

# Review of the modern terminology related with the definition, formation, development and evolution of the coastal zones

*Georgi Zhelezov*

National Institute of Geophysics, Geodesy and Geography, Bulgarian Academy of Sciences, Acad. G. Bonchev str., Bl. 3, 1113-Sofia, Bulgaria; gzhelezov@abv.bg

**Abstract:** Coastal zones are among of the most populated areas of the Earth. This is determined by the availability of resources, favorable climatic conditions and opportunities for development of various economic activities. The paper is a review, structured in three general parts. First of them is related with the definition of the term coastal zone, second part describes different shore types and the processes of their formation with some examples, and the third part is focused on the morphostructure of the coastal zone. Some changes in terminology in relation with contemporary knowledge are outlined. The problems of development and evolution of the coastal zones are also noted.

**Key words:** coast, shore type, morphostructure

## Introduction

Coastal zones are among of the most populated areas of the Earth. This is determined by the availability of resources, favorable climatic conditions and opportunities for development of various economic activities. The paper is a brief review of the modern terminology related with the definition, formation, development and evolution of the coastal zones.

## Material and methods

The paper is based on the modern literature search and is a brief summary of the most commonly used terminology (e.g. WHITTOW 1984, 2005, MAYHEW 2015 and references therein) with special attention to the Bulgarian geomorphological and geographical literature (e.g. KANEV 1980, 1983, 1989, NIKOLOV & KOLEV 2011). The review is structured in three general parts. First of them is related with the definition of the term coastal zone, second part describes different shore types and the processes of their formation with some examples, and the third part is focused on the morphostructure of the coastal zone.

Some changes in terminology in relation with contemporary knowledge are outlined. The problems of development and evolution of the coastal zones are also noted.

## Results

Definitions of coast, coastal zone and related terminology

The use of the terms *coast*, *shore* and of the relevant to them term *coastal zone* broadly vary and there are no single definitions but most commonly they are used in the following way: The *coast* is defined as the part of the land bordering the ocean, sea, lake, bay, river, lake or other water body; The *shore* is the line that is formed adjacent to the water pool; The *coastal zone* is the area that falls under the influence of the respective basin and develop on the landward after the coastline.

According to the modern Bulgarian Geographical term dictionary (NIKOLOV & KOLEV 2011) the *coast* is a narrow strip of the land surface

contact and interaction between land and water bodies (oceans, seas, lakes, dams) or between land and river courses (rivers, streams temporary). It consists of underwater and surface area and is characterized by a diverse cross section developed on both sides of the shore line. According to the same authors the *coast line* is the line of transition from the land to water surface. It is the main line in used in the mapping. The term *coast line* is used also for the territorial border for countries with access to the sea.

In the Dictionary of physical geography, WHITTOW (1984) determined the *coast line* as a line forming the boundary between the land and water. More specifically the term refers to the highest limit reached by the swash of storm waves during the high-water spring tides.

The kinetic energy of river currents and the sea wave surf, manifested in abrasion and accumulation, are the main factors for the formation of the coast. The tectonic movements also play role in this process. The *coasts are low and high* and include specific forms of the relief - underwater sand shafts, bench, cliff, landslides, rock falls, low sea and river terraces, dunes, sandy beaches, lagoons, estuaries, deltas and more.

*Bank* is defined as a part of the coastal zone, which is formed with relative width of 5 to 20 km, at the front of which are preserved traces of ancient coast lines formed by dynamic interaction between the land and the corresponding basin. Banks can be formed in connection with the raising or lowering of the coastal land. According to their origins, banks are mainly divided into abrasion and accumulative types.

*Abrasion coast* is a high and steep sea or lake shore, which was destroyed by the action of the wave surf. Key elements in the construction of the abrasive beach are underwater slope, underwater accumulative terrace, wave niche and cliff limiting abrasion terrace of land.

*Accumulative beach* is a sea or a lake shore, built by the accumulation of sediments under the influence of river accumulation, waves and currents. Major factors in the distribution of the deposition of the sludge within the scope of shoreline are the accumulated energy in the river flow, the waves and surge flow.

### Shore types (ST)

In regard to the origin, process of formation and achieved morphology, shores could be divided in several types (ST), commonly defined as:

*Neutral ST* is a beach, in the formation and

morphology of which any dependence on the construction of drought was not noticed. It is most common for the platform structures.

*River ST* is the strip of interaction between river water and land. Riverbanks could be of erosion type, formed by the action of the vertical and lateral erosion or of accumulative type caused by the accumulation of deposits. The morphological characteristics of the river are determined by the geological structure, dynamics of river flow and tectonic movements. Important are also the gravitational processes (landslides, etc.).

*Ingressive ST* is the indented stretch of beach formed in Ingression. Depending on the genesis of the segmentation of the submerged coastal land *fjord, riasov, firth, lagoon, dalmatian coast* are differentiated.

Riasov (discordant) ST is formed when the general direction of the shore or shoreline is arranged obliquely or transversely to the direction of the axes of the geological structures which form the coast. It is characterized by highly uneven terrain, comprised from the alteration of multiple bays, separated by cliffs sections.

Dalmatian (concordance) ST is formed when the general direction of the coast is consistent with the stretches of geological structures. By contrast with the cross (discordant) coast, it is characterized with small segmentation and little variety in coastal shapes.

Marshev ST is a wide strip of coast based on two elements - the vast lowlands (wool) and sloping shores accumulative (marsh), which are formed by a decent flats marine waves.

Reefs are defined as a strip of water area within the scope of which underwater limestone formations are developed. These formations are built by the vital activity of colonial polyps, calcareous algae and other organisms and are located sub-parallel to the coastal line. Reefs are mostly typical for the warm tropical seas and among them the following types are distinguished: barrier, atoll, coastal, etc.

Fjord is a strip of sea coast, indented by fjord valleys flooded by the sea. Fjords are narrow and deep seabays with steep to steep slopes that plunge deep into the mainland. Fjords themselves are former glacial valleys in which the ice was subsequently converted into inlets. They can reach a large length, exemplified by the Sogn fjord with its 187 km.

Shherov ST is a beach with numerous islands, made of large crystal blocks cut by glaciers and separated by shallow streams.

Cliff ST is defined as a steep bank, built by indigenous rocks that separate the land from the sea.

At its base often recesses are formed by surf waves and called surge niches.

Firth ST is formed when the banks fully match the outline of the submerged river valleys. The bay may be connected with the sea or to be closed from the sea with sand. In this way there by coastal lakes are formed, which can be exemplified by the Bulgarian Black Sea coastal lakes Varna Lake, Burgasko lake, Atanasovsko lake, etc.

Lagoon ST is formed when waves carry destroyed material which is deposited on the seabed, forming a sandy underwater shaft. Gradually sandy shaft increases its size as departing from the surface and removed to land shallow water body part or occlude small bays (lagoon). In these scenarios coastal lakes also could be formed. One of the examples from the Bulgarian Black Sea coast is the Pomorie Lake.

Estuaries ST are defined as shores formed due to the enhanced reduction in the coast bay estuaries (estuaries of rivers Elbe, Oder, Seine, Thames, Congo, etc.).

### Morphostructure

Three main elements can be distinguished in the relief of the seabed and ocean floor: the *shelf*, *continental slope* and *abyssal bottom*. In each element a number of meso forms, which diversify the underwater surface could be differentiated (KANEV 1980, 1983, 1989).

*Shelf* resembles continental plane inclined towards the interior of the water basin. The average slope of the shelf is 0,5-1,0°. Shelf is built from rocks that formed the continents. It is assumed that it extends from the shoreline to the area where the slope changes abruptly and began continental slope. The boundaries of the shelf are determined almost flat, surface with small gradient, and not from the sea depths reaching to 200 m. In the shelf zone are concentrated reserves of various natural resources, which in recent decades focus the interest of scientists from different fields. This led to a change in the perception of the continental shelf and its border. The discovery that the shelf is made of continental type crust cause a shift in the boundaries of the shelf zone to border with underwater plane and sharp amending its slope.

Underwater valleys, which occur naturally over river valleys, are disclosed in the shelf zone. In addition, significant declines with steep slopes that resemble underwater canyons have been revealed in the shelf.

The *continental slope* covers a wide strip of the seabed. The average slopes are between 5-7°, but there have been found also areas where the

average slope reaches 15-20°. The continental slope is predominantly with a stepped topography resembling a macro slide surface. At the very slope develops an underwater feet widely surrounded by steep slopes. Smaller steps that resemble landslides on the Earth drought are observed in many places. The continental slope is cut by narrow and deep canyon valleys, which flow into the hill side with more than 2000 m depth. Their cross section is predominantly with a V-form. Dissected canyons and gullies resembles occur in some places.

Continental slope occupies the transition band between the continental slope and abyssal bottom reaching a depth of 5000-6000 m. The average slope of the foot does not exceed 2,5°. The surface of the continental slope is hilly with several alluvial cones, cut in pieces of canyon valleys and large amounts of slumped material. The continental slope is considered the most dynamic part of the ocean bottom.

*Abyssal zone* occupies the deepest part of the underwater terrain. Systems of abyssal valleys that have equal or hilly relief can be seen there. Among them oceanic trenches and the mid-ocean ridges are observed.

The following large morphological structural units: shelf, planar morphostructures; shelf, kettle morphostructures; continental slope morphostructures; ridge-plateau morphostructures; continental-bases morphostructures; abyssal-planar morphostructures; ridge-oceanic morphostructures; arc-island morphostructures and grooved morphostructures can be recognized in the pelagic morphostructures (KANEV 1980). Only the first two of them (shelf, flat and shelf, valleys morphostructures) are related directly to the coastal zone.

Shelf plane morphostructures cover extensive leveled spaces. Modern deposits in them form the large coastal strip, which does not exceed 7-8 km width. At 30-40 km of the coast line strips of modern marine sediments that form low and narrow shafts can be seen. These sediments are mobile as they can overgrow drowned river valleys and form a flattened sandy surface in front of the coast line. Terraced slopes and torn terraced grounds were found in the shelf. It is assumed that the terraced shelf is formed by a submerged by sea water terraces. Due to the great fragmentation of platforms and terraces complications of the terraced slope, they are commonly accepted as underwater landslides.

Shelf kettle morphostructures occupy both central and peripheral parts of the shelf, and in some cases, the interior of the sea basin is encircled by island arcs. Shelf kettles are deeper than 2000 m and

can reach 5000 m. They have steep slopes, but the hollow bottoms are equal or rolling.

## Discussion

The brief review provided above was done after checking of the many definitions proposed to describe the coastal structures and main shore types and provided the most common geomorphological understandings

of the main terms. It shows also the possibilities to find different accents in the definitions of some broadly used geographical terms, which is due to the fact that some classifications are based on geomorphology, but others are built on the water circulation, etc. Therefore, it is strongly recommended in future biological works on coastal biodiversity, monitoring and nature conservation to provide clear definitions and relevant references in the methodological descriptions.

## References

- KANEV D. 1980. General geomorphology. Sofia: Publ. House of Sofia University "Kliment Ohridski" 610 p. (In Bulgarian)
- KANEV D. 1983. General geomorphology. Sofia: Nauka I Izkustvo. 400 p. (In Bulgarian)
- KANEV D. D. 1989. Geomorphology of Bulgaria. Sofia: Publ. House of Sofia University "St. Kliment Ohridski". 322 p. (In Bulgarian)
- MAYHEW S. 2015. A Dictionary of geography. Oxford University Press. 5<sup>th</sup> edition. 560 p.
- NIKOLOV T. & KOLEV B. (Eds.) 2011. Geographical term dictionary. Sofia: Academic press "Prof. Marin Drinov". 297 p. (In Bulgarian)
- WHITTOW J. (Ed.) 1984. The Penguin Dictionary of physical geography. London: Allen Lane. 591p.
- WHITTOW J. B. 2005. The Penguin Dictionary of physical geography. UK: Penguin Books Ltd. 2nd edition. 608 p.