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Albanian's Adriatic Coastline Behaviour and its Morphodynamic State. Durrësi Bay Case

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Abstract: This paper tries to present the changes of Durrësi Bay coastline through the works carried out by the Albanian Geological Survey in this area during the last decade. This work was aimed for the monitoring of the coastline behaviour of which compared with the older data collected during years '70-80' of the past century during the hydrographical and topographic surveys carried out. Using our data and those carried by other hydrographical works we have tried to give for the first time a classification of beach state for the Durrësi Bay, according to the concept of beach morphodynamic states given in the literature.

***Keywords**: Adriatic Sea, Durrësi Bay, beach, morphpdynamics, monitoring*

Introduction

The coastal area is composed by its composed by two main environments, the continental or subareal one and the marine one. Up to now, the studies of these dynamics are was concentred in Albania, only in a two dimensional study of morphometric evolution, taking into the consideration only of the elements situated in subareal environment, such as lithologic composition, fluvial sediment supply, seismic activity and tectonic movement, climate and structure of relief (Balla, 2015).

The worldwide experience (Dean, 1973; Wright & Short, 1984) show the importance factors which act in marine environment of coastal systems, such wind waves, morphology of swash zone and tidal range in the morphological beach form.

Albanian coastal area is one of the less studied regions by the Albanian geologists because of the absence of important raw materials concentrations (Uncu, 2011; Marku, 2014).

Big migratory movement of population 1991 made this are the most important economic zone. Such lead the Albanian Geological Survey to make a detailed strategy of research in the coastal area. The first serious study was undertaken by Durmishi *et al*., (2005), which was aimed to make a genetic zoning of coastal area and to initiate a permanent system of coastline behaviour monitoring.

In this work we have distinguished the coastal areas with accumulative and erosive behaviour. Both coast types are present in the Durrësi Bay. Thus, the area of Durrës beach, partly area of Shkëmbi i Kavajës beach (66%), areas of Golem and Qerreti beaches show accumulative behaviour, in the meanwhile the southern extreme, Karpen beach, northern extreme, Durrësi Hill and the remain part of Shkëmbi i Kavajës beach (34%) belong to erosive behaviour.

This work was followed by a periodic permanent observation of coastal area behaviour. Durrësi Bay was first monitored in the year 2006, following by a triennial period of monitoring (2006, 2009, 2012). Those surveys were a first step to introduce in the study of coastline area in Albania. But a more detailed study is required to prevent coastline behaviour and its oscillation.

Characteristics of the Area

Durrësi Bay is an important area of Albania. Among others things, the biggest harbour of Albania is situated in Durrës. The bay has a longitude of 9.7 maritime miles; meantime the maximal distance from north-south axis to coastline is 4 maritime miles (Shqypi *et al*., 1992). The relief in bay's extremes is high, but the central area is flat. The predominant winds in the bay are those of north-eastern direction and of less predominance those of south-eastern direction. The velocity of north-eastern wind is no more than 4 m/sec, meantime those south-eastern has a velocity up to 5 m/s and with greater impact in wind wave's creation (Shqypi *et al*., 1992).

The areal part of Durrësi Bay belongs to Adriatic Depression tectonic zone meantime the marine part belongs to South Adriatic Basin tectonic zone (Xhomo *et al*., 2010; 2011). The contact between

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two zones is tectonic, presenting a powerful seismic line called Adriatic-Ionian seismic line (Marku *et al*. 2014). A number of high intensity earthquakes have been generated and part of which have hit time after time the city of Durrës.

Quaternary sediments appear in the upper parts of the geological section in the both tectonic zones. In the continental area those cover the upper part of lower relief and reach a thickness up to 280 m (Xhomo *et al*., 2010; 2011). Towards the sea, those sediments who present the substrate of sea bottom reach greater thickness. Sea bottom in this part of the Adriatic Sea is generally flat and not much deep. The littoral of this region is presented by two topographic landscapes. Flat landscapes are formed by the Quaternary deposits, and the hilly landscapes are built by the molasses of Miocene-Pliocene age (Durmishi et al., 2005; Figure 1).

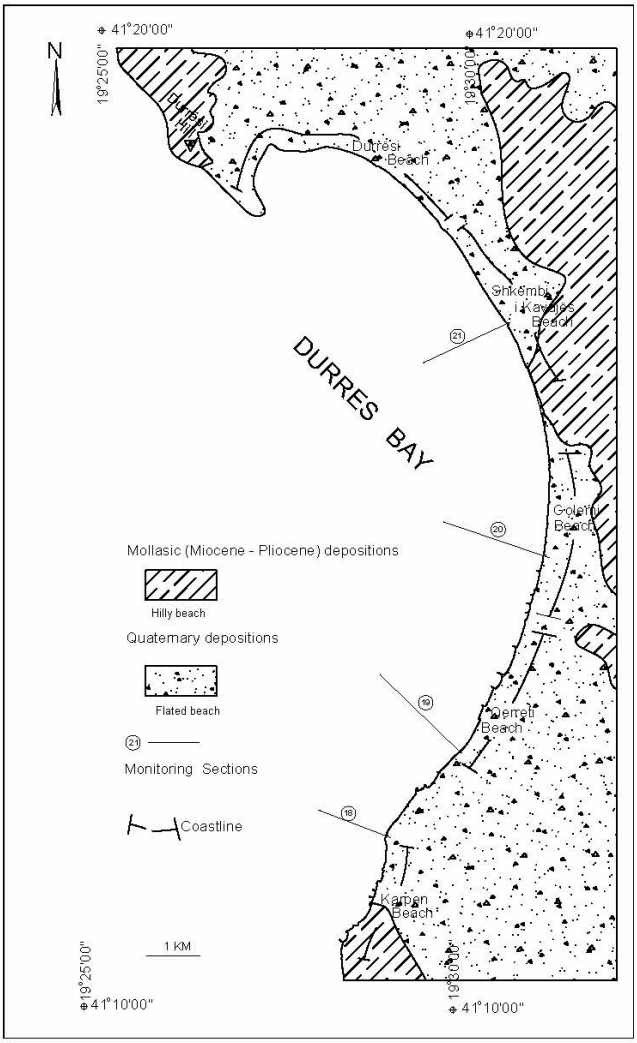

Figure 1. Geological composition of Durrës Bay with the areas of each beach sector with the monitoring profiles (designed by Marku S, based on the coastline designed by military topographic maps of year 1983 and geological border designed by Xhomo *et al*., 2002)

Table 1. The data of four monitoring profiles in Durrës Bay

Profile No.		**18**	**19**	**20**	**21**
Coordinates of initial point	Y	4373017	4374358	4376018	4375270
	X	4563722	4565324	4569025	4573481
Elevation of Initial point *(meters above m.s.l)*		1.38	0.65	1.45	1.28
Areal profile longitude *(meters)*		84.7	30.4	107.9	59.9
Marine profile longitude *(meters)*		1370	2138	1996	1753
Bathymetry of end point *(meters below m.s.l)*		6.8	6.4	6.3	6.3

Materials and Method

The results presented in this paper were carried out by the observations performed in the Durrës Bay area during the period of 2006-2016. The observations were aimed to measure the morphology substrate, using the equipment Sonar BT. First detailed monitoring of this coastline segment was performed in 2006, and was followed by periodic monitoring every three years (2006, 2009, 2012). The low tide shoreline was defined as base line of monitoring. A monitoring network compounded by four static profiles was settled in 2015 for the area, and the data are given in Table 1, and their location is presented in Figure 2.

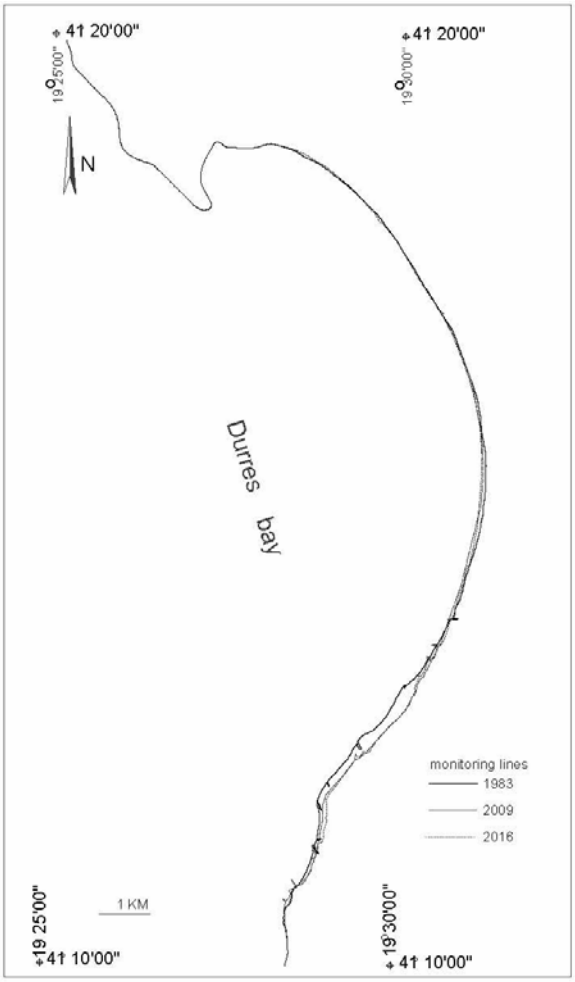

Figure 2. Positions of three coastlines in year 1983, 2009 and 2016

To have a historical comparison for the coastline behaviour, the data of coastline position was compared with the map of 1978 and the published military topographic maps of year 1983. GPS Spektra 120 model PM5V2 was used for the measurement of geographical coordinates. To discuss on the morphodinamic state of the beach we are referred to the principles published by Wright and Short (1984).

Such discussion is supported by the data of four profiles realised by our survey (Figure 3) regarding the morphologic components of sea substrate and the data from the Albanian Hydrological Service (Shqypi *et al*., 1992) regarding the tides characteristics, wind waves and dominant winds. The average level of tide is between 0.2 meters in winter and 0.4 meters in summer in the Durrësi Bay according to these works. The wind waves are created in offshore area and occur during 19% of the year. Their average height is 3.25 meters, with a length of 50 meters. In the area of capes those waves reach a height of 4.0 – 4.5 meters, and a length of 70 – 80 meters.

The stronger ripples reach the height of 2-3.5 meters with a period 6-7 seconds. The direction of these ripples is 180-220 degrees. The most frequent occurrence has the western direction.

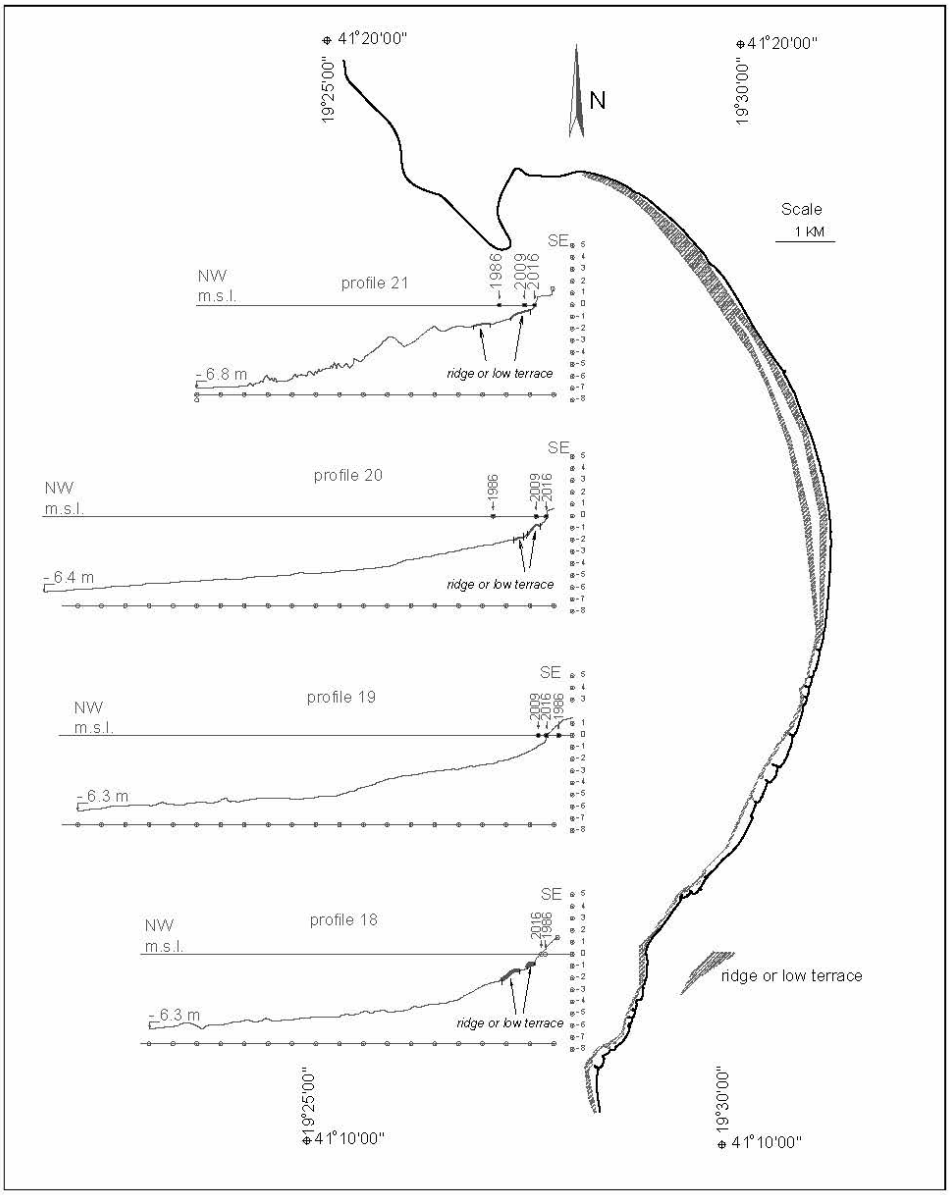

Figure 3. Four monitoring profiles and the elements of morphodynamic coastline state

Results and Discussion

The conclusions were reached out by the comparisons derived from the observations of the period 2009-16 shown as in following. In the littoral of Durrësi bay result a total of 14 hectares of accumulation (accretion) area, meantime the eroded area is 23.4 hectares. This means that the marine erosion is predominant phenomena in this area. Kavaja and Golemi beaches compound the larger area of accumulation. The erosion is observed more in the southern part of the bay, in the area of Karpen and Qerret beaches.

By the comparison made with the coastline of 1978, the results that during period 1978-2016 in this area, the phenomena of accumulation and erosion are alternated periodically.

Comparing the coastal area of Durrës, with the other Adriatic coastline of Albania, we reach to the conclusion that the segment taken in the study by this paper stays out of the influence of the sediment supply from fluvial flows. In contrast with others where in coastal plain run a number of rivers with abundant sediment supply which influence the coastal behaviour, here the surface flows are reduced in scarce number of torrents (Qiriazi, 2001). In such conditions, the waves and tidal regime are the factors which impact the coast line.

The configuration of profiles observed in all four profiles realised show low tide terrace next to coastline and parallel to it (Figure 3). Entire Adriatic coast of Albanian shows a low tidal range (TR <

2 m) according to Davies (1964). The beach is flat and waves lose their energy in the breaker zone discharging the material they transport not far away from the coast, creating a ridge (or low terrace) (fig 3) in a distance between 20 to 100 meters from the low tide shoreline.

According to Wright & Short (1984), the conditions of beaches in Durrës Bay, in its marine environment, favour an intermediate morphodynamic state of beach. This is characteristics for the "ridge and runnel-low tide terrace" morphodynamic state (fifth state of classification), according to Wright & Short (1984).

References

Balla A, (2015) *Morphometric and morphologic evolution of coastal area Shëngjin-Vlorë.* Dr. Thesis. University of Tirana. 209 p. (In Albanian).

Davies JL, (1964) A morphogenic approach to world shorelines: Zeitschrift für Geomorphologie 8, pp. 27-42. In: Masselink G, Short AD, (1993) The effect of tidal range on beach morphodynamics and morphology: a conceptual beach model. *J. Coastal Research* **9** (3): 785-800.

Dean RG, (1973) Heuristic models of sand transport in the surf zone. Engineering dynamics in the surf zone. Proc. *First Aust. Conf. Coastal Eng., Inst. Eng., Australia*, pp. 208 – 214.

Durmishi Ç, Kavaja V, Qeleshi Gj, Moisiu L, (2005) Geological, sedimentological, geophysical study and monitoring of Albanian coastal area. The Impacts in infrastructural, urban and touristic developments for a sustainable planning, administration and management. *Albanian Geological Survey Project*. 347 p. (In Albanian)

Eftimi R, (2010) *Hydrogeological characteristics of Albania*. AQUAmundi. pp. 79-92. DOI 10.4409/Am-007-10-0012

Guma L. (2016) *Assessment of the coastline and littoral in the costal area of Durresi Bay segment*. Albanian Geological Survey Project. 50p. (In Albanian).

Marku S, (2014) *Evolution of Quaternary researches in Albania, according to geological maps in 1:200.000 scale.* Department of Geology and Stratigraphy. Faculty of Geology and Mining. Tirana. Microthesis. 52 pp. (In Albanian)

Marku S, Panza G, Ormeni R, (2014) The necessity of an anti-seismic law in Albania based on NDSHA method of risk calculation. X*X Congress of the Carpathian Balkan Geological Association Tirana, Albania,* 24-26 September 2014, Special Session SS23. Bul. Shk. Gjeol., Special issues, Nr 1/2014. pp. 462-465.

Qiriazi, P. (2001) *Physical Geography of Albania. Afërdita.* 367p. (in Albanian with Engish summary).

Shqypi M, Postoli D, Limani L, Ajazi P, (1992) *Navigation guide for Adriatic and Ionian Seas*. Editing House of Army. 228 p. (In Albanian).

Uncu L, (2011). Holocene landscape changes of the Lezha region. A contribution to the palaeogeographies of coastal Albania and the geoarchaeology of ancient Lissos. Dissertation zur Erlangung des Doktorgrades der Naturwissenschaften (Dr. rer. nat.). (Marburg/Lahn). 331 p.

Wright LD, Short AD, (1984) Morphodynamic variability of surf zones and beaches: A synthesis. *Marine Geology,* **56**. 93-118

Xhomo A, Kodra A, Xhafa Z, Shallo M, (2002) *Geological Map of Albania in scale 1:200.000.* Albanian Geological Survey publication. Tirana 2002.

Xhomo A, Kodra A, Xhafa Z, Shallo M, (2010 & 2011) *Geology of Albania (Stratigraphy, Magmatism, Metamorphysm, Tectonic, Neotectonic, palaeo-geographical and geo-dynamic Evolution*) "Ngjyrat e Kohës", Tiranë. (in Albanian).