

NATURAL-GEOGRAPHIC CHARACTERISTICS OF THE BOKA KOTORSKA AREA AS THE BASIS OF DEVELOPMENT

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The paper contains essential interaction determinants of the spatial position and natural geographical bases of the Boka Kotorska area in the function of its development. Covering an area of about 800 km² and with more than 60.000 inhabitants it form a specific littoral area in the contact zone Montenegro-Croatia. Special consideration is given to the characteristics of the geological origin and structure of this area, to geomorphological features, climatovegetational characteristics and influence of soils. Rich water appearances were essential for the preservation and continuity of life and economic development. The author points out the importance of physicogeographical components in historiogeographical and recent development and also the necessity of valuing them in the modern socioeconomic development conditions.

Key words: Boka Kotorska, geographical features, development

Rad sadržava bitne odrednice međutjecaja prostornog položaja i prirodno-geografske osnove Boka kotorske u funkciji njena razvoja u prošlosti i danas. S oko 800 km² i preko 60.000 stanovnika čini specifičan primorski prostor u dodirnoj zoni Crna Gora-Hrvatska. Posebno se razmatraju značajke geološkog nastanka i građe otoka, geomorfološka obilježja, klimavegetacijske značajke i utjecaj tala. Bogatstvo vode bitno je za očuvanje i kontinuitet života i gospodarskog razvoja. Autor ukazuju na značenje fizičko-geografskih sastojnica, ali i na nužnost njihova vrednovanja s obzirom na povijesno-geografske i suvremene društveno-gospodarske okolnosti razvoja.

Ključne riječi: Boka kotorska, geografska obilježja, razvoj

The significance of the geographical position, extension and spatial differentiation

Boka Kotorska (*Mouth of Kotor*, Eng., *Bouches de Kotor*, Fr., *Bocche di Cattaro*, It.) is one of the best known bays of the Adriatic, situated in southern part of its eastern coast in the contact zone of nowadays Montenegrin and Croatian territories. By its deep indentation into the land, by its expansion and extensiveness and especially by its historical geographical and geostrategic role and significance it stands out among the bays

of the Mediterranean (Fig. 1). The entrance to Boka Kotorska is closed by the cape Oštra from the west and by the cape Mirište from the east at the very mouth or entrance of the bay called the Strait of Oštra or the entrance of Boka Kotorska. The most dragged part of the bay near Kotor is at 15 nautical mile distance from its entrance.

This area, inhabited since the oldest times, standing out in preroman Illyrian thalassocracy on the Adriatic, preserved great importance in traffic-geographical valuation in the periods of Antiquity and Middle Ages. From 1420 to 1918 (1929) administrative-political affiliation of Boka Kotorska area was connected with the Dalmatian South Croatian territory except the corridor of Sutorina which made part of Herzegovinian territory. From then it was mostly connected with Montenegrin (or Zeta Banovina, 1929-1944) territory, and after W.W. II it was almost completely annexed to Montenegro within the borders of communist Yugoslavia. Only a smaller part of Vitaljina exit into the most open part of the bay from the cape Oštra to the western cape of the cove Čipavica, being centennial South Croatian territory of Dubrovnik and Dalmatia, remained within the borders of the Federal Republic of Croatia. After the break-up of the S.F.R. Yugoslavia in 1991, Boka Kotorska, on the basis of the international recognition of ex Yugoslav republics' borders, remained mostly within the borders of Montenegro i. e. of the S. R. Yugoslavia and its smaller part within the borders of the Republic of Croatia.



Fig. 1 Geographical position of Boka Kotorska

Sl. 1. Geografski položaj Boke kotorske

The geographical position of this bay has multiple significance, which manifests in millenary geostrategic importance for geopolitical units of the eastern Adriatic coast, and where even today the interests of great world forces and pacts (NATO, Russian interests) connected with the predominance over the Mediterranean interfere or those of Balkan countries in their aspiration to get exit to the Adriatic as well as the interests of Croatia and Central European circle of countries to insure the existence of Mediterranean-

West European civilisation. There is also Italy searching for economic domination over the Adriatic Basin etc.

The great importance in Adriatic and Mediterranean maritime traffic always has been evident in long-lasting development of coastal urban centres in this Bay. Even today it is well expressed in the role of the Kotor ship company.

Geographically, Boka Kotorska is constituted of three well expressed unities: exterior, central and interior unities (Fig. 2). Its exterior part consists of Hercegnovi-Topla Bay with Oštra Strait i. e. Boka Kotorska Door, with surrounding land belonging to it. The central part is linked to the Tivat Bay and the interior part to the Kotor Bay i.e. Risan-Morinj-Kotor Bay. The Bays of Hercegnovi and Tivat are connected by Kumbor Strait and the Kotor and Tivat Bays are joined by Verige Strait (width 340 m, length 2300 m). In the narrow littoral zone all urban centers have been placed using local geographical circumstances and maritime activities: Kotor, Hercegnovi, Perast, Risan, Tivat, Bijela etc. In the immediate hinterland of Boka Kotorska there are mountain peaks of Lovćen (1749 m), Dobrostrica (1590 m), Subra (1680 m), Orjen (1894 m) and other mountains whose steep slopes dip downward to the bay coasts, forming a unique geomorphological basis characterised by striking unlevelnesses and contrasts. Such a constellation of geomorphological features causes also earthquaking (seismicity) of the zone, in other words embodies a considerable danger of possible earthquakes.

Within Montenegro, Boka Kotorska region is administratively organised into municipalities: Hercegnovi (235 km²), Kotor (335,4 km²) and Tivat (46,1 km²), a total of 617 km², with 53,028 inhabitants in 1981, in a larger sense the municipality of Budva (122 km² and 6,106 inhabitants in 1981) is associated with the region, which amounts to 839 km² and 61,660 inhabitants (1981). After W. W. II municipal borderlines of this area were shifted several times as well as the borderline between Montenegro and Bosnia and Herzegovina. In the village of Vitaljina belonging to the Republic of Croatia, 300 inhabitants lived in 1991 (223 in 2001).

Natural-geographic features

Geomorphological features, structures and genesis

The relief basis of the Boka Kotorska area is made up of karst ridges and sunken, deeply cut valleys, lying in the common Dinaric direction NW-SE. Boka Kotorska is a deeply dragged in bay and one of the best indented parts of the Adriatic coast. The most indented are: Kotor Bay (40 m deep), Morinj or Risan Bay (37 m deep) which are sometimes called Morinj-Kotor Bay (PASINOVIĆ, 1967) and which are connected with other parts of the bay i. e. with the Bay of Tivat by Verige Strait (the narrowest part is 340 m wide and maximum depth measures 37 m). The Bay of Tivat is the most extensive part of Boka Kotorska reaching the depth of 48 m in its southern part, but considerably shallowed in its eastern part. It is connected with Hercegnovi Bay (depth 47 m) by Kumbor straits (depth 43 m, the least width 730 m). Here the 1360 m gateway between Kobilica and Kabala capes gives passage to the entrance part so called Boka Kotorska Door between Oštra and Vitaljina from NW and Luštica from SE (depth to 58 m). Unsunken parts of present-day relief around the bay form a particular and differentiated medley of

geomorphological phenomena and forms, one of the most attractive on the eastern coast of the Adriatic. Such a constellation of complex of bays, straits and doors has enabled a millenary resistance and development of the local units in accordance with the sea activities.

Composed forms of the local karstic morphology, in a similar way as in other parts of Dinaric karst, were formed by the end of the last Pleistocene epoch (Würm), when there was land there. The contact of impermeable flysch (sandstones, marls, conglomerates) with porous carbonates, exposed to corrosive processes caused also the occurrence of numerous springs and sources and with the climatic conditions, prevailing during the end of Neogene, predestined levelling and washing away of flysch, creating inundation sediments on limestone, intensive margin limestone corrosion, plateau spreading and creating of complex and specific karst forms. Strong vertical movements in external contact with Triassic dolomites, cretaceous limestone and Tertiary (Palaeogene) flysch point to the complex tectonic-erosive origin of the bay. "On the slope of high and humid coastal mountain ridge intensive processes of differential erosion were performed, which finished in creating closed recessions; waters eroded impermeable rocks and sinking through limestone. Widenings were formed in less resistant flysch layers and dolomites and narrow gorges appeared in limestone. Strong springs which issue from the bottom of internal bay witness the deepness of karst process." (ROGLIĆ, 1962). Such a composition of very different and specific morphological details, enabled for centuries particular anthropogeographic evaluation of local microareas depending on local circumstances.

Namely, today's appearance and coastline were shaped after the last pleistocene glacial period, when the sea level rose about 100 m and when more narrowings and widenings were formed within the bay zone. Up to then a powerful river flew with a deep valley penetration and predetermined tectonic movements, under considerably colder climate conditions (ca 10 °C lower averages with glaciers on Orjen Mountain). It flew from direction of Ledenice-Vrsno penetration over Risan, with its left-hand tributaries from Kotor direction (Zveronjak, Škurda), and Tivat direction (Gradiošnica, Vodolješnica or Široka Rijeka, Jankova Voda, Koložun), and its right-hand tributaries from directions Morinj, Kut (Rujevo Potok and Suhi Potok) and Sutorina (the Sutorina River). In the soft flysch layers the river formed valley widenings and deposited fluvial sediments, and in hard carboniferous rocks of the marked ridges of Snježnica mountain (Devesilje, 775 m), Vrmac (St. Ilija, 765 m), and Obostnik (585 m) – Kobila (452 m) it cut in steep ravines, gorges. The sea indented deeply into the land along the lowest parts of the valley.

Higher peripheral parts built out of hard rocks are the land space with gravitates towards the bay and which can be differentiated into several basic zones. The zone Vitaljina belongs to Croatia and is characterised by lower coastal ridge (with the Cape Oštra detached by 65 m narrow Prevlaka /= isthmus/), and the higher micro zone of Kobila's Ridge. Kobila stretches northwest toward Vinogradina and Studeno, and at the same time constitutes traditional border (1718-1806 Dubrovnik-Turkish b., then Austro-Hungarian-Turkish b. until 1878 etc.), and present-day border between Croatia and Montenegro.

From Kobila and Osoj on the west to the area of Crkvice and Mačja Planina (Cat's Mountain, 1368 m) on the SE there are the Valley of Sutorina, gentle mountainous relief of Herceg Novi-Bijela coastal inland, and mountainous karst of Orjen Mountain and Krivošije Plateau areas. Mountainous massif of Orjen and Krivošije dominates this space.

It covers 403,9 km² (RİĐANOVIĆ, 1966) two thirds of which are in Montenegro among Grab Fault (rift) in the west and deep valleys of the Trebišnjica River tributaries and Grahovo Polje in the north, meridianly set down valley at contact point with Katun karst which goes on along the Risan Bay in the east, and at the foot of mountain slopes facing south i. e. Boka coastal area. The highest zone is within the borders of the national park of Orjen, which is partly situated in neighbouring Bosnia and Herzegovina. This area, due to its roughness and isolation, has been always less inhabited and valued. In traditional local economy cattle breeding has played an important role, which resulted with a disperse settling in many small villages and hamlets.

In his study, J. Ridanović specially treated Orjen (1966), therefore only basic data are given here. He points out that Orjen, in contrast to other coastal mountains of eastern Adriatic littoral, which extend in Dinaric direction (NW-SE), denotes an uncommon form of a detached massif. He classifies five massif sectors (western or Vrbanj sector, eastern or Crkvice s., north-western and northern or Bijela gora s., northwestern of Dobri Do s., and final northwestern or Konj-Orahovica s.). Orjen is characterised by a rocky complex with numerous karst recesses. These recesses are regularly open towards edges. Smaller and bigger plane micro areas with abundance of well-preserved glacier traces also stand out. Expressive and somewhere bizarre karst forms are a common phenomenon. "Numerous mountainous crests stretch radially from the centre and alternate with imposing troughlike recesses, which are open towards the edges" (RİĐANOVIĆ, 1966). Mountainous complex is constituted of numerous differentiated micro unities of karst elevations of traverses (Reovačka greda, Crljena greda, Vela greda, Kokotova greda, Mrčava greda, Sokolova greda, Ljuta greda, etc.), plateaus micro zones, cracks in limestone, and the like, then karst valleys i.e. dolines or sinkholes (Reovački Dolovi, Duboki Do, Crni Do, Vuči Do, Stjepov Do, Dubovi Do etc.; there are over one 100 of them, and they are the most important part of the highland area in Orjen karst, often with moraine deposits at the bottoms), dells ("udolina"), little flatten areas ("poljica"; Poljana and others), bays and rarely smaller or vast swallow-holes. The largest SW part of this area pertains to Kotor municipality. Orjen crest (1895 m) is a peak zone with several other outstanding peaks (Pazua 1771 m, Crljena greda 1548 m, Vučji zub 1802 m) in border area with Bosnia and Herzegovina.

Orjen is formed of different carbonate rocks, predominantly limestone, where various carstic forms and phenomena are frequent, but there is also a fair number of dolomites and rocks mixed with marly and clayey substances. The rocks are furrowy and date from Trias to Pleistocene. There are numerous traces of glaciers' work dating from ice ages. Moraine material is found in the Montenegrin part southwest from Orjen zone (Orjen, Subra, Vrbanje, Vuči Do, Mokri Do, Kruševica and others), around Crkvice, in the Risan Bay, then in the south at the foot of Radošćak and Dobrostica under the cutting of Vratilo towards Kameno. As various petrographic and stratigraphic complexes come to surface, a considerable disarrangement of sediments is evident, which is the repercussion of powerful tectonics. Namely, the wedge of Orjen between Zeta-Skadar basin and deep South Adriatic submergence indicates geotectonically significant instability and activity.

With regard to the height and climatic conditions (lower temperatures, great temperature vacillations, large quantities of precipitation, snowfalls and the like) population density is low, and Crkvice developed at a height of 1097 m above sea level. There is a larger number of cave objects in the zone of Orjen and Crkvice. Several fault lines of meridian direction form eastern boundary towards Katun karst. Along these

cracks several smaller dilatations developed (Ledenice, Grkovac, Markov do) and more northernly, outside of the space belonging to Boka, Dvrsno polje. The southern part of Krivošije is composed of outstanding massifs: Subra (1680 m), Dobrostica (1570 m), Radoštak (1446 m), Rt (1403 m), Kabla (1470 m), Baštike (1391 m) and somewhat lower – Snježnica (1104 m), which top steeply lower zones that extend in a semicircle around massif from Vrbanja over Kruševica, Mokrine, Kut to Morinj.

In this way the Orjen massif is markedly separated by Dobrostica and Radoštak in the sea direction (the Tivat Bay and the Topla or Hercegnovi Bay) from Dračevica and other lower and gentle relief zones in Hercegnovi-Bijela hinterland and coastland named Podgor, where, besides already mentioned lower zones, smaller reefs stand out. They are: Petrova glava (760 m), Gomila (769 m), Devesilje (775 m), Janča or Jarčeva glava (693 m), Jeremijino brdo (716 m), and those nearer to the coast: Mijojl brdo (430 m), Rid (558 m) and Sokolova glava (666 m). Close to the coast stand out Španjola (177 m) and Savina (102 m) in Hercegnovi, Buljana (131 m) near Zelenika, Ploče (131 m) near Bijela and others. Among numerous peaks and elevations, flysch phenomena (marls and sandstone formations) are considerable and the variety of structure and material enabled numerous water appearances. Many gullies and streams cut their steep valleys into the relief, with notable extendings and levellings here and there. Inside mountain elevations numerous small terraces in karst or doline extendings can be seen, more important among them being: Ubli, Kameno, Žlijebi, Kuti Gornji and Donji, Morinj, as well as little valleys, coastal terraces and low brook and torrent mouths. These, mostly arable microzones have enabled local inhabitancy since oldest times. An additional peak is worth mentioning in the zone towards Croatian border: Vidov vrh and several knolls: Miljakovina, Oštri vrh (366 m), Bijela Kuka and others. Elevations Ilijina Kita (1089 m), Studeno (480) m and Kobila form border part with Croatia. Sutorina Valley, also well-inhabited and evaluated agrarian zone, lays between them and Hercegnovi karst hinterland in NW-SE direction. Its tributaries, which join it mostly from the left side (NE), enlarge the valley on the left side (Presjeka Bay, Trtora and others).

The land area to the NE of the bay i. e. in the hinterland of Hercegnovi and partly of Risan is extended and encloses Krivošije with Orjen and the Sutorina Valley. On the other hand, in Risan-Kotor zone, only a narrow part of maritime crest and steep slopes of Dobrota belong to Boka Kotorska. In the interior, these slopes continue through traditional Montenegrin space of the Katun karst plateau of Njeguši. The soil mounts steeply in the hinterland of Risan, and in the hinterland of Perast and Orahovac Ilijino Brdo (873 m) and Rudo Brdo (776 m) dominate. Dobrota slopes formed of the Jurassic period limestone, rise from the sea level to the over 900 m height (915 m over Ljuta, 909 m above Marovići, 920 m above Plagenta) in the zone barely 1000-1300 m large where ground slopes mostly surpass 35% of inclining. This zone is crossed by numerous arid valleys and screes. The Plateau of Njeguši in hinterland, at an altitude of 900-1100 m is a carstic, denuded landscape with some outstanding peaks (Pločnik, 1202 m), Mravljanik (1339 m), etc, and numerous sink-holes. Flysch appears in a narrow coastal zone along the whole area of Dobrota with Kotor, most frequently along the coast covered in younger Quaternary sediments, which enables also agrarian evaluation of the region. The most recessed part of the Kotor Bay is marked by the steep valley of the River Škurda and considerably larger valley of Zveronjak Rivulet, filled with alluvia in the lower course, formed mostly in Eocene flysch formations and covering them. Southward of the Zveronjak source, Trojica and Gorazde extend. These arable micro zones have played a

big role in the development of urban centre Kotor up to now. Upper valleys of Krimalj stream (southward) and Odoljenščica (north-westward) cut between them, which flow off towards Župa.

Župa (Upper Župa) is the lowest (0-20 m) and levelled space of a flysch valley opened toward the Bay of Tivat (Polje and Krtole valleys) on the WSW, situated among Vrmac ridge on the north, the Luštica peninsula on the west, Grbalj on the south and SW, and Lovćen slopes on the east (Trojica, Grabov Pod). The flysch basis is covered here by young soft alluvial deposits laid down by numerous running and converging waters (Odoljenščica, Koložun, Široka, Gradioštica, Jankova voda and others), which, at the mouths join together into a delta shaped enlargement with numerous irregular backwaters and channels. This wetland zone was only partially cultivated in the past, but potentially it could be much more evaluated in agrarian production. From old times propitious part, flooded by sea, has been used as salt pans (Solila) so that a larger part of the zone is also called Solila polje (Soliosko polje). Old salt pans were renewed in 1961 when modern salt production started (BLAŠKOVIĆ, 1962). Besides, the levelled space of Upper Župa i. e. of the Tivatsko Polje, is the only favourable zone for building a larger airport and, in consequence the old runway was modernised. Between Odoljenščica and Koložun River mouths in the west and Gradioštica in the north, more resistant parts of flysch remained in elevation of Stražnice (29 m), which continues to Prevlaka (Sv. Trojstvo – St. Trinity) in NW direction, then islets Stradioti (St. Mark) and Our Lady of Mercy. The notion of Župa in a larger sense comprises also Grbalj (Lower Župa).

Grbalj (Lower Župa) is a south-eastward continuation of Upper Župa, the Luštica peninsula being on the west, the open Adriatic on SW, the Budva littoral on the southwest and the Lovćen massif in the east. Grbalj is composed of springing place and upper valley of the Koložun River and its tributaries, distributary zone towards the valley of Lukavac (or Kučac) stream with the Mrčevo Polje. There are also the tributaries of Lukavac: Vrutak, Drenoštica (FUR.: *Cuçaç F. i Drenosiça F.*; PAL.: *Cuzaz T.* and *Dremostiza T.*; TAB.: *Cuzacz Fl.*) and others as well as the whole area between these valleys towards the Adriatic, i. e. Grbalj in a narrower sense, which is formed of carbonic crests and the Krtole Valley in the northwest up to the Platamuni Cape in the south-east.

Carbonic crests and Grbalj valleys are formed of low coastal elevations and peaks of the two parallel crests extended in Dinaric direction from NW towards SE: Velović Brdo (232 m), Grabovac (256 m), Kosmač (294 m), Prčja Glava (408 m), Mačkova Gomila (326 m), Ogradina (364 m), Tršteno (65 m), and close to the coast the Velika Gora crest (FUR.: *M. Velika Gora*) with the knolls: Stražnik (141 m), Viljina (117 m), Velja Gora (350 m), Gradište (425 m), Sv. Stjepan (307 m), Kupa (141 m). Between the crest and some knolls there are narrow and more fertile valleys of Bigova penetration (Trašte), Zagora, Vranovići, Glavati and others built by cretaceous (senonian) limestone with dolomites. By the coast there are outstanding capes Jaz and Platamuni (FUR: *Cao Platamoni*) in the south, Kostovica and Žukac (Žukovac) towards the open sea and to the SW the Cape of Trašte (Punta od Bigove), which shelters the wide, spacious bay of Trašte. A larger number of small coves line the shore (Bigova, Slatinica, Žabica, Žukovac, Mali and Veliki Nerin, Komin, Velika and Mala Krekavica) till the bays of Tršteno and Jaz open towards the SE. There is only one reef in front of the coast. It is Kalafat to the NW of the Žukovac Cape.

The zone of Grbalj slopes in the ENE direction towards the flysch area of the Koložun (Gornji Grbalj) and Lukovac (Donji Grbalj) valleys. The small river of Lukovac

(or Kučac) deposited, in its lower flow, the wide valley of Mrčevo polje, which ends up as a sandy beach in the Jaz valley. To the east, flysch slopes climb towards Upper Carboniferous slopes of Grabov Pod (1452 m), Koložun (1474 m), Goliš (1046 m). The flysch zone is partly covered in younger alluvial deposits. Numerous brooks (Koložun, Kriminalj et al.), by means of erosion, cut their dells into softer parts of marl and sandstone. The Koložun area faces Gornja Župa (Upper Župa) and the one of Lukovac looks onto the Mrčevo Polje.

A lot of water and plenty of agrariable micro areas in flysch and alluvium of the zone enabled the development of many small settlements in this zone, as well as a significant local food production in the past. Nowadays these potentials should be improved as well.

Vrmac, an imposing ridge situated to the west of the Zveronjak valley and north of levelled Gornja Župa, between the Kotor and Tivat Bays, and the Verige straits, which connects them, is an outstanding peninsula with particular relief features. Its crests extend in NNW-SSE direction. It is built of older carboniferous conglomerates of Triassic, Jurassic and Cretaceous sediments, which towards the SW continue down the flysch zone of the Eocene sandstone and marl whereas younger and soft Quarter alluvial layers are settled circumferally in coastal zone and on flysch. Verige Strait slopes are built of dense limestone, which, being excellent building stone, was used in the process of building in Venice, Odessa, New York etc. (BLAŠKOVIĆ, 1962). The slopes of the peninsula are milder towards SW just because of the directions of watercourses and the width of flysch area in the zone Donja Lastva-Tivat-Crni Plat-Polje, whereas N and NE slopes are steeper with considerably narrower coastal area of the Quaternary deposits in the zone Stoliv-Prčanj-Muo. The peaks that stand out in the highest zone are Sv. Ilija (St. Elias) or Vrmac (765 m), Velji Vrh (712 m), Čisti Vrh (616 m), Popova Glava (584 m), Sv. Vid (St. Vitus, 440 m), Kalac (417 m), Boljun (487 m). There are numerous sources in the peak part, which become active specially in the moister part of the year when numerous streams flow away towards the peninsula' edges. So numerous dells, often with steep slopes are differentiated. The most considerable of them is the valley of Gradioštica, which flows towards the south and SW forming a vast alluvial plateau at the mouth, into the Tivat Bay. In the upper flow near Bogdanići, waters accumulate at the foot of St. Ilija, and Čisti Vrh in the hilly extension. The valleys of the brooks: Paukovo, Školjanovo, Opatovo et al. are also oriented towards the Tivat Bay, while Spilje and others face the Bay of Kotor. The flysch zone, towards the south, is cut in many places by numerous brooks and tributaries of the Gradiošnica and Vodolješnica. Elevations remained between them in more resistant rocks (Zekova glava, 60 m, Sinjarevo, 43 m). The zone is a continuation of the lower part of Župa. It is well inhabited and evaluated through an intensive agrarian production and development of settlements, among them Tivat being the most significant centre.

Similarly to Vrmac the wide peninsula of Luštica is an extension of the area of Grbalj and Župa and it shields the bays of Tivat and Topla from the open sea. Its geological structure is carbonate, consisting mostly of senonian limestone and some dolomite. The main crest, which stretches in Dinaric direction and is located to the northeast of the peninsula, is dominated by Obostnik (585 m; on the old geographical maps Oboštik) with smaller peaks: Disanova gomila (438 m) and Kovačeva gomila (321 m). Several knolls, among which Blizanštik (376 m) dominates, stand out in southwestern part of the peninsula: Velje brdo (215 m), Kosmač (213 m), Veliko Graište (251 m),

Kipetanj (241 m), Gomilice (233 m), Kabala (145 m), Gomila (155 m), Mačka (172 m), et al. Such a physico-geographical constellation has caused a low inhabitancy and mostly poor cattle-breeding evaluation of the zone. Some smaller valleys and dry valleys, cut in among knolls, are exploited by few settlements: Brguli, Mrkovi, Klinci, Mardari, Zabrdje, Krtoli and others. The slopes of the peninsula are steeper to the NE than towards SW, though there are also some steeper parts (Strmac, Dobreč, Tijesna Luka et al.). Northern coast towards the Bays of Tivat and Topla is poorly indented and not easily accessible, with only a few small coves (Oko, Bjelila, Rose), whereas there are more feebly sheltered coves. The coves that line up from the NW towards the NSE are: Ploča, Dobreč, Žanjica, Mirišta, Lučica, Zlatna or Morakova Luka, Mala Gora, Veslo, Tijesna Luka, Dobra Luka. The cape Kočište on the Luštica and the cape Trašte on the Grbalj close the Trašte Bay where there is a series of coves on the side of the Luštica: Međedna (Međena), Oblatna and Pržna. Outstanding capes are: Đurov Kam, Dobreč, Mirišta (Arza), Debeli, Zakolje, Mala Gora, Veslo, Mačka, Kočište, Kamenova. In front of the coast there are islets: Velika Žanjica (or Veliki Žanjic) called also Lastavica, and it is recorded into Italian geographic maps of the 19th c. as Rondoni and Mamula like the fortress known under the same name, which was named after the Austrian officer), and Mala Žanjica (or Mali Žanjic or Mala Gospa). The coasts of Luštica are mostly rocky and difficult to approach, with a larger number of speleological phenomena (Međedna or Međena Cove, Karadica, Modra Spilja /Blue grotte/ et al.).

Along the submerged Boka Kotorska valley, on its upper flank parts, which were not covered by sea, there are often alluvial sediments and the remnants of the former river terraces. Some elevations composed of carbonate rocks, which could not be levelled by the river erosion, remained in depression widenings. In our days the peaks of these hillocks stick out shaped like small islets or shallows. The well known and attractive islets are: Gospa od Šrkpjela (Our Lady of Škrpjelo), Sv. Đorđe (St. George), Otok Gospe od Milosrđa (Our Lady of Charity Island), Stradioti or Sv. Marko (formerly also Sv. Gabrijel, 36 m high), Prevlaka or Cvjetni Otok, Velika Žanjica, Mala Gospa. Better known shallows are Tunja at the depth of 13 m in the Tivat Bay, Ploča at 12 m, at the Boka Kotorska entrance, et al. Large layer slopes, considerable delevelings and instability of alluvia, avalanche material and screes, condition the effects of denudation e. i. erosion, and in some places of the coastal zone considerably expressed abrasion. Washed away material settled to the bottom of the bay so that the submerged part of the former river valley is often covered in recent sediments of mud and sand.

Relief characteristics have made possible settling from prehistoric times up to nowadays. The edges of coastal levellings are particularly suitable for settling (Sutorina, Hercegnovi, Bijela, Tivatsko polje /Tivat field/, Župa, Morinj, Risan, Škaljari et al.) but also a number of dells, valleys, little flatten areas ("poljica") and closed forms just off hinterland, where suitable arable land has been found. Sheltered condition of the bay and its deep indentation have enabled millenary orientation towards sea and seafaring, which stimulated the development of urban agglomerations along the coast from ancient times up to the present day, especially where suitable farming zones have been placed in the very neighbourhood (Kotor, Risan, Hercegnovi, and recently Tivat). With its 49,9% of urban population (1991, and probably almost 60% in 2001), Boka Kotorska is the most urbanised region of the contemporary Montenegro.

The coasts are mostly steep, and at the mouths of numerous brooks, gullies and streams there is some more alluvial material, and it is there that gravel and sandy coves

with attractive sandy beaches are formed (Igalo, Tivat Bay et al.). The length of the coastline is 106 km and the total sea surface of the Bay is 90 km². The bottom of the Bay, whose mean depth varies from 30 to 40 m, has the form of a plateau filled with deposits, in karst formations, and is slightly inclined towards the exit of the Bay.

Speleological phenomena are also numerous, which is due to the karst basis which swallows enormous quantities of waters which, in the underground, create forms in vertical direction. There are plenty of water leaky cracks (fissures) of large capacity, especially in higher zones. Already Slovene potholer-biologist E. Pretner knew over 80 potholing localities on Orjen (RIDANOVIĆ, 1966). J. Ridanović published the ground-plan of a 184 metre deep Jasen cave on Reovačka greda (to the north of Crkvice (1966, 53). The other known caves are: Jama (Cave) on Orjen-ridge, Rajčeva Jama near V. Kabal (or Kabao), Vranja jama near Prstati dol, Vučja Jama at Vrbanj, Ledenica on Kalipna Greda, Galova Jama near Kruševica et al. Many of them are connected with springs and wells in coastal area e.g. with Sopot, Spilo and Smokovac in the Bay of Risan (RIDANOVIĆ, 1966). Waters also flow away into underground and towards sea by a larger number of chasms. They can be found in Kruševica, Ubli, Dubov Dol, Dubok Dol etc. Blue cave and Karadžica cave on Luštica Peninsula are well known. As early as 1688 the toponym for the Mededna Bay (*Megega Valle*) figured on a Coronelli's map, and Furlanetto (1785) noted *P^a Megedna o P^a Remo*, which point to a probable habitat of Mediterranean monk seal, in Luštica zone towards the open Adriatic, where it could stay in numerous caves and semicaves, and even in above-mentioned Blue and Karadžica ones. There is a larger cave near Obodnik (to the north-east of Perast).

The geological structure of the terrain consists mainly of Mesozoic carbonate rocks of Triassic, Jurassic and Cretaceous periods. In the lower coastal parts there are Eocene carbonates and young Quaternary deposits (Fig. 3).

The oldest complex of middle Triassic (Ladinic) built of a series of hornstones, schists and plate-silificated limestones comes to the surface in the coastal zone of Hercegnovi (RIDANOVIĆ, 1966). It belongs, just like Upper Triassic complex here, to so called "Budva-Cukali-Krasta-Pind" zone. Fossils have been found (*Posidonia wengensis*, *Daonella lommeli*, *D. indica*, and others). Upper Triassic deposits (Noric and Rhaetic) extend peripherally in the highest zone towards Lovćen specifically in the area of Koložun (1474 m) and in the wide neighbourhood of Budva.

In a large part they are built of thinly layered limestone with hornstones and shells (*Halobia*, *Daonella*). Triassic-Jurassic carbonates occur to the east of Risan and north of Perast on the higher zone (Goli Vrh), which is surrounded by Jurassic layers in the lower parts. Triassic complex is characterised by marked appearance of dolomites.

Layers known under the name of "Mesozoic of the Budva zone" enclose Triassic-Jurassic carbonates, Jurassic carbonates and clastic sediments and Cretaceous carbonates. That means that Mesozoic carbonate – clastic complex extends parallelly with the coast in the zone Šušnjatica-Devesilje-Vrmac-Trojica-Goliš and goes on to the southeast towards Budva, Petrovac and Rumija Mountain. There are also incorporated, in a large degree, previously considered sediments of middle and upper Triassic, which are in terms of space and stratigraphy difficult to be distinguished from younger Jurassic and Cretaceous formations so that geologists classify them into a unique sediment complex. Smaller mineral deposits with manganese were found near Kotor.

Jurassic older Lias sediments (limestone, dolomites, clasts) take up upper zones to the east of Kotor (east, north and southeast of Štirovnik). Dogger, limestone and

dolomites with clastics and marls cover a narrow zone of Sniježnica, Radošćak and Dobrošćica southern slopes. Transitional Jurassic age complex Dogger-Malm built limestone, dolomites and clasts to the north of Kotor and Dobrota (Lovćen slopes, Pestin Grad). The youngest Jurassic (Malm) sediments continue to the north of Dogger deposits in the zone Sniježnica-Radošćak-Dobrošćica.

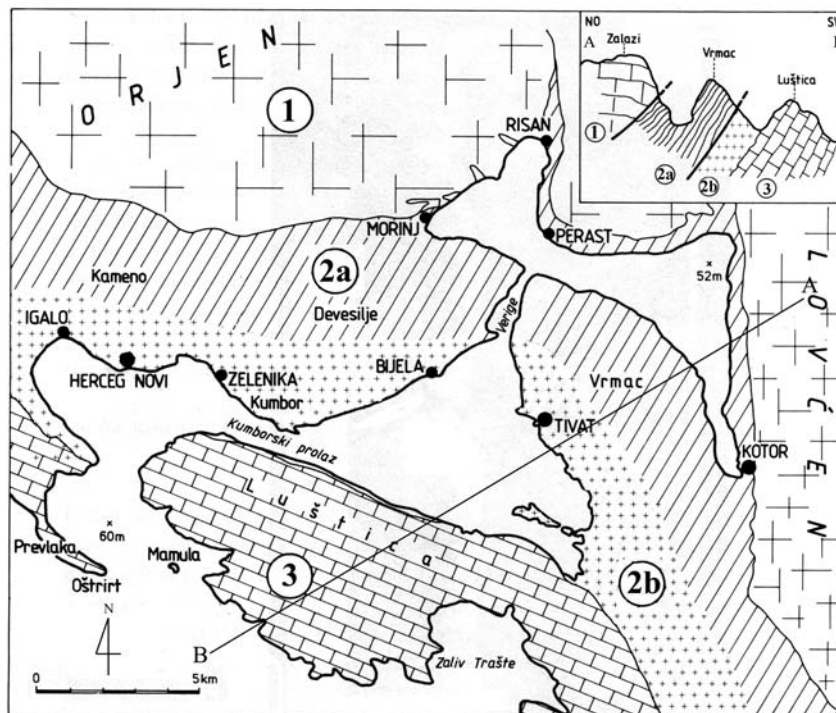


Fig. 3 Main structures of Boka Kotorska area (1 – Karstic zone: predominantly Cretaceous with appearances of Jurassic and Triassic carbonate rocks; 2 – Mesozoic Zone Budva /2a/ partially covered with Paleogene and Quaternary sediments within synclinal /2b/; mostly clastic formations; 3 – Predominantly Upper Cretaceous limestones and dolomites; after RIĐANOVIĆ, 1993, modified)

Sl. 3. Glavna obilježja građe prostora Boke kotorske (1 – zona krša: uglavnom karbonati krede s pojavama jurskih i trijaskih karbonata; 2 – mezozoik zone Budve /2a/ dijelom prekriven paleogenskim i kvartarnim naslagama unutar sinklinale /2b/; 3 – uglavnom gornjokredni vapnenci s dolomitima; prema RIĐANOVIĆ, 1993., dopunjeno).

Cretaceous sediments extend on to the north towards Krivošije, first the Lower Cretaceous, and then also Upper Cretaceous clastic sediments. Around Risan there are Cenomanian rudist limestone where bauxite occurs, which was formerly exploited. Upper Cretaceous sediments of Senonian limestones, which are part of contiguous clastic facies along eastern Adriatic littoral, cover the whole Luštica Peninsula and extend to the

southeast in the zone of Grbalj as long as St. Nicholas Cape and in the northwest on the Oštra Cape, Prevlaka and in the zone of Vitaljina (all in Croatia). They also cover the zone of Igalo-Bijela except in the closest coastal zone where there are Quaternary deposits.

All carbonate zones, especially in mountainous parts of the Boka Kotorska region, were not optimal for settling and agrarian evaluation, so they have been always less inhabited and used mostly for cattle breeding.

In the hinterland carbonates are covered by a narrow zone of Palaeogene flysch (Vrmac slopes) that is Eocene one (Middle and Upper Eocene) on the Kobilja slopes in the zones of Pod, Malo Brdo (at the foot of Radošćak and Dobrošćica), Ilijino Brdo and north-eastern slope of Grbalj. Palaeogene flysch goes also together with the coasts from Kotor to the Risan Bay continuing through the Morinj Bay, into the hinterland across Morinj and Žlijeb till Mokrine. It builds also the Gospa od milosrđa (Our Lady of Mercy) and Stradioti islands. It is a question of marls and sandstones, yellowish and redbrownish in colour. The whole zone is about 25 km long, about half of it by the Kotor Bay. The zone is large about 500-600 m. Morphologic border of flysch and older carbonates is about 60-80 m over sea. All flysch zones have always been well exploited by local agrarian activity in connection with fertile soils covering them. It enabled traditional Mediterranean food production and settling in many small rural settlements and hamlets.

The youngest layers are the Quaternary mostly fluvial deposits, which occur by the Kotor Bay shore (Stoliv-Prčanj-Kotor-Orahovac), in the higher zone round Ubli and Mokrine, in Sutorina along the shore of Hercegnovi up to Bijela, then along the Tivat Bay from Donja Lastva across Tivat to Župa alluvial valley including also part of Koložun valley. In the 19th century the clay of Tivat Polje was used in producing bricks and tiles in Krtole (PERIČIĆ, 1986). In the higher Orjen zones, as already mentioned, there are also Pleistocene moraine deposits in some valleys ("dol").

Characteristic exchange of thick limestone deposit zones and Palaeogene flysch zones, this flysch being often wedged in under carbonates like scales, beside significant occurrence of older Triassic rocks and apparition of dolomites are dominant geological determinant of Boka Kotorska area. The youngest Quaternary sediments cover regularly older rocks (Jurassic to Oligocene), which is evidence of long-lasting terrestrial developing period of present-day relief especially of higher parts. Similarly to flysch zones, alluvial zones have also been well evaluated in historio-geographical development of the region. But in wetland areas, settling was not possible in a higher degree, so they have been used as meadows or salines.

Tectonic area of Boka Kotorska is remarkably complex. By orogenic movements older Triassic layers were pulled up on younger Palaeogenic and Cretaceous layers in coastal zone. To the east of Risan, anticlinal axis Goli Vrh lays in the direction north-south, which indicates a considerable departing from usual extension line NW-SE. Namely "the axes of some branches of Boka Kotorska cross each other so that the parallelism of forms, which is typical for our coast, does not exist and it indicates that directions do not have origin in primary folding but in subsequent radial movements. Boka Kotorska is the belt of strong movement between the massif of Montenegrin mountains and southadriatic basin. This tectonic position is important for understanding genesis and characteristics of this complex bay" (ROGLIĆ, 1962).

Layer inclinations are often remarkably outstanding. Folding processes in geological past were very strong so that here and there flexure slip is expressed, in some

places foldings lay down one on another and somewhere they are slipped on like scales (scale structures). In some places foldings are separated by faults. Faults are numerous, which indicates intensive tectonic dynamics. This dynamics is reflected also on occasional shifting, deleveling, and earthquakes. Among these faults the one called Risan fault is important. It is composed of a number of fissures. These ones form a depression, which separates the massif of Orjen from Katun karst. Fissures extend towards the north south and are accompanied by delevelings, water appearance and the like. In the western part of Orjen massif so called Grab fault dominates. It is in fact completely within the territory of Croatia and Bosnia and Herzegovina (Orahovac-Dubravka-Grab). Wedging of the Orjen massif between Zeta-Skadar cove and deep Southadriatic submarine depression with a delevelings of some 3300 m on a relatively short line, so that steep land and submarine slopes are strongly expressed. This wedging is geotectonically very indicative and points to an explicit instability of the whole area. Older cracks were partly revived by younger epirogenetic processes in lithosphere or generated new ones, vertical or under different angles with respect to the basic Dinaric direction of relief stretch. Many times, as the result of an intensive seismic activity, earthquakes hit this area and caused dangerous colapses, landslides and glidings greatly damaging building fund. As situated in the faulty zone on the level of Mohorovičić Discontinuity, which stretches on the line Ston-Dubrovnik-Boka Kotorska-Skadar lake, and which is set up along deep profile of seismic sounding, the danger of possible strong earthquakes is rather significant.

The area of Boka Kotorska belongs to the zone of earthquakes of potentially strongest intensity ($I_0 = IX$ and X °MCS). By the beginning of the 20th c. there were several earthquakes registered especially on the space of Kotor, three of them very strong (Kotor, Hercegnovi, Tivat) with intensity $I_0 = IX$ °- X ° and at least three with $I_0 = VII$ °- $VIII$ °MCS scale. Intensive earthquake was recorded in Kotor in 1563 ($I_0 = IX$ ° or X °; PRELOGOVIĆ ET AL., 1982). On the 6th of March 1667 a disastrous earthquake hit Kotor when half works of construction were destroyed and 200 people were killed. Hercegnovi was also badly struck, but the most catastrophic earthquake hit Dubrovnik (CVIJANOVIĆ, 1965). Lately, in the 20th c. epicentres of three earthquakes were registered, magnitude being $M = 4,7-5,6$ (1979 and others), and around Budva five or six ones (ALJINOVIĆ ET AL., 1987). Powerful earthquake (over IX °MCS) happened on the 15th April 1979 causing enormous damages in construction fund (quays, 12.000 building objects, 70% flats). New land-slides scree, and fissures appeared in the local relief.

Climatovegetational characteristics

Narrow coastal belt of Boka Kotorska appertains to the Mediterranean climate area specifically in a zone of mild and agreeable so called proper Mediterranean climate or eumediterranean. On the slopes over 400 m height above sea-level submediterranean influences prevail gradually, and in the higher zones of highland and mountain hinterland continental influences prevail with characteristics of mountain climate in the highest zones.

Intensified humidity of the fresher part of the year with almost monsoonal characteristics is the result of big heights and dynamic relief just off the Adriatic coast. Plant cover also goes along with climate features so that belonging climato-vegetational zones stand out from true Mediterranean to harsh mountainous with meager juniper-wood. A large number of days without cloud (about 200) and heat total of over 2000 °C

render possible normal ripping of delicate Mediterranean and subtropical plants (citrus fruits and others; (BLAŠKOVIC, 1962). About 240000 olive trees, 21000 citrus fruit trees, then cultivation of exotics, mimosa, camellias, cactuses, agaves and other subtropic sorts point to mildness and agreeable effects of local climate. Contrast between clear, sunny skies on the one hand and humidity on the other reflects specific qualities of the Bay of Kotor climate. Abundance of coastal and mountainous plants offers opportunities of harvest and processing (Risan).

Considerable quantities of solar radiation result in relatively high mean **air temperatures** (Rt Oštra - Herceg Novi 16,0 °C, Igalo 16,3 °C), which surpass 14 °C in the whole coastal zone, Luštica and Grbalj (Budva 15,5 °C). However, with height they decrease so that on Krivošije they range 6-10 °C (Crkvice, 9,7 °C on 940/1050 m height above sea level), and on the higher parts of Orjen and Lovćen annually they fall to about 4 °C. In January temperatures show mild maritime characteristics (Rt Oštra 9,2 °C, Herceg Novi 8,6 °C, Igalo 8,7 °C, Budva 8,0 °C) but they fall rapidly on steep crest mountainsides and in higher zones, so that they vary about 0 °C on the part of Krivošije and Lovćen (Crkvice 0,7 °C) and on the highest parts of Orjen they reach -5 °C. The highest temperatures are in July and August. July temperatures surpass 24,5 °C for the most part of coastal zone (Igalo 25,0 °C, Herceg Novi 24,8 °C, Budva 23,8 °C) and in the rest of the area they attain 24-25 °C to 100 m height above sea level. Upwards they decrease (Crkvice 19,3 °C, Lovćen ca 15-16 °C and peaks of Orjen ca 14 °C).

Tab. 1 Annual mean temperatures

Tab. 1. Godišnji hod temperature zraka

Station	Period	Nr. of Years	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Annual
Crkvice (940 m)	1931-60	30	0,7	1,7	3,6	7,7	12,5	16,3	19,3	19,0	15,4	11,0	6,4	2,5	9,7
Budva (2 m)	1931-60	30	8,0	8,8	10,2	13,5	17,8	21,5	23,8	23,4	20,5	16,0	12,9	9,8	15,5
Dubrovnik (49 m)	1931-60	30	8,6	9,3	10,6	13,9	18,1	22,0	24,6	24,5	21,5	17,1	13,5	10,4	16,2

Source: GAJ, 78, 79.

Very suitable temperatures are due to the zone maritime influence. In August, mean **sea surface temperature** in Budva is the highest (23,9 °C), and the lowest is in January (13,1 °C). Mean annual relative air moisture is about 71-72%, maximum in November and minimum in July. Mean annual cloudiness is from 45 to 50% in the coastal zone and over 50% on Orjen. The number of cloudy days is about 85 per annum (mean daily cloudiness over 80%). Mean annual number of clear days (mean daily cloudiness less than 20%). The total of sunny hours ranges approximately about 2400-2500, and for example in Herceg Novi 2426 hours annually (RADOIČIĆ, 1982).

Annual mean **precipitation** ranges from about 1500 mm to about 5000 mm. The smallest amount falls by the coast (Rt Oštra about 1500 mm, Budva 1626 mm, Herceg Novi 1974 mm and 1832 mm towards Radoičić or 1717 mm after Blašković, Risan 3458 mm, but 2929 mm after Radoičić). The maximum is reached on the high mountains (Orjen over 5000 mm, Crkvice 4926 mm at height of 940 m, after Radoičić even 5155

mm, which is the highest amount in Europe; the absolute maximum is 8063 mm reached in 1937, Lovćen about 3500 mm).

Tab. 2 Annual mean precipitation

Tab. 2. Godišnji hod količine padalina

Station	Period	Nr. of Years	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Annual
Crkvice (940 m)	1931-60	30	547	567	483	315	229	130	85	79	246	605	793	847	4926*
Budva (2 m)	1931-60	30	177	166	142	98	91	63	35	52	125	223	232	222	1626
Hercegnovi (30 m)	1951-60	10	230	221	183	135	130	73	28	45	160	181	326	262	1974
Risan (40 m)	1934-60	17	414	465	319	198	173	106	48	91	232	400	500	480	3458
Dubrovnik (49 m)	1931-60	30	147	113	102	92	79	60	24	38	97	156	213	180	1301

Source: GAJ, 1988, 78-79 (Crkvice, Budva, Dubrovnik); RİĐANOVIĆ, 1966, 41-42 (Hercegnovi, Risan).

*Fifteen-years average 1925-1940 in Crkvice was 5317 mm (BLAŠKOVIĆ, 1962).

In this way the region of Boka Kotorska is one of the rainiest parts in Europe, and the Orjen massif area has the largest precipitation amount on the continent. It results from relief prominence and the direction of moist maritime air mass current. The maximum of precipitation occurs in the winter half of the year, especially in autumn, in November and December. Summer is considerably drier. After abundant rainfalls sea currents intensify especially in the straits of the bay. In autumn emergent current can be strong so that, at Verige, for example, to the east and west of the strait it can be seen with the bare eye.

The most characteristic **winds** are bora in winter and sirocco in spring and autumn and landward breeze (sea breeze) in summer. Sirocco is the most unpleasant wind, which is strong and can hamper ships when entering or leaving the bay. It can also be strong in Verige where it makes boat traffic difficult.

Hercegnovi and Meljine ports are exposed to sirocco squalls and to waves provoked by it, so that smaller breakwaters cannot shelter larger boats. Sirocco also strikes from the southeast through Krtole saddle zone into Tivat Bay with greatest effects towards Bijela. There is the most sheltered part of Grbalj and Krtole Bay. Bora is the strongest from Risan direction towards Verige where it hampers the traffic of smaller boats in the straits, and is known as Risan bora. It strikes stronger towards the north shore of Luštica Peninsula. In the Risan Bay it blows from Krivošije (south, southeast direction) and in the Bay of Kotor from the south through the cutting over Orahovac. This bora is convenient for sailing towards Kotor but unfavourable for sailing towards Risan.

Sea breeze through Kumbor strait is pretty strong in summer, it blows in the south direction and softens summer heat in Tivat and Donja Lastva, and the wind of the same characteristic coming from the south-east direction over Krtole saddle also blows towards the interior part of Boka Kotorska. Risan-Morinj-Kotor Bay is the most impenetrable to this breeze owing to the shelter the mountains offer, it has great difficulty to penetrate so that only local air currents or calms are prominent. Among the local currents the night seaward wind is important. It descends towards the bay from neighbouring plateaus cooled down during the night (Njeguši plateau and others) and the daily one in landward direction i. e. from the bay towards plateaus. It blows by day

bringing warm and humid masses from the warm sea surface. It leads to the process of condensation in the higher zones round Lovćen, on Orjen and others with appearance of mist and cloud. Calms are frequent when not a breath is stirring and by consequence the sea surface is totally calm and smooth.

According to the data from the station near Crkvice (Malov Do) south winds prevail (S, SE, SW) with frequency of about 51%, the west winds with 15%, eastern ones with 14% and north-eastern with 14%. Less frequent are northern winds (11%), NE and NW winds with 4% frequency. Observing reports quote windiness of about 78,5% and calm of 21,5% (RIĐANOVIĆ, 1966).

Climate influences directly **climatozonal vegetational associations**, which point to beneficial effects of littoral zone and roughness, which grows with height and mowing away from coastal edge. Consequently there are two different vegetational zones in the space of Boka Kotorska: Mediterranean (eumediterranean and submediterranean) zone close to littoral zone and continental zone in higher areas. Besides natural vegetation: holm-oak forests, pine and cypress groves, in the coastal Mediterranean zone there are many cultivated and imported subtropical sorts: cactuses, agaves, palms, aloes, camellias, oleanders, mimosas, tropical-fruit (lemon, orange, mandarin, clementine and others). In the 19th c. there were attempts of cultivation of flax, pyrethrum, Venetian sumac and even tobacco (PERIČIĆ, 1986). The most frequent of crops are those common in Mediterranean (olive, wine grape, mulberry, almond, various fruit, cereals, vegetables, vetch, potato and others).

Natural vegetation by the coast consists of Mediterranean evergreen holm oak forests (*Orno-Quercetum ilicis H-ić*) with belonging sorts: holm oak (*Quercus ilex*), myrtle (*Myrtus communis*), terebinth (*Pistacia terebinthus*), lentisk (*Pistacia lentiscus*), wild olive (*Olea oleaster*), strawberry-tree (*Arbutus unedo*), apple of Cani (*Viburnum tinus*), various wines and lianas etc. By centuries it has been degraded into lower forms (macchias and garigues) and rocky grounds. So Luštica Peninsula and Vitaljina zone are covered by holm oak macchia (*Orno-Quercetum ilicis myrtetosum H-ić*). Everywhere in the eumediterranean zone there is a fair amount of maritime pine, Aleppo pine and stone (umbrella) pine (*Pinus maritima*, *P. halepensis*, *P. pinea*), cypress (*Cupressus sempervirens*), laurel (*Laurus nobilis*), rosemary (*Rosmarinus officinalis*), dog-rose (*Rosa canina*), peteria (*Petteria ramentacea*), rush broom (*Spartium junceum*), brier (*Erica arborea*), and along the coast tamarisk (*Tamarix africana* and *T. gallica*), somewhere pomegranate (*Punica granatum*). Similar situation is by the coasts of the Tivat Bay. What characterizes the Bay of Kotor is a luxuriant plant cover along the south-eastern coast and existence of chestnut (*Castanea sativa*) forests and oak "sladuh" (*Quercus confertae*) on the slopes of Devesilje and Vrmac, in Stoliv and Kostanjevica. On craggier and less suitable habitats there is plenty of brown-berried juniper (*Juniperus oxycedrus*), common juniper (*J. communis*) and others (*J. macrocarpa*), Christ's (Jerusalem) thorn (*Paliurus aculeatus*, *P. spina Christi*), sloe or bull plum (*Prunus spinosa*) etc.

In places, this abundant plant cover is characterised by ethereal quality, beneficial, restoring and refreshing influences. Out of ground floor plants curative and well known are lavender (*Lavandula officinalis*), sage (*Salvia officinalis*), thyme (*Thymus serpyllum*), hyssop (*Hyssopus officinalis*), wild marjoram (*Origanum vulgare*), everlasting (*Helichrysum italicum*), feather-grass (*Stipa penata*) and others. Plants imported in some places are numerous: agaves, yucca, aloe, mimosa, different cactuses, palms etc. Besides most common cultures of this climate, such as olive, (wine) grape and

fig, there are also almond, carob, pomegranate, tobacco, citrus (orange, mandarin, lemon) and other kinds of fruit (plum, peach, sweet cherry, sour cherry, loquat, medlar, apricot, kiwi, kaki, sorb, and different vegetables (tuber, bulb, vetch etc.), cereals and others.

Over the belt of Mediterranean evergreen forest, a narrow submediterranean belt of deciduous submediterranean oaks (*Quercetalia-Pubescentis*, Br.-Bl.) to a height of about 1000 m over sea level dominates. Bay oak (*Quercus robur/pubescens*), Adriatic or Australian oak (*Q. cerris*), horsechestnut (*Aesculus hippocastanum*) and sweet chestnut (*Castanea sativa*), arborvitae (*Thuja occidentalis*), maple-tree (*Acer monspesulanum*), ash-tree (*Fraxinus ornus*) and others dominate this association. Austrian pine (*Pinus nigra*) often appears. Olive trees are fewer and fewer. There are almost no citrus fruits. The absence of pomegranate, carob and similar is notable.

In the upper belt, from 1000 m to 1200 m, mixed beech-oak forests appear. A forest of beech and autumn rush figures in the lower and warmer parts of Orjen or a true beech forest (Orjen, Lovćen). On the colder parts beech mixes with fir less frequently and the forest of common maple and European ash appears. There is whitebark forest (Orjen and Lovćen), which is often bent owing to snow and wind, and at the highest part there are subalpine beech (*Fagus sylvatica*) and pine arborvitae (*Pinus mughi*).

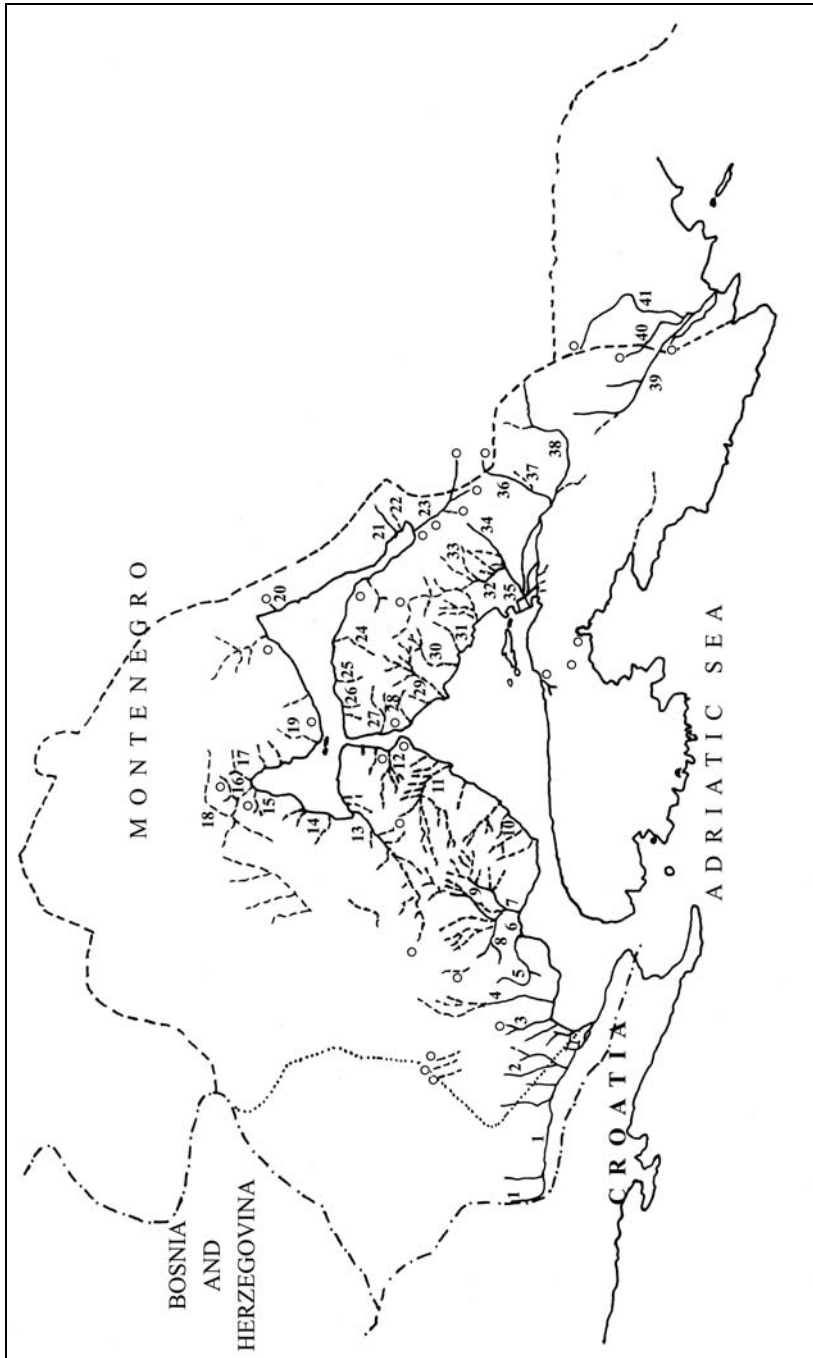
On crags and rocks adequate forms of lower vegetation similarly to those on screes and mountain bare rocks grounds, on limestones appear.

Plant cover has traditionally had an extraordinary importance in the life and survival of population of the region (firewood, quarters and shipping timber, medicinal herbs, honey plants, flowers, net colouring, resin, Venetian sumac, pinewood splinter etc.). For this reason it reflected in the local toponimy and nomenclature of settlements and localities (Kostanjica, Odoljen, Kosmač, Glogovnik, Glogovac, Devesilje, Zelenika, Orahovac, Gora, Rasovi, Grabovac and others). Climavegetational favourable conditions of Boka Kotorska have their effect on numerous life and economy segments: agriculture, tourism, traditional home medicine, health services and health-service tourism (Igaló since 1949).

Water Occurrence and its Importance

With regard to prominent orography the area of Boka Kotorska gets considerable precipitation quantities. Abundance of water discharged over the territory next to hinterland especially on Orjen and Lovćen, as it can be seen from the previous chapter, has an effect on prominence and importance of local hidrography. These characteristics have enabled sufficient water supply for the local inhabitants what always has been one of the important reasons of continual evaluating of this area by human societies.

Quantity of natural water enables the occurrence of numerous springs, brooks and streams, although large quantities of water get lost in karst underground by miraculous ways of porous carbonates (Fig. 4). Underground is characterised by great water circulation, which is manifested by occurrence of strong wells and springs of the territory of Kotor and Risan. Waters have always had crucial significance for population and the development of every region, so here too have played a decisive role in survival of numerous coastal and hinterland settlements. Until the beginning of the 20th c. numerous mills were watermills (in 1874 there were 91 for grinding grain or cloth-making; /PERIČIĆ, 1986/). Out of numerous smaller above ground-water occurrences only the most important and outstanding are treated here.



Among running waters the Sutorina River or Rika (= river) stands out. It is also called Konavočica or Debeli Brig's Brook (COR.: *Fiumara Sutorina* /Fig. 5/; CAN.: *Sutturina fl.*; ALB.: *Sutturina*; FUR.: *Sutorina*; TAB.: *Potok od Debelog Briga* and *Fluss Richa*). Its tributaries Prijevoz and numerous others come from the left i. e. northeast side, which bring waters from upper zones, and on which there were more old mills. It springs near Prijevoz and flows into the bay of Hercegnovi. Lower flow has been drained and meliorated through the use of canal system, by means of which vineyard and orchard areas are irrigated. There are muriatically salt and gently radioactive mineral springs, whose waters as well as surrounding curative oore sediments are used in healing rheumatic, neurological, gynaecological, respiratory and other illnesses (Institute "Dr. S. Milošević" in Igalo). Towards the east, in Igalo and in Trebesinje, there are several stronger springs, whose waters flow off towards sea, and at their mouths there is sedimentary peloid. More easternly towards Topla the brook Telerbas enters the sea (ALB.: *Aqua di Telerbas*). At Topla the brook of the same name (Topla) called also Ljuti Potok (ALB.: *Gliuti potoch ili Rubioso Torrente*), which supplies itself with water from the sources in Kameno, Matkovići and others at the foot of Dobroštica, flows into the sea. In old days mills on it were functioning. The Savinska Rijeka (Savina Rivulet) enters the sea near Savina. From the Podi zone in the hinterland of Hercegnovi, where there are more springs and old mills, the Meljina Stream feeds with waters (ALB.: *Meglina F.*). It flows into the sea near Meljine. There are some more outstanding streams: Suhi Potok and Rujevo Potok with numerous streamlets from the direction of Lastva (a number of old mills), Kutí and Rujevo, which fairly often dry up. In the lower course they form the rivulet of Zelenika (COR.: *Selenica T*, ALB.: *Selenica T^e*, FUR.: *Xelenica*) and enter the sea in Zelenika in the Bay of Hercegnovi.

There are some periodical streams that flow towards the sea in Kumbor and Đenovići, and there are sources too (COR.: records: *Tre canali d' acqua*; *Sorgente d.^a Grab*). The similar situation is in Baošići where there are local brooks and springs on the slopes of Grlica, and in neighbouring Bijela too. The brook Pijavica or Bijela (COR.: notes it as *Piauiza P.*) gathers waters on the larger area of Kruševica where there is a strong spring of the same name. It enters the bay of Tivat at Bijela, where it forms an outstanding cape, having the same name, with alluvial material. The Jaki Potok (Strong Stream; with other name Moračna Voda; ALB.: *Morazna voda*) enters the Verige Strait at Kamenjari (Đurići), and somewhat southerner another stream near Jošići. Near the cape of Sveta Nedjelja there are springs, where once there were mills by the sea (COR.: *Molini de Mazari*). By the west Verige Strait coast there is a stronger spring at Pajovica.

A strong rivulet named Protivnik flows into the Bay of Morinj (ALB.: *Protivnich F.*). It brings waters from several stronger springs at foot of Rt, Snježnica, Plana Brdo and Jarčeva Glava. (Kalac Spring and others), and near the mouth there are strong springs with mills nearby. Three mills had enough water during the whole year, and, like those near Kotor, were among the busiest in Boka (PERIČIĆ, 1986). A bit to the north the stream of Lipac enters the sea near Lipci.

The smallest number of water streams occurs from Risan across Perast to Kotor. The Stream of Risan or the Risan River joins the sea at Risan (ORT.: *Rhiso flu.*; COR.: *Risano T.*; CAN.: *Risano fl.*) as well as the Norin Torrent (ALB.: *Norin T^e*). There is Sopot Well (Sopot Fall), a strong periodical source on the road Risan-Strp to the southwest of Risan at 30 m height above sea level in the cave of the same name (COR.: *Sopot Cauerna*, FUR.: *Sopot*). It is active during heavy rains in autumn and spring. It

consists in fact of several "very interesting wells" at the foot of which there is a strong submarine spring. Its strong fresh water (ca 2m³/s) bubbling can be seen on about 20 m² long and wide sea surface (V. Blašković, 1962, 7-8). There is the Well of Spila near Risan too (ALB.: *Spilla*) whose waters join the Risan River. Between Risan and Perast there are several smaller streams with Smokovac, near Risan, standing out among them. Pavlova Rika (Paul's River) flows into the sea to the coast of Perast (ALB.: *Paulova Ricca*). There is also a stronger source near Donji Orahovac (Sv. Đorđe). In the northern part of Dobrota, near the hamlet of Ljuta, there is a known well Ljuta River with the short but strong flow towards sea (COR.: *Gliuta T.* with the mark *Folo et Molini* i. e. there were mills there; ALB.: *Gliuta T^e*, FOR.: *Gliuta*) whose spring part is located on Vališta on the plateau of Njeguši. There is one even smaller spring to the south of Ljuta.

There are three water streams near Kotor. Škurda River makes the northern border of the Kotor old town, and it is generally considered that it feeds on waters from the plateau of Njeguši. Gurdić Stream, whose waters are brackish, is situated southernly of town walls. Zveronjak Stream named also Velji Potok or Popova Voda, springs at the foot of Troljeza (ALB.: *Vegli Potoch ossia Popova Voda*), which flows in the seabed of the Kotor Bay forming gravely alluvial plain on which Škaljari, newer parts of Kotor, have grown up. Nearby another smaller water stream enters the Bay of Kotor (COR.: *Aluco* with the spring *Fontana di Macedonia* by the mouth; FOR.: *Torrente* and *Fontana*; marked only as Lokva /pool/ on the older topographic maps). Mills, which were in function during the whole year owing to water abundance, worked outside of *Porta Fiumera* on Škurda till the beginning of the 20th century (PERIČIĆ, 1986).

There is Rijeka Spring in Prčanj, only a metre height above sea level at 25 m distance from the coast. Contrary to the southeast side of Vrmac peninsula which is characterised by steep dry valleys and numerous gullies (water-worn ravines) filled with water when it is raining heavily (Stolivski Potoci, Rdakovo and others; Mark Cape alluvium at the mouth of such a ravine called Špilje), the southwest side is richer in waters. Dračevica enters the sea in Lepetane (ALB.: *Aqua di Drasevizza*). From Lepetane across Donja Lastva to Tivat several streams and coastal springs line up: Plavda (springs to the south of Lepetane with mills Sveti Lovre; COR.: *S. Lor:^o molini*; ALB.: *Plada*), Opatovo (COR.: *Opatauo T.*, ALB.: *Opatovo T^e*, FUR.: *Opatovo T.*), Seljanovo (COR.: *Seglianouo T.*, ALB.: *Seglianovo T^e*, FUR.: *Seglianovo T.*) with numerous springs in the upper zone of Gornja Lastva, then streams Paukovo (COR.: *Paucouo T.*, ALB.: *Paucovo T^e*, FUR.: *Paucovo T.*) and Kalimanj in Tivat, and a few more smaller ones.

Župa is the richest area in water, situated to the southeast extension of the Tivat bay. Waters flowing from the direction of Vrmac, Koložun and Lovćen, and from Grbalj zone form a confluence here. Rivers have accumulated a large amount of fluvial material in the area of Župa, which is the most levelled space of Boka, and the airport Tivat is located in this place. Owing to a number of amelioration works Župa has become the most fertile and agriculturally the most valuable part of Boka Kotorska. The largest water streams with stronger springs in upper zones, keep, in most cases, water permanently. There are: Gradišnica or Gradišnica (COR.: *Gradiostiza F.*, ALB.: *Gradiosnizza T^e*), with several smaller tributaries (Mračevac) and numerous springs at the foot of Vrmac in Gornji and Donji Bogdašići (Luković and others), Odoljenšćica or Vodolješnica (or Vodoljeznica or recently Lijesnica) or Pipoljevac (COR.: *Odolienstiza F.*, ALB.: *Odolienstizza F.*; TAB.: *Bach Pipolijewacz*) which is also called Široka Rijeka in its lower flow and which springs near Pipoljevac between Goražde and Trojica and flows

through Odoljen at the foot of St. Trinity fortress where there were old mills. Then there is the stream of Krimalj at whose spring, near Mirac, there are several old mills, and which receives several smaller streams with strong springs (Jankova Voda and others). Koložun (with Dobra Voda source and more smaller streams in its upper and middle flow, is also called Kolužinji or Kolužnji Stream; COR.: *F. che uiene da Zuppa*, ALB.: *Colozugn F.*; PAL.: *Coloxun T.*), and many others. Several strong springs offer abundant quantities of water, and feed the lowest parts of the district (Bačun and others). On the common shallow space of the springs Vodolješnica, Krimalj and Koložun, which has all the characteristics of a delta interrupted by backwaters and channels, there are zones favourable for salt works (PIN.: *Saline*), which existed there until recently, so called Solila.

The Peninsula of Luštica, contrary to Župa, is a waterless area, almost without water flows and without abundant springs, which certainly had an effect on its population density and relatively small economic significance. Near the Oko quai in the Bay of Krtole, there is live water Oko (by COR.: *Ocho Valle con acqua uiua*), and near Bjelilo there are springs and a waterflow called Ubla.

Owing to karst basis many waters disappear underground directly and reappear at the surface as numerous wells and springs in coastal area or at the foot of higher ridges, usually at the place where penetrable and impenetrable sediments adjoin. There are several more important springs in hinterland too. They have no outflow and, in karstic region they are of great importance as for example Pištet in the far north-east part to the north of Ljuta (ALB.: *Aqua di Pistet*) at the foot of the hill of Kuzman, few small sources at the foot of Dobroštica and Radoštak (Dizdarica and others) itd.

Soils

Noticeable relief, parent material and rock structure, climatovegetational characteristics and particularities of hydrologic circumstances as well as human activity (man-made soils) condition origin, development and features of the soils in a space. In the area of Boka Kotorska the soil cover is collocated with softer basis and with isolated and limited levelled areas in karst. Although relatively small, zones of the fertile soils have always been significantly important for the development and resistance of the human societies in this area.

Shallow skeletal soil (entisol) occurs on moraines, fluvio-glacial material and karst poljes and valleys (Orjen, hinterland). It is, in fact, a subtype of skeleton brown soils on gravel (entropic cambiosols), which develop on Quaternary coarse detritus of pebble and sand (from rounded to sub-rounded) whose fragments in the soil are numerous. They are rarely cultured.

On limestone and dolomite limestone, the type of brown (reddish) so called red soil (*terra rossa*) prevails (Luštica Peninsula, Grbalj and elsewhere). It is a fertile and valuable soil, typical for clean carbonate rocks, and is a prevailing type of soil on the karstland. It fills karst small poljes, valleys, coves, sink-holes and fissures.

Alluvial and alluvial-diluvial soils (fluviosols) are frequent on young deposits and deposits of water flow sorted material. They develop on young alluvial terrains and mouths (deltas) of rivers and streams and in small dolines and poljes where there are waterfowls. They have stratified profile structure, sand and skeleton part being rounded. They cover a large part of Gornja Župa, mouths and valleys of some of these waterfowls.

A part of these fertile and most frequently valued soils is exposed to flooding, to underground water influence and to erosion. Because of exceptional value of these soils, soil improvement measures have often been done, but they demand continual and optimal maintaining of the system of meliorations.

Salted alluvial soils (near Tivat in the zone of Solila i.e. Tivat Polje, with more than 3% of salt in surface layers) are, in effect, here already type of marsh-gley soils (gleysols), which develop in the lowest, inundated parts of alluvial terraces (mouths, muds). Similar phenomena on the north of the Sutorina are marked by muds, which are used in health care (Igaló - curative mud).

Rendzinas are climatozonal type of soil, which appears on carbonate substrates of hilly and mountainous locations (here and there in higher zones and sporadically in karst zones: Orjen, Dračevica, Podgor at al.). The most frequent are carbonate black earths, which develop by accumulation of organic matter under cool mountainous conditions. They are fertile and valuable but scattered about ("in rags").

Brown carbonate soils in flysch (carbonate cambiosols) developed on clays and marls in the flysch zones of Dobrota, near Tivat, in Grbalj and others. Owing to strong erosion of a worn-out basis in some places, as a consequence of inclination and heavy rains, very often be a naked flysch basis is found (*sirozem* i.e. *regosol*), and agricultural surfaces are often terraced, which points to the significance of anthropogenic factor in their preserving and upgrading. They are good for olive growing, citriculture and similar.

Underdeveloped rocky soils (lithosol) are spread out all over the karst of Boka Kotorska. It is a question of coarse debris of parent rocks on screes and stony heaps, rough torrent and alluvial deposits, eroded moraine and fluvio-glacial deposits, where finer surface layer did not develop or preserve; but only in a smaller part enriched by humus of the meagre grass and other resistant vegetation.

The significance of natural geographic basis for socioeconomic development

From the oldest times Boka Kotorska has been offering possibilities of settling, existence and development of social communities. Its area on the east coast of the Adriatic has been one of more significant focuses of economic and demographic activities. Economic importance has been manifested in traditional forms of agro-cattle raising Mediterranean economy which, for thousands of years, has been supplemented with significant orientation to the sea, about which more scientific works have been published (maritime affairs, fishing, trade) and, in modern circumstances of development, in strengthening of tourism.

With over 49,9% of urban population in 1981 and about 60% in 2001, Boka Kotorska is the most urbanized space within Montenegro borders. Kotor shipping company "Jugooceanija" with 22 ships in the eighties of the 20th century, maintained appreciable tradition of shipping and maritime affairs of Perast, Kotor, Risan, Prčanj, Dobrota, Muo and other settlements. Contemporary development of road network, especially from 1908, when the road around the whole bay was finished and also after the sixties of the 20th c., when the Adriatic tourist road was built and numerous local lines were opened, many roads were paved with asphalt, among others also the old road Kotor-Lovćen, finished in 1881, with 26 sharp hairpin-bends till the saddle of Krstac, and which

negotiates a 1000 m altitude difference, having some 20 km of real length, on scarcely 2 km of air distance.

The development of tourism relies on 17,4 km of beaches (with Budva 27,3 km; MARTINOVIĆ, 1979), attractive relief forms and picturesque landscape of noneveryday and unique views, deposits of curative mud (health-service tourism), possibilities of mountaineering, holding home and international car races, where competitors race over hilly roads with numerous hairpin-bends (Kotor-Cetinje) etc. Rich cultural heritage (numerous churches, monasteries, museums, cathedral in Kotor, historical monuments, sacral and profane traditional manifestations) is a captivating factor.

First tourist visits, in the contemporary sense, started as early as the 19th century. At mid- 20th c. (1952) Boka Kotorska received, for example, 27.000 visitors, who realised 185.000 overnights, and in 1975 there were already 252.400 visitors with total of 2,495.000 overnights (with Budva 505.000 visitors and 4,682.000 overnights) i.e. almost three quarters of Montenegro realised trade (MARTINOVIĆ, 1979). Budva and Herceg Novi are the strongest districts of Montenegro littoral. Though ship lines, which connected Boka Kotorska with Croatian and Montenegro littorals, were completely abolished, as well as the narrow-gauge track from Zelenika towards Dubrovnik and Herzegovina (used from the beginning to the sixties of the last c.) the Adriatic tourist road and air traffic (international airport Tivat), have recently enabled modern connection. Gornja Župa levelness enabled building of a modern airport near Tivat, when old grassy runway was reconstructed and modernised in 1971. Realising this enterprise ancillary buildings and a runway 2.500 m long and 45 m wide, were built (OSTOJIĆ, 1984). Before the collapse of SFR Yugoslavia, in late eighties of the 20th c. there were up to 300.000 passengers (boarding and getting out) mostly in summer season. Fast ferry-boats near Lepetane and cutting a tunnel through Vrmac on the route Kotor-Tivat, have improved possibilities and free flow of traffic connections. Boka Kotorska has remarkable preconditions of developing health service tourism, in particular near Igalo, where layers of curative mud and ooze are deposited. However, natural basis of Boka Kotorska does not possess inexhaustible exploiting possibilities. There are natural limits, which suggest necessity of limited and balanced development so that natural potentials would not be devastated or destroyed. It has already been warned against danger of polluting coastal sea and submarine world of the bay (PASINOVIĆ, 1977), caused by industrial plants (Kotor), shipyards, military establishments, tourist facilities and settlements. Negative effects of polluting and devastating the area and soils are evident. They are provoked by too fast expansion of some settlements, the effects of racket (Tivat) and especially of natural disasters (earthquakes).

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SAŽETAK

Damir Magaš: Prirodno-geografska obilježja prostora Boke kotorske kao osnova razvoja

Boka kotorska je jedan od najpoznatijih zaljeva Jadrana. Autor naglašava važnost geografskog položaja u sredozemnoj regiji. Smještena je na II dijelu istočne obale Jadrana, u dodirnoj zoni hrvatskog i crnogorskog prostora. Duboko uvučena u kopno, povijesno-geografski i geostrateški značajna, ističe se među zaljevima Sredozemlja. Naseljena od prapovijesti ima značajnu ulogu za vrijeme ilirske talasokracije, kao i u vrijeme održavanja antičke i srednjovjekovne plovidbe na Jadranu. Poslije 1420. postaje dio dalmatinskog tj. južnohrvatskog posjeda Venecije, a kasnije je dio Austro-Ugarske Monarhije do 1918. Sutorinski koridor, kao dio hercegovačkog prostora bio je izuzet. Poslije 1918. Boka kotorska je teritorijalno priključena Zetskoj Banovini, a iza II. Svjetskog rata uglavnom priključena Crnoj Gori, jednoj od federalnih republika Titove Jugoslavije. Mali, vanjski dio zaljeva dugo je pripadao Dubrovačkoj Republici, a danas Republici Hrvatskoj.

U radu se obrađuju glavne prirodno-geografske značajke Boke kotorske, važnost geografskog položaja, glavna geomorfološka obilježja, značenje klimavegetacijskih obilježja, kao i važnost voda i tala i njihov utjecaj na sociogeografski razvoj. Služeći se s nekoliko povijesno-geografskih izvora i zemljovida, i rezultatima prijašnjih analiza koje su obavili drugi istraživači, kao i vlastitim spoznajama, autor kritički i detaljno objašnjava bitne fizičko-geografske okolnosti ovog prostora.

Naglašena je važnost reljefnih obilježja za vrednovanje prostora Boke kotorske. Reljef bokokotorskog područja čine krški hrptovi i potopljene, duboko usječene udoline, položeni u općem dinarskom smjeru SZ-JI. Najdublje uvučeni su Kotorski zaljev, Morinjski i Risanski zaljev koje s Tivatskim zaljevom spaja tjesnac Verige. Kumborski prolaz povezuje Tivatski zaljev s

Hercegnovskim zaljevom. Odavde se kroz 1360 m široka vrata između rtova Kobilja i Kabala prelazi u ulazni dio tzv. Bokokotorska vrata između Oštra i Vitaljine sa SZ i Luštica s JI. Složeni oblici lokalne krške morfologije oblikovani su glacioeustatičkim dizanjem morske razine prije posljednje oledbe prije oko 10.000 godina, tj. do kraja pleistocenskog razdoblja Würma, kada je ovdje bilo kopno. Geološku građu čine trijaski dolomiti, kredni vapnenci i tercijski (paleogenski) fliš. U priobalnim dijelovima ima eocenskih karbonata i mladih kvartarnih naslaga. Obodni dijelovi oko zaljeva, viši su i građeni od čvrstih stijena, i mogu se diferencirati u nekoliko osnovnih zona. Zona Vitaljine pripada Hrvatskoj i karakteriziraju je niže primorsko bilo (s Prevlakom izdvojenim rtom Oštra) i više bilo Kobile koja se SZ proteže prema Vinogradini i Studenom, te ujedno čini tradicionalnu (od 1718. godine dubrovačko-tursku), a danas suvremenu granicu.

Od Kobile i Osoja na zapadu do prostora Crkvice i Mačije planine na SI prostiru se dolina Sutorine, pitomi brdoviti reljef hercegnovsko-bijelskog zaobalja i planinski krški prostor Orjena i Krivošija. Orjen čine brojne diferencirane mikrocjeline karbonatni, uglavnom vapnenačkih krških izdignuća, gređa poda, škrapara, zaravni i sl. te dolova (Reovački dolovi, Duboki do, Crni do, Vuči do, Stjepov do, Dubovi do itd.; najvažniji su dio površja u orjenskom kršu, često s morenskim nanosima u dnima), udolina, poljica (Poljana i dr.), uvala i rijetko manjih ili prostranih ponikava. Iz ledenih doba zaostali su brojni tragovi rada ledenjaka. Veći je broj spiljskih objekata u zoni Orjena i Crkvice. Orjen je Dobrošticom i Radoštakom, u pravcu mora (Tivatski i Topaljski ili Hercegnovski zaljev) naglašeno izdvojen od Dračevice i ostalih nižih i pitomih reljefnih zona u hercegnovsko-bijelskom zaobalju i priobalju zvanih Podgor, gdje se, uz navedene niže zone, ističu manji primorski grebeni. Između brojnih glavica i uzvišenja značajne su flišne pojave (lapori, pješčenjaci). Raznovrsnost sastava i građe omogućila je brojne pojave vode. Boki kotorskoj pripada tek uski dio primorskog bila i strmih padina Dobrote koje se u unutrašnjosti nastavljaju tradicionalnim crnogorskim prostorom katunske krške zaravni Njeguša. Najjuvčeni dio Kotorskog zaljeva obilježavaju strma dolina Škurde i znatno veća i u donjem toku naplavinama ispunjena flišna dolina Zveronjaka. Južno se produžavaju se uzvišenja Trojica i Goražde između kojih su se usjekle gornje doline Krimalj potoka (prema jugu) i Odoljenščice (prema SZ) koje otječu prema Župi.

Posebno je istaknuta važnost Župe (Gornja župa), najnižeg i uravnenog prostora flišne udoline otvorene prema Tivatskom zaljevu, smještene između Vrmca na sjeveru, poluotoka Luštica na zapadu, Grblja na jugu i JZ i Lovćenskih padina na istoku. Flišnu podlogu ovdje prekrivaju mladi, meki aluvijalni nanosi brojnih tekućica (Odoljenščica, Koložun, Široka, Gradioštica, Jankova voda i dr.) koji se pri ušćima stječu u zajedničko deltasto proširenje s brojnim nepravilnim rukavcima i kanalima. Povoljni dio koji poplavljuje more od starine se koristi kao solana (Solila) pa se veći dio zone nazivlje i Soliosko polje. Od 1971. ovdje je uređena nova zračna luka. Na zonu Gornje župe nastavlja se južno Grbalj (Donja Župa). Zapadno od doline Zveronjaka, i sjeverno od uravnjene Gornje Župe, između Kotorskog i Tivatskog zaljeva i tjesnaca Verige koji ih povezuje, izdiže se imponantni greben Vrmac, pružen u smjeru SSZ-JJI. Građe ga starije karbonatne stijene mezozoike koje se prema JZ nastavljaju flišnom zonom eocenskih pješčenjaka i lapora, a u priobalnom pojasu i na flišu su nataložene mlađe i meke kvartarne aluvijalne naslage. Na prostor Grblja i Župe se zapadno nastavlja prostrani poluotok Luštica.

Zaštićenost zaljeva i njegova duboka uvučenost, omogućili su tisućljetnu orijentaciju na more i pomorstvo, što je poticalo razvoj urbanih aglomeracija uz obalu od antičkih vremena do danas. U Zaljevu ima više otočića: Gospa od Škrpjela, Sv. Đorđe, Otok Gospe od Milosrda, Stradioti ili Sv. Marko (nekad i Sv. Gabrijel), Prevlaka ili Cvjetni otok, Velika Žanjica, Mala Gospa. Obale su uglavnom strme, a na ušćima brojnih potoka, i rječica se oblikuju šljunčane ili pješčane uvale s žalima i plažama (Igallo, Tivatski zaljev i dr.). Dužina obalne crte je 106 km, a ukupna morska površina zaljeva je 90 km².

Istaknuta je i važnost brojnih speleoloških pojava. Samo na Orjenu je poznato preko 80 speleoloških lokaliteta. Poznate su Modra spilja i Spilja Karadžica na Luštici. Već kod Coronelija (1688.) nalazi se na jednom zemljovidu toponim uvala Međedna (*Megega Valle*), a Furlanetto (1785.) bilježi *P^a Megeđna o P^a Remo*, koji ukazuju na vjerojatno obitavalište morske medvjedice u

zoni Luštica prema otvorenom Jadranu gdje se mogla zadržavati u brojnim pećinama i potkapinama, pa i u Modroj spilji i Karadžici. Prostor Boke kotorske spada u zonu potencijalno najjačih intenziteta potresa. U novije vrijeme, u 20. st, ovdje zabilježeni epicentri 3 potresa magnitude $M = 4,7-5,6$ a 15. travnja 1979. snažan potres uzrokovao je goleme štete na građevinskom fondu (pristaništa, 12.000 građevinskih objekata, 70% stanova).

Poseban utjecaj na razvoj i očuvanje lokalnih zajednica ima klimatski faktor. Priobalje Boke kotorske pripada prostoru sredozemne klime i to zoni blage i ugodne tzv. prave sredozemne klime ili eumediterana. Na padinama iznad 400 m nm. v. prevladavaju submediteranski, a u višim zonama gorskog i planinskog zaobalja kontinentalni utjecaji sa značajkama planinske klime u najvišim zonama. Oko 240.000 stabala masline, 21.000 stabala agruma, zatim uzgajanje egzota, mimoze, kamelija, kaktusa, agava, i drugih suptropskih vrsta ukazuju na blagost lokalnog podneblja i mogućnosti vrednovanja. Suprotnost vedrine i osunčanosti s jedne, i humiditeta s druge strane, odražava specifičnosti bokokotorskog podneblja s visokim prosječnim godišnjim temperaturama zraka (14-16 °C). Temperature visinom opadaju na 6-10 °C, a na višim dijelovima Orjena i Lovčena iznose oko 4 °C godišnje. Prosječne temperature siječnja, 8-9,2 °C odražavaju blaga maritimna obilježja i opadaju na strmim prastranicima bila i u višim zonama tako da se na dijelu Krivošija i Lovčenu kreću oko 0 °C (Crkvice 0,7 °C), a na najvišim dijelovima Orijena i do -5 °C. Najviše temperature su u srpnju i kolovozu 24-25 °C, visinom opadaju (Crkvice 19,3 °C, Lovčen oko 15-16 °C i vrhovi Orijena oko 14 °C). Prosječna temperatura mora na površini u Budvi je najviša u kolovozu 23,9 °C, a najniža u siječnju, 13,1 °C. Ukupan broj sunčanih sati godišnje kreće se u prosjeku oko 2400-2500. što je pogodno za turističku valorizaciju prostora. Prosječne godišnje količine padalina su oko 1500-5000 mm. Ljeto je znatno suhlje od zime i jeseni. Od vjetrova najistaknutiji su bura zimi, jugo u proljeće i jesen, a maestral (maistro) ljeti.

Dodir dvaju područja vegetacije u prostoru Boke kotorske: sredozemnog (eumediteranskog i submediteranskog) područje u neposrednom priobalju, i kontinentalnog područja u višim zonama dodatna je geografska povoljnost ovog prostora. Uz prirodne sastojine šume hrasta crnike, borovih i čempresovih šumaraka, u priobalnoj sredozemnoj zoni je mnogo uzgojenih i donesenih suptropskih vrsta. Od kultura najčešće su (maslina, loza, dud, badem, razne voćke, žitarice, povrtnice, grahorice, krumpir i dr.). Prirodna vegetacija uz obalu je sredozemna šuma zimzelenog hrasta crnike (*Orno-Quercetum ilicis H-ić*). Iznad pojasa sredozemne vazdazelene šume, širi se uski submediteranski pojas listopadnih submediteranskih hrastova (*Quercetalia-Pubescentis*, Br.-Bl.) do visine od oko 1000 m nad morem. U višem pojasu, od 1000 do 1200 m javljaju se miješane bukovo-hrastove šume. Na hladnijim dijelovima rijede se bukva miješa s jelom, a javlja se i šuma običnog javora i bijelog jasena. Na višim dijelovima je šuma munike (Orjen i Lovčen), često povijena od vjetra i snijega, a na najvišem dijelu subalpska bukva (*Fagus sylvatica*) i klekovina bora (*P. mughi*). Na stijenama i liticama razvijeni su odgovarajući oblici niže vegetacije, slično kao i na točilima (siparima), planinskim goletima na vapnencima itd. Biljni pokrov je tradicionalno imao iznimno značenje za opstanak stanovništva ovog kraja.

Hidrogeografija ovog prostora oduvijek omogućava zadovoljavajuću opskrbljenost vodom što omogućuje susljednu naseljenost i vrednovanje od najstarijih vremena. Čine je pojave brojnih izvora, potoka i rječica. Od tekućica ističu se Sutorina ili Rika, Konavočica ili potok od Debelog briga, Meljina, Suhi potok i Rujevo potok, rječica Zelenika, potok Pijavica ili Bijela, potok Lipac, Risanska rijeka, potok Norin, Škurda Gurdić, Zveronjak zvan i Veli potok ili Popova voda, Dračevica, Plavda, Opatovo, Seljanovo, Paukovo, Kalimanj i nekoliko manjih. Jaka su vrela Sopot, Spila i Ljuta rijeka. Vodom najbogatiji predio Boke je Župa, s rječicama Gradiošnica, Odoljenšćica ili Vodolješnica (ili Vodolježnica ili Pipoljevac, Široka rijeka. Slijede Krimalj potok i Koložun (s izvorom Dobra voda i brojnim mlinovima u gornjem i srednjem toku, zovu ga i Kolužinj i Kalužnji potok; rukavcima i kanalima ispresijecane delte, povoljne za solane, koje su se tu nalazile donedavna, tzv. Solila). Sve do početka 20. st. radili su na vodotocima brojni mlinovi (1874. bilo ih je 91, za mljevenje žita ili suknare).

Prirodna osnova oduvijek je pogodna za razvoj pomorstva. Zaštićenost zaljeva i njegova duboka uvučenost, omogućili su tisućljetnu orijentaciju na more i pomorstvo, što je poticalo razvoj

urbanih aglomeracija od antičkih vremena do danas. Kotorska "Jugooceanija" je s 22 broda osamdesetih godina 20. st. održavala značajnu tradiciju brodarstva i pomorstva Perasta, Kotora, Risna, Prčnja, Dobrote, Mua i drugih naselja. Turistički razvoj oslanja se na 17,4 km plaža, atraktivne reljefne oblike i živopisni krajolik nesvakidašnjih vidika, ležišta ljekovitog blata (zdravstveni turizam), mogućnosti planinarenja, mogućnosti održavanja domaćih i međunarodnih brdskih auto-moto trka na cestama s brojnim serpentinama (Kotor - Cetinje) itd. Bogata kulturna i spomenička baština s brojnim crkvama, samostanima, muzejima, značajni je privlačni čimbenik. Uskotračna željeznička pruga od Zelenike prema Dubrovniku i Hercegovini korištena od početka 20. st. ukinuta je šezdesetih godina 20. st. Jadranska turistička cesta i zračni promet (zračna luka Tivat) omogućili su suvremeno povezivanje. Boka kotorska ima i značajne preduvjete razvoja zdravstvenog turizma, posebice kod Igala gdje su deponirane naslage ljekovitog blata i mulja. Boka kotorska ipak nema neiscrpe mogućnosti za iskorištavanje. Postoje prirodna ograničenja koja sugeriraju nužnost ograničenog i uravnoteženog razvoja kako se prirodni potencijali ne bi devastirali i uništili.

SOMMAIRE

Damir Magaš: Les caractéristiques naturelles-géographiques de la zone de Boka Kotorska comme la base du développement

Boka Kotorska (Bouches de Kotor) est une des baies les plus connues de l'Adriatique. Elle est située au sud-est de la côte orientale de l'Adriatique, dans la zone de contact des territoires de la Croatie et du Monténégro. Profondément échancrée dans la côte, très importante au point de vue géographique, elle se distingue parmi les baies de la Méditerranée. Peuplée depuis la préhistoire elle a joué un rôle de premier plan au temps de la thalassocratie illyrienne, aussi bien qu'au temps de la navigation antique et médiévale dans l'Adriatique. Après 1420 elle est devenue part de possession de la Dalmatie c'est-à-dire de la possession sud-croate de Venise, et plus tard part de la monarchie d'Autriche-Hongrie jusqu'à 1918. Le corridor de Sutorina, étant part du territoire hérzégovinien, a été excepté. Après a été rattachée au banat de Zeta et, après la deuxième guerre mondiale, elle a été en substance intégrée dans le Monténégro, l'une des républiques de l'ex-Jougoslavie. Une petite part extérieure de la baie appartenant à la république de Dubrovnik (Raguse) et aujourd'hui à la république de la Croatie.

L'étude traite les caractéristiques principales naturelles-géographiques de Boka Kotorska, l'importance de sa position géographique, principales caractéristiques géomorphologiques, importance des caractéristiques climatovégétales aussi bien que l'importance des eaux et des sols et leur influence sur le développement sociogéographique. En se servant de quelques sources historiques-géographiques, cartes géographiques et analyses précédentes faites par d'autres explorateurs aussi bien que sa connaissance personnelle, l'auteur explique d'une manière critique et détaillée les conditions physiques-géographiques essentielles de ce territoire.

Le relief de ce territoire est composé des crêtes karstiques et des vallées submergées, profondément taillées, couchées dans la direction dinarique (nord-ouest – sud-est). Les baies les plus profondément échancrées sont celles de Kotor, Morinj et Risan, qui sont liées avec la baie de Tivat par le détroit de Verige. Le détroit de Tivat conjugue la baie de Tivat avec celle de Hercegnovi. D'ici on passe à travers une porte large 1360 m. entre les caps de Kobilica et Kabala, dans la part d'entrée soi-disant la porte de Boka Kotorska parmi Oštra et Vitaljina du côté nord-ouest et Luštica du côté sud-est. Les formes complexes de la morphologie karstique locale ont été formées par élévation glaciaire-eustatique du niveau de mer avant la dernière glaciation il y a environ 10000 ans, c'est à dire jusqu'au Würm (fin de l'époque de pléistocène), quand il y avait terre ferme. Matériaux géologiques sont composés des dolomites triasiques, calcaires, crétaqués, et tertiaire (paléogène) flysch. Dans les parts littorales il y a des carbonates d'éocène et de jeunes sédiments quaternaires. Les parts périphériques de la baie sont plus hautes de rochers durs, et qui

peuvent être distingués dans quelques zones fondamentales. La zone de Vitaljina appartient à la Croatie. Ce qui la caractérise c'est la crête maritime plus basse (le cap d'Oštra est séparé de Vitaljina par un isthme étroit – 65 m.) et la crête plus haute de Kobilja qui se prolonge vers Vinogradina et Studeno (N.-O.), formant à la fois la frontière traditionnelle (depuis 1718) entre la République de Raguse et la Turquie et aujourd'hui la frontière entre la Croatie et le Monténégro.

De Kobilja et Ostoja à l'ouest jusqu'à l'espace de Crkvice et Mačija planina (la Montagne du Chat) au sud-est la vallée de Sutorina s'étend, doux relief montagneux de l'arrière-pays de Hercegnovi-Bijela, et puis l'espace montagneux et karstique d'Orjen et de Krivošija. Orjen est composé de nombreuses micro-intégrités différenciées des élévations de carbonates, en substance calcaires karstiques, de poutres, de plans, des crevasses, des plateaux etc, puis des vaux: Reovački dolovi, Duboki do, Crni do, Vuči do, Stjepov do, Dubovi do etc, et qui sont la part la plus importante dans le karst d'Orjen, souvent avec des alluvions moraines dans les fonds des vallées de petits poljés (Poljana etc), des anses et rarement des entonnoirs plus ou moins grands. De nombreuses traces du travail des glaciers sont restées. Dans la zone d'Orjen et de Crkvice il y a un nombre considérable de grottes. Grâce à Dobrostica et Radoštak, Orjen est, dans la direction de la mer, (la baie de Tivat et la baie de Topla ou Hercegnovi) distinctement séparé de Dračevica et d'autres zones de relief basses et douces dans l'arrière-pays et le littoral appelées Podgor, où en outre les zones basses déjà mentionnées des écueils mineurs se distinguent. Parmi de nombreuses collines et élévations les phénomènes de flysch (les marnes et les grès) sont des phénomènes significatifs. La diversité de structure et de matériaux a rendu possible de nombreuses apparitions d'eau. À Boka Kotorska n'appartient qu'une partie étroite de la crête littorale et de pentes escarpées de Dobrota. Celles-ci continuent à l'intérieur, traversant le territoire traditionnel monténégrin de Njeguši (plateau karstique d'habitation estivale des pasteurs dans les montagnes). La partie la plus enfoncée dans la côte de Boka Kotorska est notée par la vallée abrupte de Škurda et per Zveronjak (vallée de flysch considérablement plus grande), remplie d'alluvions en aval. Les élévations de Troljeza et Goražde se prolongent vers le sud, et parmi celles-là se sont installées les vallées d'en haut du ruisseau de Krimalj (vers le sud) et d'Odoljenščica (vers le nord-ouest), qui écoulent vers Župa.

Župa (Gornja Župa) est le plus bas espace aplati de la vallée ouverte vers la baie de Tivat située entre Vrmac au Nord, la presque île de Luštica au sud, Grbalj au sud et sud ouest et les pentes de Lovćen à l'est. La base de flysch est couverte de jeunes alluvions mous de nombreuses eaux courantes (Odoljenščica, Kožun, Široka, Gradioštica, Jankova voda et d'autres) qui, pres des bouches, confluent dans un commun élargissement de delta avec de nombreuses branches irrégulières et de canaux. Depuis les temps anciens la partie favorable, inondée par la mer, est exploitée comme saline (Solila) de manière que la plus grande partie de la zone est aussi appelée Soliosko Polje. Des 1971 on a rétabli le nouveau aéroport.

L'imposante crête de Vrmac s'étend dans la direction NNO-SSE. Elle est bâtie de plus vieux rochers de carbonates de mésozoïque qui, vers le sud-ouest, continuent dans une zone de flysch des grès et marnes d'éocène alors que dans la zone littorale et sur le flysch de jeunes, molles couches alluviales quaternaires sont déposées. La vaste presque île de Luštica se rattache au territoire de Grbalj et Župa. Dans la baie il y a plusieurs îlots: Notre-Dame de Šrpfjelo, St. Georges, L'île de Notre-Dame de Miséricorde, Stradioti ou St. Marc (jadis aussi St. Gabriel), Isthme ou l'île de fleurs, Grande Žanjica, Nativité de la Vierge. Les côtes sont généralement abruptes, et des vallées caillouteuses ou sableuses avec des plages se forment à l'emouchires de nombreux ruisseaux et petites rivières (Igalo, La baie de Tivat etc.). La ligne de la côte est 106 km longue et la superficie totale de la mer dans la baie est de 90 km². La baie est bien abritée et profondément enfoncée, ce qui a rendu possible une orientation millénaire vers la mer et la navigation, et a stimulé le développement des agglomérations urbaines le long de la côte depuis des temps anciens jusqu'à nos jours.

Les phénomènes spéléologiques sont nombreux. Orjen seul compte plus de 80 localités spéléologiques. La Grotte Bleue et la Grotte Karadica sont bien connues. Coronelli déjà (1688) a entré dans une ses cartes géographiques le toponyme de la vallée Mededna (*Meggega Valle*) et

Furlanetto (1785) marque *P^a Megedna o P^a Remo*, qui indiquent probable demeure de la ourse de mer dans la zone de Luštica vers l'Adriatique où elle pouvait demeurer dans de nombreuses grottes et creusements ainsi même dans la Grotte Bleue et la Grotte Karadica. Le territoire de Boka Kotorska appartient à la zone des tremblements de terre d'une intensité potentiellement la plus forte. Dans les derniers temps, au 20^e siècle, trois tremblements de terre ont été notés M = 4,7-5,6. Le tremblement de terre qui a eu lieu le 15 avril 1979 a causé d'énormes dommages aux fonds de construction (débarcades, 12000 d'objets de batisse, 70% d'habitations).

Le littoral de Boka Kotorska est caractérisé par le climat méditerranéen ou euméditerranéen. Cependant sur les versants, 400 m. audessus du niveau de la mer, l'influence du climat méditerranéen prédomine, et dans les zones de montagne c'est l'influence climatique continentale qui prévaut avec toutes les caractéristiques du climat des zones les plus hautes. A-peu-près 240.000 oliviers, 21000 arbres d'agrumes, puis la culture des sortes exotiques telles que mimosa, camélia, cactier, agave, et d'autres sortes subtropicales montrent la douceur du climat local. Le contraste de clarté et de soleil d'une part et l'humidité d'autre part, reflète les spécificités du climat de Boka Kotorska avec les hautes températures moyennes annuelles (14-16 °C). Au fur et à mesure qu'on monte, elles descendent à 6-10 °C. Ainsi sur les parts supérieures d'Orjen et Lovćen les températures sont autour 4 °C. Les températures moyennes annuelles au mois de janvier vont de 8 à 9,2 °C et reflètent douces caractéristiques maritimes. Cependant elles descendent sur les déclivités des crêtes et dans les zones plus hautes ainsi que dans une part de Krivošije et sur Lovćen elles sont de 0 °C (Crkvice 0,7 °C) et aux sommets elles vont à -5 °C. En été (juillet et août) les températures sont les plus élevées (24-25 °C) et descendent à mesure qu'on monte (Crkvice 19,3 °C, Lovćen environ 15-16 °C et les sommets d'Orjen autour 14 °C). La température moyenne annuelle de la mer à la superficie à Budva est la plus haute au mois d'août, 23,9 °C et la plus basse au mois de janvier 13,1 °C. Le total des heures solaires par an va en moyenne de 2400 à 2500. La quantité moyenne annuelle des précipitations atmosphériques est environ 1500-5000 mm. L'été est considérablement plus sec que l'hiver ou l'automne. Le vent le plus connu est le bora, le sirocco souffle au printemps et en automne, pendant que l'été es la saison du mistral.

On distingue deux zones de végétation sur le territoire de Boka Kotorska: région méditerranéenne (euméditerranéenne, et subméditerranéenne) le long de la côte et la zone continentale dans les régions supérieures. A côté de composition naturelle de la forêt de chêne vert (*Quercus ilex*) des bosquets de pin et de cyprès (*Cupressus sempervirens*) il y a beaucoup de sortes importées et cultivées dans la zone littorale méditerranéenne. Les plus connues en sont: olivier, vigne, mûrier, amandier, différents arbres fruitiers, grains (céréales), pommes de terre etc. La végétation naturelle le long de la côte est composée de la forêt méditerranéenne du chêne vert (*Orno-Quercetum ilicis H.-iç*). Au dessus de la zone de forêt toujours verte méditerranéenne une étroite zone subméditerranéenne s'étend composée des chênes caducs subméditerranéens (*Quercetalia-Pubescentis, Br.-Bi.*) et qui monte jusqu'à l'hauteur de 1000 m. au dessus du niveau de la mer. Les forêts qui paraissent dans la zone supérieure, de 1000 à 1200 m., sont un mélange du fayard et du chêne. Dans les parties plus froides le fayard est plus rarement mêlé avec le sapin, cependant la forêt d'érable et du frêne élevé apparaît aussi. La forêt de "munika" occupe les parts supérieures (Orjen et Lovćen). Par la faute du vent et de la neige elle est souvent penchée. Au sommet on rencontre le hêtre subalpin (*Fagus silvatica*) et pin nain (*Pinus mughii*). Les configurations d'une végétation dégradée sont développées sur les rochers semblablement à celle des entonniers, montagnes pelées, sur les calcaires etc. La végétation a traditionnellement eu une importance exceptionnelle pour l'existence de la population de cette région.

L'hydrographie consiste en nombreux sources, ruisseaux et riviérettes. Parmi les eaux courantes ces qui se distinguent sont: Sutorina ou Rika, Konavočica ou Potok od Debelog Briga (potok = ruisseau), Meljina, ruisseaux Suhi potok et Rujevo, riviérette Zelenika, ruisseaux Pijavica ou Bijela et Lipac, la rivière de Risan, ruisseaux Norin, Škurda, Gurdic, Zveronjak appelé aussi Veli potok ou Popova voda, Dračevica, Plavda, Opatovo, Seljanovo, Paukovo, Kalimanj et un certain nombre de plus petits. Les sources fortes sont: Sopot, Spila, et Ljuta rijeka. De toutes les régions de Boka Kotorska c'est Župa qui est la plus riche en eau avec les riviérettes Gradiošnica, Odoljenšćica

ou Vodolješnica (ou Vodolježnica ou bien Pipoljevac) et Široka rijeka. Il faut mentionner Krimalj potok et Koložun (avec la source Dobra voda et de nombreux moulins dans son cours supérieur et moyen, appelé aussi Kolužinji potok ou Kalužinji potok. Il y a aussi son delta, qui est coupé par des bras et canaux et qui est propice pour les salines, qui s'y trouvaient il n'y a pas longtemps, soi-disant Solila). Jusqu'au début du 20^{ème} siècle de nombreux moulins à eau fonctionnaient (en 1874 il y en avait 91) dont on se servait pour moulinier le grain ou pour fouler des étoffes.

La base naturelle a toujours été favorable pour le développement de la navigation. La baie est bien abritée et profondément entaillée, ce qui a rendu possible l'orientation millénaire vers la mer et la navigation et qui a incité le développement des agglomérations urbaines de l'antiquité jusqu'au temps présent. Dans les années 80 du 20^e siècle "Jugooceanija" de Kotor, avec ses 22 navires, maintenait la tradition significative de navigation et de marine de Perast, Kotor, Risan, Prčanj, Dobrota, Muo et d'autres habitats. Le développement du tourisme se base sur 17,4 km. de plages, formes attractives du relief et un paysage pittoresque des vues uniques, des gisements de la vase thérapeutique (tourisme de santé), possibilités de l'alpinisme, possibilités de prendre part aux courses d'automobiles du pays et internationales qui ont lieu sur des routes serpentineuses (Kotor-Cetinje) etc. Un patrimoine culturel riche en monuments (nombreux couvents, églises, musées) est un facteur attrayant. Le chemin de fer à voie étroite, qui circulait de Zelenika vers Dubrovnik et la Herzégovine, en fonction du début du 20^e s., a été aboli dans les années 60 du 20^e s. La route côtière touristique et circulation aérienne (aérodrome de Tivat) rendent possible les connexions contemporaines. Boka Kotorska a aussi des conditions considérables du développement de tourisme de santé, spécialement près d'Igalo, où les gisements de la vase péloïde sont déposés. Toutefois Boka Kotorska n'a pas de conditions inépuisables d'exploitation. Il y a des limitations naturelles qui suggèrent une nécessité absolue, du développement limité et équilibré pour que les potentiels naturels ne soient pas dévastés ou détruits.