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Peculiarities of the Development of the Black Sea Coast of Kolkheti (Georgia) in Modern Conditions

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ABSTRACT

The Kolkheti coastal zone of the Black Sea is a typical sample of joint marine and river accumulation area. At the same time, on the Black Sea coast of Georgia, the Kolkheti section is one of the most damaged in terms of technogenic impact. The cause of the crisis phenomena, developed in the Kolkheti Lowland coastal zone (Poti lithodynamic system) is only anthropogenic factor. Only the River Supsa - River Natanebi section still more or less keeps the natural dynamics and ability of independent existence. The rest of the areas that are undergoing washout or heavy accumulation, require constant monitoring and significant capital expenditure.

Keywords: coastal zone, sediments, lithodynamic system.

Introduction

Black Sea Kolkheti coastal zone is a typical example of sea and river accumulation. Kolkheti Lowland coastal zone, according to classification of, represents Poti lithodynamic system [1]. Here, at different sites, total accumulative displacement of alongshore sediment takes place from the north to the south, as well as from the south to the north direction. This is explained by various exposition of the coastal line, dominant west direction sea disturbances; also it should be noted that among the Black Sea coasts of Georgia, during the last one and a half century, Kolkheti section has undergone one of the most intensive human impact, in consequence of which many negative results are revealed.

Material and methods

Spatial-temporal comparison of events, cartographic methods and analysis. There are used background materials, published scientific articles. In some cases, by means of the material, obtained from the Internet is made visual evaluation, Also, several results of the experiments, performed in the Black Sea Kolkheti coastal zone.

Results and discussion

The coast under the study, by the direction of the alongshore stream movement towards the disturbances, feeding source and degree of autonomy, before interference of the human impact, were divided into three subsystems: 1. Riv. Enguri – Riv. Khobistskali; 2. Riv. Khobistskali – Riv. Supsa; 3. Riv. Supsa – Riv. Natanebi Fig.1, [1].

The coast, located north from the Riv. Enguri estuary, was fed by the gravel and sand alongshore stream, moving from the Riv. Mokvi via Ochamchire towards the Riv. Enguri. Abundance of the rough material conditioned creation of a spit near the estuary, by means of which cobblestone was moving to Anaklia beaches and going south to the Riv. Khobistskali together with the Riv. Enguri sand. Ochamchire port moles, built in 1934-1936, have blocked the Riv. Mokvi sediment alongshore stream and the washout of the Ochamchire coast has started. In the 60s along the town of Ochamchire were built the coast protecting

constructions (walls, groins), which finally stopped southward movement of the coastal zone washout products.

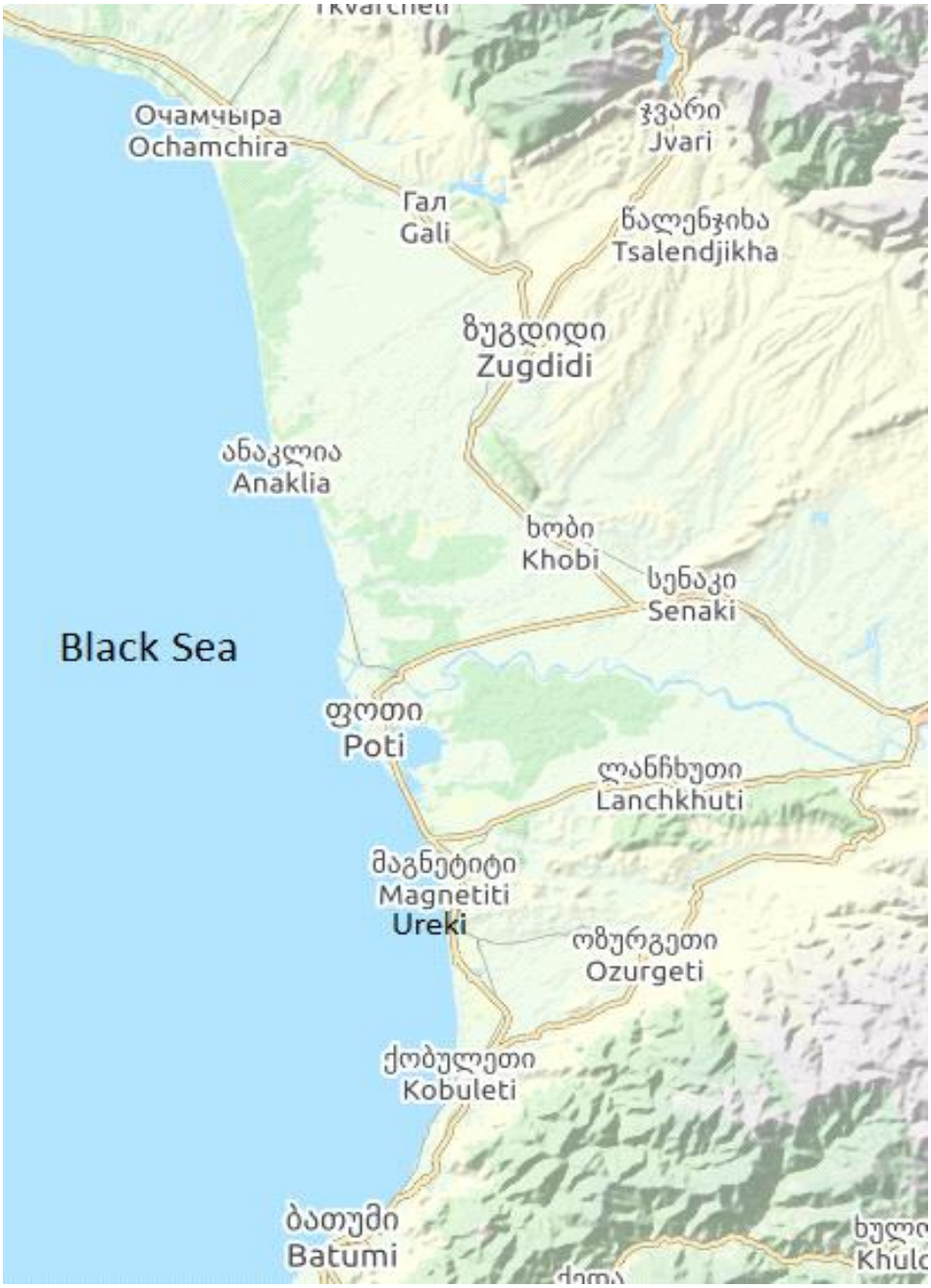

Fig. 1

In the 60s of the XIX century was built Poti port. In 1939, the main mouth channel of the Rioni river at the mouth of the the sea was artificially moved 4 km northward for protecting town Poti and port against flooding. In consequence of the abovementioned, Poti lithodynamic system now is divided into four more or less autonomous subsystems: 1. Riv. Enguri – Riv. Khobistskali; 2. Riv. Khobistskali – Poti port; 3. Poti port – Riv. Supsa and 4. Riv. Supsa – Riv. Natanebi.

Breakdown of solid sediment volume of the rivers. In the Riv. Rioni average annual volume of the beachforming material decreased from 2,1 million m^3 to 1,3 million m^3. Generally, the Riv. Enguri marine estuary is quite dynamic. This was conditioned not only by significant solid runoff of the river (before construction of the hydroelectric power plant) and hydrodynamic impact of the waves, but also by important content/ratio of suspended material in the 6-7-meter layer of water near coastal zone.

Fig. 2 Q-Concentration of suspended material in 10 m sea water layer near Enguri river sea mouth

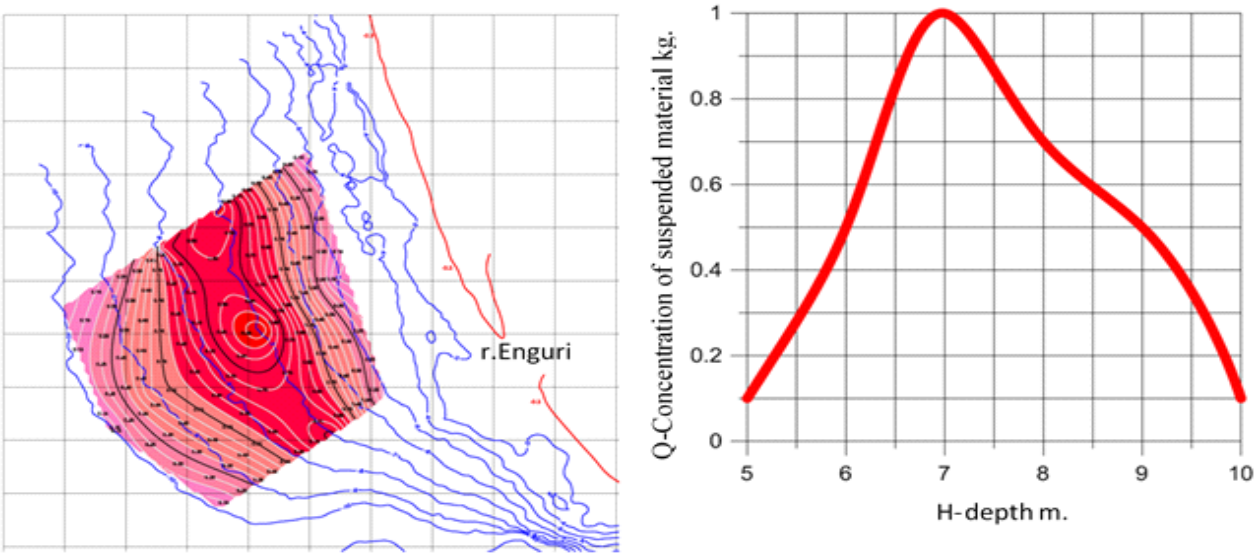

Fig. 2,3 [2]. The solid runoff of the Riv. Enguri (before construction of the HPP) was 1,5 million m^3, from them beachforming was about 0,5 million m^3. The power plant, built on the Riv. Rioni in the 70s of the XX century caused diminution of the volume of the solid sediment, brought by the river by more than 80% [3].

Riv. Enguri – Riv. Khobistskali. After construction of Riv. Mokvi port mole, Ochamchire beachprotecting groins' and walls' system, southward moving beach material stream was completely blocked. Retreat of the Riv. Enguri estuary and washout of the neighbouring lands started Fig.4. The coast retreat in Ganmukhuru (north from Enguri) and Anaklia (south from Enguri) was at least 200 m. The fishers' settlement and pinewood line were washed out.

Fig.4

In 1988-89, the Ministry of Energy deposited 200,000 m^3 of coarse cobblestone, extracted from the Enguri dewatered riverbed on the beaches, located north of Ganmukhuri. This helped to preserve the beaches [4]. The material, deposited on the beaches by this measure expired in recent years. In 2012 near the "Camp

of Patriots" was built 135 m long mole, at the end of which, in the sea, was erected an abstract construction (Fig. 5).

Fig.5

During the construction process mole was surrounded with tongues and filled with ballast. As it is inadmissible to build a blind construction in the wave beat line, after finishing works the tongues should be removed or cut at the bottom level. This was not done and we do not know the reason why. We can see washout south from the mole in 2017, Fig.6.

Fig. 6

After entering inert material 2018, fig. 7

Fig.7

North from the mole accumulation of the material began, and south a coast line of 30-40 meter width was washed out. A part of a yard of a local inhabitant was washed away. To this was added the first stage of Anaklia port construction – deepening of the water area and elevation and surfacing of the shore with the extracted material. As a result, south of the under construction port was activated coast washout and on the protected area (along Churia swampland) the beach parameters significantly lessened, danger of seepage of the sea water into the swampland appear. There was such a danger earlier too, when during construction of Kulevi terminal they widened the Riv. Khobistskali estuary to 300 m, excavated access channel and turning circle. In consequence – the north located coast retreated by about 250 m. Actually this site is protected with rockfill. In 2016-17, the Ministry of Infrastructure deposited inert material on the beaches: of Ganmukhuri - 100 000 m^3 and that of Anaklia also 100 000 m^3. This measure has temporarily mitigated the danger. It is necessary to repeat this measure periodically in the future, in order to avoid the seepage of the seawater into Churia Protected Area swampland and destruction of its fauna and flora.

The future of this subsystem depends solely on artificially incorporating of the material. It would be good, if the material will be carried in by the future port administration, under the supervision of the Ministry of Infrastructure.

Riv. Khobistskali – Poti port – This section is divided into three sites: Riv. Khobistskali – Nabada, Nabada – Poti port and Poti port – Riv. Supsa. In 1939, after moving Riv. Rioni riverbed to Nabada, appeared Rioni delta, which by now has moved forward by more than 2km in the sea [5]. The length of the delta frontal part (distance between Riv. Rioni north and south confluents) is about 2.5 km. The delta parameters are constantly growing.

Riv. Khobistskali – Nabada - At this site the coast is constantly increasing, at Nabada by 10-12m and at the south limit of Kulevi terminal – by 5-6m per year. At the 400-meter section, immediately adjacent to the access channel, there are local washouts, conditioned by proximity of great depths (14m) of the access channel. Actually this section is protected by the rock fill. The dominant direction of the sediment alongshore stream is from the south to the north.

Nabada - Poti port - At this site the delta is moving forward and the port access channel is being sanded with the material, brought by the Riv. Rioni. To provide navigation, the extra material is

systematically being removed from the access channel. The dominant direction of the sediment alongshore stream is from the north to the south.

Poti port – Riv. Supsa – In 1939, after moving Riv. Rioni riverbed to Nabada, as Poti city channel throughput turned out not to be sufficient, intensive washout of Poti-Supsa section started. Especially this was manifested at Poti-Maltakva section, where about 300ha coastal line was washed away. In Grigoleti the washout process continues even today. This process became particularly intensive after 2003, when in pine wood started construction of private resort buildings. The construction often took place in the wave beat line, in consequence a building got damaged and the beach washout was intensified. Nowadays, the Ministry of Infrastructure continues artificial filling of beaches with the beach material with cobblestones and the beach parameters already started to grow significantly. In Grigoleti in 2016 were entered 106 thousand m^3 cobblestones, in 2017 - 24 thousand m^3 cobblestones. The cobblestone mound on the beach retains sand. Together with this, during a sea disturbance the cobblestones are sinking and leveling underwater slope, increasing the beach stability and preventing from washout. The stability of this site depends on the city shannel pass-through function, west and north-west direction sea disturbances, which have to transport the sand, accumulated at the city channel estuary and in Maltakva, towards Grigoleti. In this case it is expectable that Maltakva beach parameters diminish. Grigoleti beaches are fed with city channel drift, which depends on the correct functioning of water dividing center. They are currently being rehabilitated. The Grigoleti section periodically requires the artificial introduction of small and medium pebbles on the beaches. The predominant alongshore sediment flow direction is from north to south.

Riv. Supsa – Riv. Natanebi – This section always managed to self restore and never had been washed out completely thanks to the rivers Natanebi and Supsa. For arranging Kobuleti by-passing way they have used alluvial material, likely hundreds of thousands of cubic meters, extracted from Riv. Natanebi and Riv. Kintrishi riverbeds, when average annual solid runoff of the both rivers does not exceed 60 000 m^3. This action will negatively impact the coasts' stability. In the early years taking away of magnetite from Ureki beaches irreparably damaged the sea coast Fig 8, [6]. In consequence, the beaches were narrowed by at least 40-50m. As a result, some of the resort buildings turned out to be in the wave beat line. Recently constructed boulevard in Ureki is in the wave beat line, which made lose the already narrow beach 6-8 meters. It is important that the population of the site under study, and particularly that of Ureki, knew that the beach is much more precious than the buildings that they construct directly on the hush and contribute to its washout.

Fig. 8

Conclusions

From our overview is seen that the reason of the crisis phenomena, developed in Kolkheti Lowland coastal zone (Poti lithodynamic system), is only the anthropogenic factor. Hence, it is clear that only Riv. Supsa – Riv. Natanebi section is still more or less keeping the natural dynamics and ability of independent existence. The other sites, undergoing washout or strong accumulation, need constant attention and research works, and also significant capital expenses. This is necessary for keeping sea coast relief, as a kind of frame of coastal ladscapes and, one of the main among them, their recreational and coast protecting functions.

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შავი ზღვის კოლხეთის სანაპიროს განვითარების თავისებურებები თანამედროვე პირობებში

ი.გელოვანი, გ.ლომინაძე, გ.ყავლაშვილი

რეზიუმე

შავი ზღვის კოლხეთის სანაპირო ზონა ერთობლივი ზღვიური და მდინარეული აკუმულაციის არეალია. ამავე დროს, შავი ზღვის საქართველოს სანაპიროზე, კოლხეთის მონაკვეთი ტექნოგენური ზემოქმედების თვალსაზრისით ერთერთი ყველაზე უფრო დაზიანებულია. კოლხეთის დაბლობის სანაპირო ზონაში (ფოთის ლითოდინამიკური სისტემა) განვითარებული კრიზისული მოვლენების მიზეზი, მხოლოდ ანთროპოგენული ფაქტორია. ბუნებრივ დინამიკას და დამოუკედებლად არსებობის უნარს მეტნაკლებად ჯერ კიდევ ინარჩუნებს მხოლოდ მდ. სუფსა- მდ. ნატანების მონაკვეთი. დანარჩენი უბნები, რომლებიც განიცდიან წარეცხვას ან ძლიერ აკუმულაციას, საჭიროებენ მუდმივ მონიტორინგს და მნიშვნელოვან კაპიტალ დანახარჯებს.

Особенности развития Колхидского побережья Черного моря в современных условиях

И.Л. Геловани, Г.Дж. Ломинадзе, Г.И. Кавлашвили

Резюме

Черноморская береговая зона Колхиды является ареалом совместной морской и речной аккумуляции. В тоже время, Колхидский участок на Черноморском побережье Грузии, в смысле техногенного воздействия, один из самых повреждённых. Причина кризисных явлений, наблюдающихся в береговой зоне Колхидской низменности (Потийская литодинамическая система), всецело антропогенный фактор. Междуречье Супса-Натанеби, в основном, еще сохраняет природную динамику и способность независимого существования. На остальных участках, где наблюдается размыв или сильная аккумуляция, требуются постоянный мониторинг и значительные капиталовложения.