g. the coast redwood (Passendorfer and Zabłocki 1946), and interbeddings of brown coal. The latter are most clearly visible in the area of Rudnik Ravine (Fig. 6). This coal was extracted till 1860 for local purposes (Sikora 1978).

Fig. 6. Insertions of brown coal in sandy-silty Miocene sediments in the central part of Chłapowo Cliff (photo I.J. Olszak)

Very characteristic forms within this cliff are deep erosion cuts of the edge of Swarzewo morainic plateau. The largest ones are Granczik Ravine, Augustików Ravine, Rudnik Ravine, Łącznik Ravine (Fig. 7) and Lepści Ravine (Subotowicz 1977). The latter is better known as Łebski Gully. These forms vary in length. The shortest one is Augustików Ravine, i.e. 150 m. The longest are Łebski Gully – about 400 m and Rudnik Ravine – about 1,000 m. These ravines were formed as a result of precipitation and meltwater flow from the surface of the Swarzewo plateau. Their beds are still modelled by deep erosion. The central part of Łebski Gully can serve as an example.

Fig. 7. Chłapowo Cliff. Outlet of Łącznik Ravine (photo I.J. Olszak)

In the past, some of the erosion cuts constituted the most convenient passages towards the seashore. This especially concerns Granczik and Rudnik ravines. Behind the place where they occur, at the back of the cliff, there is the old village of Chłapowo. It was established by the Teutonic Knights in 1359 (Biernat et al. 2000). It used to be a fishing village and turned into a tourist one in the 1930s (Mamuszka 1989). Both ravines were thus the most convenient way to the beach or the fishing marina. Granczik Ravine has a communication function up to the present day. It is on its bottom that the only access road to the beach, paved with concrete slabs, was laid for the use of the Maritime Office and Border Guard.

The largest erosion form in this area is, mentioned above, Rudnik Ravine (Fig. 8). It is better known under the name Chłapowo Valley or Chłapowo Gully. The two latter names are related to the name of the village Chłapowo, which, as was mentioned, is located near this form. The name Rudnik comes from the russet colour of water periodically flowing on the bed of the valley. Iron compounds present in the water also colour sandy sediments russet. As mentioned, the form is covered by legal protection within the "Chłapowo Valley" reserve.

The present Chłapowo Valley is only the upper part of the original valley occurring here from the beginning of the Holocene. Its length was then about 6-8 km (Augustowski 1961b). This is revealed by traces of a valley form preserved in the bottom of the Baltic. The valley was shortened due to the retreat of the seashore during the Littorina transgression (Rosa 1987).

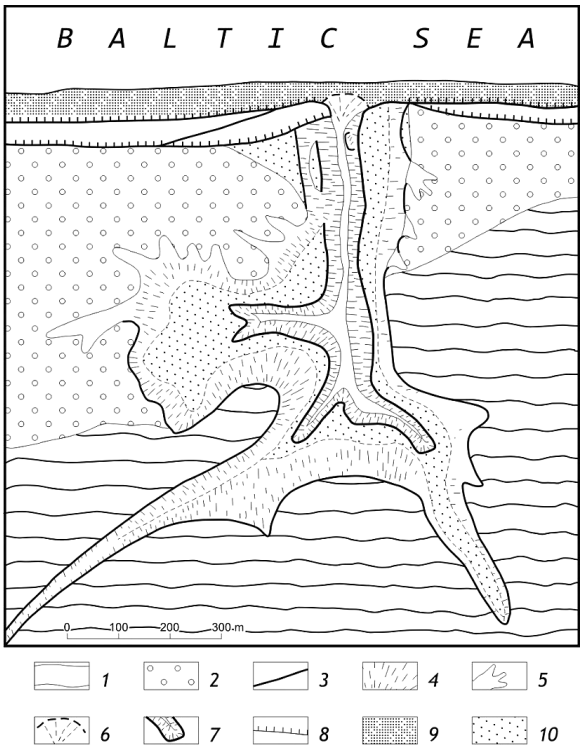
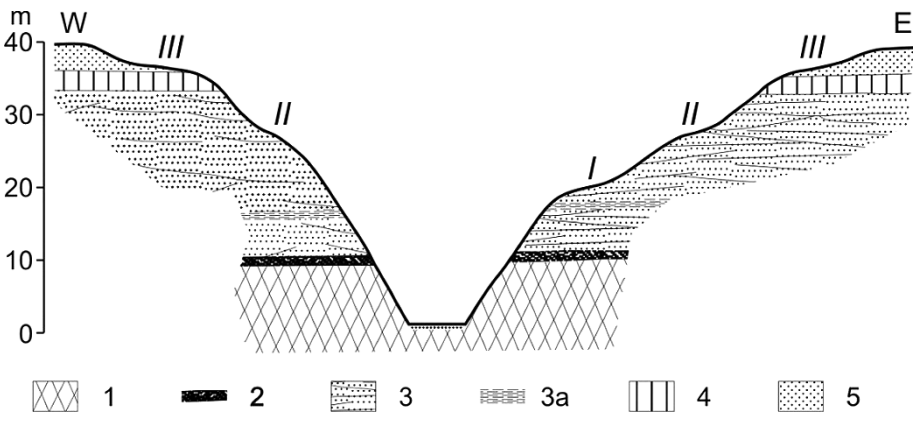


Fig. 8. Geomorphological sketch of Chłapowo Valley (Augustowski 1961a)

1 – ground moraine; 2 – outwash; 3 – terrace surfaces; 4 – valley slopes; 5 – corrasional valleys; 6 – gorge floor; 7 – alluvial fan; 8 – landslide; 9 – cliff; 10 – beach

The upper part of the form consists of three small valleys joining about 500 m from kkthe sea shoreline. The first of them, with a S-N course, begins in the village Chłapowo. Its length is about 500 m. The second, with a SW-NE course, is about 800 m long. The third, shortest one, with a NW-SE course, is about 400 m long. Its lower part is a deeply cut valley of a ravine character (Figs 9, 10). Its length is about 500 m.

Fig. 9. Upper part of Chłapowo Valley (photo I.J. Olszak)



1 – Miocene deposits; 2 – residual moraine pavement; 3 – intermorainic fluvioglacial sands and gravels; 3a – varved clay; 4 – morainic clay; 5 – fluvioglacial outwash sands I, II, III – terrace surfaces

Fig. 10. Geomorphological cross section of the lower part of Chłapowo Valley (Augustowski 1961a)

Chłapowo Valley was formed during at least two geomorphological cycles (Augustowski 1961a, b). In the first cycle, a relatively shallow valley system was formed which consisted of the three above mentioned side valleys and a common part. The width of these forms in their lower fragments was below 100 m, and the depth was about 5-10 m. Erosion cuts were limited to the Quaternary sediments only. This is revealed in three visible terraces. In the second cycle, the whole lower section of the valley was lowered together with the outlet sections of side valleys. The roof part of the Miocene sediments was also cut then. The erosion process of Chłapowo Valley has lasted up to now. A certain change occurred here, however. In 1928-1931 a road connecting Władysławowo and Jastrzębia Góra was built. It split the valley into two parts: northern, i.e. the outlet section of the valley together with one of the side valley – the one with a NW-SE course, and southern, consisting of the two upper side valleys. At present, the two parts are connected only via a narrow culvert. The division of the valley into two parts caused a considerable weakening of erosion processes in its upper part. By contrast, the situation of the lower part of the valley is markedly different. A concentrated flow of waters via the narrow culvert accelerated deep erosion of this part of Chłapowo Valley. The depth of the secondary cut of the bottom ranges here from 10 to 20 m in comparison to the original valley bottom level.

Rozewie Cliff

Rozewie Cliff is relatively unattractive in geotourist terms. This is due to three reasons. Firstly, its activity is very low thanks to the protective concrete band. Secondly, the whole cliff is covered by dense forest, which does not give an insight into its

geological structure. In recent years, landslide processes have intensified, caused by precipitation waters, but the effects of these processes cannot be closely observed, as the area is under reserve protection. Thirdly, there is almost no beach here. It is very narrow and stony, and in periods of strong waving, it is under water.
Despite the above factors, Rozewie Cliff is one of the most frequently visited fragments of the Polish coast. This is related to its geographical location. To the end of the 20th century Cape Rozewie was deemed to be the northernmost point of Poland, with coordinates 54°49′48″N and 18°20′16″E. In 2000 it was established that such a point is located in Jastrzębia Góra with coordinates 54°50′08″N and 18°18′10″E.
Another nature attraction of Rozewie Cliff is the aforementioned "Cape Rozewie" reserve. There is a didactic trail leading through the reserve and its vicinity called "Across the gullies and cliffs of Rozewie" and it presents not only the vegetation covering the area, e.g. beech forest, but also anthropogenic elements, such as: a lighthouse and a road with basalt surface, called "sun highway". The trail also leads through interesting geomorphological forms, such as a cliff with a stony beach beneath and Łebski Gully and Lisi Ravine situated at the borderline of the reserve (Jankowski 1999, 2001).

Jastrzębia Góra Cliff

Jastrzębia Góra Cliff is the most attractive part of the coast in the discussed area. As already mentioned, till the early 1990s it was not protected, which, accompanied by its diverse geological structure, resulted in various forms of mass movements – landslides, slumps and mud flows. In the western part of the cliff, above the top of clayey sediments, there were vast landslide niches. Below them, two landslide steps were clearly visible, locally covered by flow clayey material. In the roof section of the clayey series there was a visible cluster of trunks of the Siberian larch (*Larix sibirica*). Their age was determined by ^{14}C method at 43 500 ±4200 years BP (Olszak 1998). As a result of the aforementioned protection works in Jastrzębia Góra Cliff in this section, the forms as well as sediments cannot be observed at present.

ANTHROPOGENIC OBJECTS

Some anthropogenic objects in the discussed area are also of geological interest. They include: road No 215 called "Sun Highway", monument commemorating the takeover of Pomerania by Poland in 1920 or the "North Star" obelisk.
„Sun Highway" is a road connecting Jastrzębia Góra with Władysławowo. The construction was initiated by count Aleksander de Rosset in cooperation with companies „Jastgór" and „Jasne Wybrzeże" in 1929-1931 (Żarczyński 2008). The surface was made of basalt (Fig. 11) sourced from a quarry in Berestowiec on the Horyń River in the Volyn Region. Basalt from the quarry was also used for paving street between WW1 and WW2 in Kraków and Gdynia.

Fig. 11. Basalt surface of road Władysławowo-Jastrzębia Góra (photo I.J. Olszak)

The second object is the monument, situated in Rozewie, which commemorates the takeover of Pomerania by the Polish army in 1920. It was made of stones gathered on the seashore and coming from the washout of till. These stones constitute quite a random collection. They include granites, gneisses and sandstones.
The third important object is the "North Star" obelisk (Fig. 12) which is situated in Jastrzębia Góra near a primary school.

Fig. 12. Jastrzębia Góra. "North Star" monument (photo A. Marek)

It was set up in 2000, in accordance to present investigation, in the northernmost point of Poland. The monument was made of a large granite rock placed on a brick pedestal.

GEOTOURIST ATTRACTIVENESS

One of the methods of determining geotourist attractiveness is objects' assessment. It involves drawing up criteria and characteristics, and assigning them to a point scale that will allow comparing the geotourist attractiveness of different objects. The criteria, which characterise potentially attractive objects include: location accessibility, degree of preservation, scientific and educational value and the state of tourism development (Table 1) (Ihnatowicz et al. 2011).

Table 1

Evaluation range and estimate in geotourism evaluation

Criterion	Attributes	Value (in points)
Field accessibility	high: geosites located close to the tourist routes (up to the range of 500 m)	3
	medium: geosites located distant from touristic routes, approx. 10 min. of walk	2
	low: geosites located far away from touristic routes, long difficult walk	1
Degree of preservation	high: well preserved, visible geological structures, undamaged	3
	medium: low visible geological structures, partly degraded	2
	low: very low visible geological structures, significant degradation	1
Scientific value	high: unique site of regional importance, many publications	3
	medium: regional importance, described in publications	2
	low: local importance, small amount of publications	1
Geotouristic educational value	high: showing many geological topics, significant tourist value	3
	medium: represents a few geological topics of tourist significance	2
	low: represents small amount of geological topics, no touristic value	1

Source: Ihnatowicz et al. 2011

The above criteria were used to perform the assessment of objects in Chłapowo–Jastrzębia Góra Cliffs (Table 2).

Table 2

Assessment of objects in the Chłapowo–Jastrzębia Góra Cliffs

Cliff	Field accessibility	Degree of preservation	Scientific value	Educational value	Value
Chłapowo Cliff	3	3	3	3	12
Rozewie Cliff	3	2	2	2	9
Jastrzębia Góra Cliff	3	1	2	2	8

Source: own study

On the basis of the performed valorisation, it was concluded that the most attractive cliff in terms of geotourism is Chłapowo Cliff. This is thanks to the relief of the cliff itself, characterised by numerous outlet sections of erosion valleys, cutting the cliff wall, and the geological structure, offering the opportunity to observe the oldest geological deposits occurring in Polish cliffs.

CONCLUSIONS

The cliff section Chłapowo–Jastrzębia Góra is very diverse in geological, geomorphological and anthropogenic terms. Among the discussed sections, the Jastrzębia Góra section undergoes the greatest dynamics. This results mainly from its geological structure, i.e. glacilimnic clays, covered by a series of fluvioglacial sands, a thin layer of brown till, and the crown of the cliff is built of the Holocene fine-grain sands. Such a pattern of layers results in erosion processes during seepage of groundwaters or precipitation, which leads to uncovering of subsequent layers of the cliff. The relatively stable section of Chłapowo Cliff is enriched with outcrops of brown coal and fossil insertions of Siberian larch, which is rather unique. Another geodiversity attraction are erosion valleys cut perpendicularly to the cliff, covered by herbaceous and bush vegetation. In view of the dynamics of Jastrzębia Góra coast, the problem of its protection was raised. This resulted in placing gabions, which negatively impact the landscape and are negatively viewed by tourists. They constitute a form of protection in Jastrzębia Góra in the section from Droga Rybacka westwards to Bałtycka street, where the shore lowers significantly. Also the concrete band, protecting the cliff fragment near Rozewie disturbs the natural coastal landscape.
Within the analysed cliff sections there are also numerous anthropogenic elements, with tourist functions.

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WALORY GEOTURYSTYCZNE STREFY BRZEGOWEJ POMIĘDZY WŁADYSŁAWOWEM A JASTRZĘBIA GÓRĄ

Streszczenie

Klifowy odcinek wybrzeża Bałtyku pomiędzy Władysławowem a Jastrzębią Górą należy do niezwykle zróżnicowanych pod względem geoturystycznym. Wpływają na to jego urozmaicona budowa geologiczna widoczna w odsłonięciach klifowych, jak i urozmaicona rzeźba klifów porozcinanych głębokimi dolinami erozyjnymi. W odsłonięciach zobaczyć można, na przykład, wychodnie mioceńskiego węgla brunatnego. Atrakcyjność wybrzeża podnosi też jego położenie geograficzne. Jest to najdalej na północ wysunięty fragment terytorium Polski. Dodatkową atrakcję na tym terenie stanowią obiekty antropogeniczne, czego przykładem może być bazaltowa nawierzchnia szosy łączącej Władysławowo i Jastrzębią Górę, czy też różne formy technicznego zabezpieczenia brzegu przed abrazją.