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Mesambria Pontica – coevolution of maritime community and coastal landscape

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ABSTRACT

The study presents the changes in coastline, fortification and development of the coastal zone of the "city-peninsula" – the Classical and Hellenistic Mesambrian polis, the provincial-Roman peregrine city and the (early) Byzantine bipolar municipality.

The archaeological, geomorphological and historical data document the dynamics of the regional geo- and hydrocratic relief-forming factors, which determine the formation of the Upper Pleistocene and Holocene terrace complex on/and around the Nesebar Peninsula, and their impact on the creation of the coastal zone. As a result of the negative geodynamic processes and, above all, the destructive sea abrasion and regional seismic activity, which have reworked the sea terrace, formed at 8–15 m and the shelf terrace up to the 4–5th isobath, the following sites and buildings have been brought down and "submerged" into the sea – most of the ancient and medieval fortifications, the northern nave of the basilica "The Holy Mother of God Eleusa", the church of "St Protomartyr Stephen", the temple of Zeus and Hera, an early Christian basilica, whose sacred space has been renewed by the church of "St George the Old", and the ancient theatre.

In the second half of the 20th c., the Nesebar Peninsula has acquired the the specific appearance of partite bay-like ingressional shores with a length of 850 m, a width of 300 m and an area of about 24 ha. With the successful completion of the present-day coastal protection activities at the beginning of the 21st c., they areas were "regained", incl. newly developed cca100 ha, falling within the boundaries and contact zone of the National Archaeological, and Architectural, and Urban Planning Reserve Nesebar – UNESCO World Heritage Site since 1983.

KEYWORDS

Nesebar, marine archaeology, sea level, abrasion, coastal area, construction and strengthening

Introduction

Studies of development and construction activities along the coastal area of Nesebar[1] fall within the scope of marine archaeology, the subject of which has recently been rethought by D. Gibbons and J. Adams to complement the traditional "ship-centricism", includes also other material traces of human activity along the coastal lines and maritime routes. Together with shipwrecks, such areas of interest are also the port basins and the flooded and/or sea dependent coastal settlement areas (see in Marriner, Morhange 2007, 137).

The coastline, the fortification, and the sacral and profane spaces of coastal Mesambria during

1 This study is based on the project "Maritime archaeology in Nesebar – costal (geo)morphology and build up" (funding NAIM–BAN).

Fig. 1. Nesebar peninsula in the third quarter of 20th c. (photo archive of L. Ognenova-Marinova)
Обр. 1. Несебърският полуостров през третата четвърт на XX в.
(фотоархив Л. Огненова-Маринова)

the classical and Hellenistic period, the provincial Roman peregrine city, and the (early) Byzantine bipolar municipality have been described, analyzed and mapped chronologically, stratigraphically and typologically and were compared to similar monuments, with clear context and interpretation (fig. 1). The study of the substantive-temporal development of the ancient and contemporary coastal territory, silhouette and environment by the system-diachronic method (Koval'chenko 1987, 192–193) is supplemented by synchronic structural-functional analysis of the spatial-temporal slices of the same periods.

I have utilized the traditional approaches in cartography – visual, cartometric and graphical to characterise the paleogeographic development and urban transformations along the coast of Nesebar Peninsula during the last 2500 years. The first approach is based on the analysis of the spatial forms, relations and structures reproduced in a visual form, which hels to establish the character of the coastal territorial development. Even greater possibilities in this respect are provided by the cartometric determination of coordinates, angles, distances, areas and other topographic and urban features.

Coastal geomorphology and archaeology – study tools

Maps

For the purposes of the horizontal plane study, I studied the topographic, bathymetric and cadastral maps of the peninsula made in the 19th–20th c. They are both research tools for the subject and a subject of the research as a model, replacing *realiae* that are no longer existing or the study of which is practically impossible. These are the first sketch plans of Nesebar made by Karl Finke and Helmut Moltke in 1837 (Beshevliev 2008, fig. 2); "Mesemvria. Plan města" by K. Shkorpil from

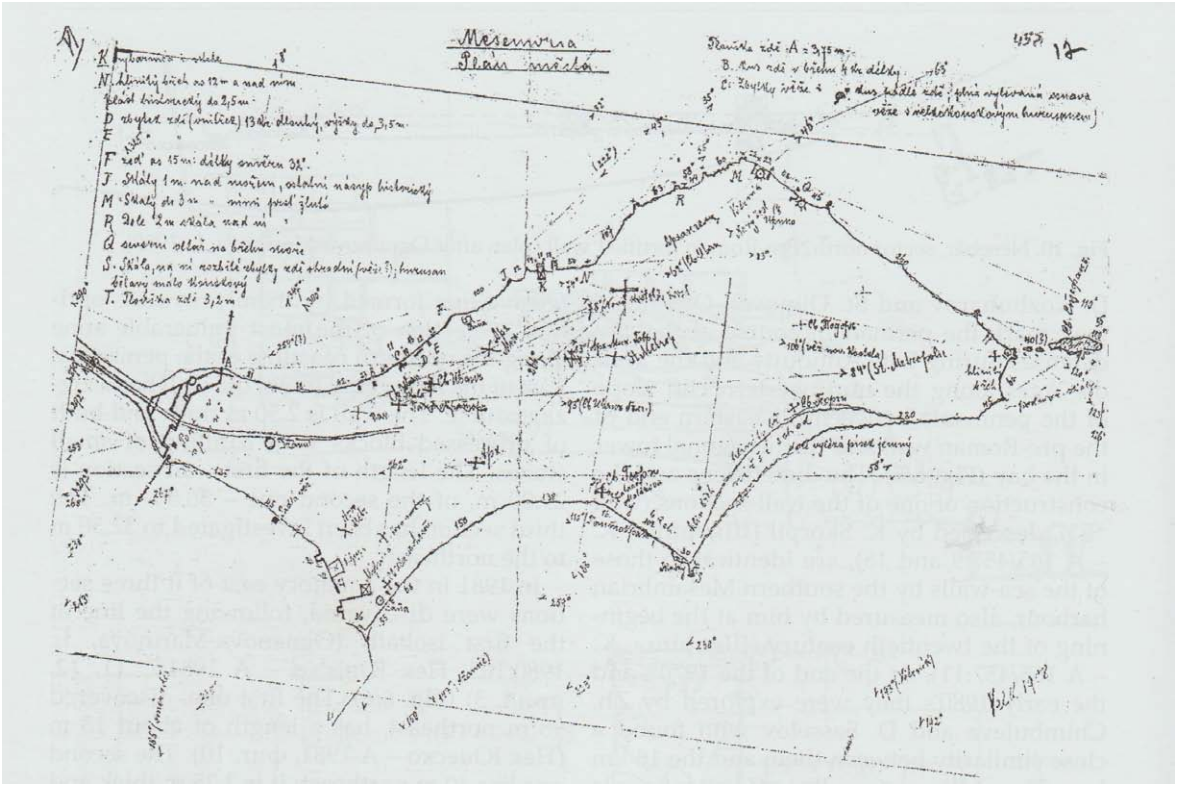


Fig. 2. Nesebar peninsula. Archaeological plan (1906)
(Archive of BAS – 165, K. Shkorpil, arch. unit 457)
Обр. 2. Несебърски полуостров. Археологически план (1906) (Архив на БАН – 165 К. Шкорпил, а. е. 457)

1906 (Shkorpil A f. 165, a. e. 457, l. 17) (fig. 2); the scheme of Nesebar from the end of the 19th – the beginning of the 20th c. (Ivanchev 1957, obr. 25); the Nesebar Regulatory Plan [1922] (Nesebar 1922); the cadastral plan of Nesebar from the middle of the 20th c. (Nesebar 1950); the Nesebar Regulatory Plan of 1980 (Nesebar 1980) and the Nesebar Digital Cadastral Map of 2006 (Nesebar 2006). On that basis, I reconstructed the course of the peninsula's isohypses, the boundaries of modern construction, the coastal and port facilities, as well as the fixed archaeological monuments integrated in the urban environment (fortress walls, public and private buildings, infrastructure).

For the reconstruction of the seafloor relief, I have used bathymetric maps, whose isobaths have been drawn up before the construction of the coastal and port facilities, which have radically changed the appearance of the seafloor in the northern bay, the aquatories to east and south of the peninsula. The isobaths in the northern bay of the peninsula up to the rocky underwater slope to the northeast are presented according to the geodetic survey, taken in connection with the strengthening of the north shore of Nesebar since 1981, which reflects the status of the seafloor relief in the shallow waters before the coastal activities (Nesebar 1981). I have reconstructed the water area east of the peninsula according to the echograms of the group for underwater activity at the National Expedition Club of UNESCO [Bulgaria] (further NEC-Unesco) (Ognenova-Marinova, Chimbuleva A 1977 [Prilozhenie]; A 1978 [Prilozhenie]; A 1983, Prilozhenie no. 2; A 1984, Prilozhenie no. 1) (fig. 3), and the isobaths in the southern coastal zone – according to the coastal plan from 1917, drawn up by the Bureau for the Study and Strengthening of the Danube and Coastal lines before the construction of shoreline and port facilities (by Shkorpil A f. 165, a. e. 457, l. 17). The use of bathymetric records from 1917 and 1977–1984 is acceptable given the minimal accumulation of seafloor, mostly sandy, deposits in the shallow waters around the peninsula (5−20 cm) (Ognenova-Marinova, Chimbuleva A

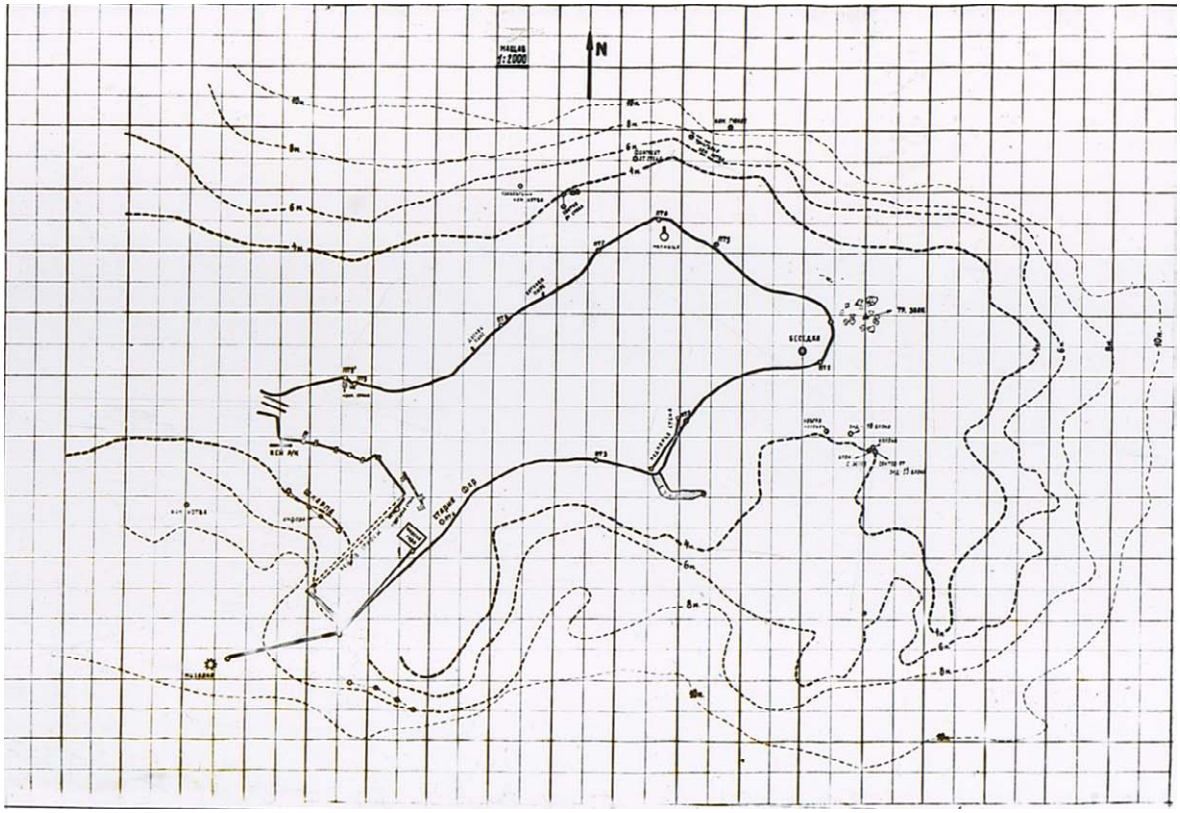


Fig. 3. Nesebar peninsula. Archaeological plan (1977) (archive Ognenova-Marinova, Chimbuleva A 1977)
Обр. 3. Несебърски полуостров. Археологически план (1977)
(архив Огненова-Маринова, Чимбулева А 1977)

1984, 11); 0.25–0.30 m (Ognenova-Marinova, Chimbuleva A 1983, 7–8, 10); bedrock (Ognenova-Marinova, Chimbuleva A 1980, 9; A 1981, 7); an unchanged seafloor relief (Ognenova-Marinova, Chimbuleva A 1978, 24, 29, figs 27–29); exceptions are the cca 3 m of sludge in the "container" of the southern port of Nesebar (Ognenova-Marinova, Chimbuleva A 1977, 5, fig. 4, "Vertical cut" of E. Clark, H. Brankov, and S. Kupriyanov from 16–18.09.1976).

Archaeological grids

The methodology requires the elaboration of a basic plan of the built-up urban area and the adjacent waters of the Nesebar Peninsula. For the purposes of the study, it is necessary to extract the outline of the city – street routes, squares, street regulation lines and axial points and horizontals (for general principles see Lilley 2000, 11–15, and for specific application see (e.g.) Davie 1987, 141–164 (Beirut case-study) from the cadastral, topographic and bathymetric plans mentioned above.

As a basis for the simplified topographic and regulatory plan, I have used the regulatory plan of Nesebar, made by "Geoplanproekt", Stara Zagora branch, at a scale of 1:500 and approved on 25.06.1980. Apart from recording the condition of the cliff slope prior to the commencement of the coastal activities, and to its axis grid in 1980–1984 (the expedition in 1980 takes place from 20.08. to 15.09.1980), the surveyors of NEC-Unesco join the tachymetrically recorded ancient and medieval buildings and features along the slope and in the waters of the peninsula. After transforming it into a larger scale of 1:1000, I superimposed the plan with a grid oriented to the magnetic north. The vertices of its squares of 50 m side coincide with the crosses fixing the vertices of the square grid forming the rectangular coordinate system of the regulatory plan. After the Nesebar Regulatory Plan of June 25, 1980 enters into force, the geodesists P. Petrov and B. Kyuchukov of NEC-Unesco transform its eastern part of a larger scale of 1:1000 and adjoin the underwater fortification facilities, anchor rods,

ceramics and seafloor relief to both grids.

In 1977–1978, for the needs of underwater surveys, the geodesists (head P. Petrov) of the underwater activity group of the NEC-Unesco make tachymetric records of the coastline of the peninsula and the isthmus through a closed 14-point polygon, linked to a triangular point 2 (further TP-2), stabilized in 1964 by engineer A. Kamenarov on the rock blockage to the east of the peninsula (Ognenova-Marinova, Chimbuleva A 1978, 7; A 1979, 7) (fig. 3). The peninsula and its aquatory up to the 10th isobath are covered by a 50 x 50 m grid. The horizontal rows are numbered in Cyrillic from "A" to "M" and the vertical are numbered from "1" to "20". The TP-2 is chosen as a datum, which facilitates the transition to the state coordinate system. The TP-2 coincides with the northeast vertices of square D-15 and lies 17.42 m west and 15.43 m south of the nearest northeast cross point of the rectangular coordinate system of the city regulatory plan from 1980. Comparing both grids at my office, I found that the two axes of the laid by NEC-Unesco grid deviate from the magnetic north by about 1°50′00″ (northwest–southeast). This deviation, the graphical accuracy with which plan lengths (0.40 m for 1:2000 scale) can be plotted or measured, and the displacements deriving from the multiple sketches to a smaller scales, affect the accuracy of some situational plans (especially at 1:2000 scale) of the peninsula.

This necessitated a check of the mutual position (horizontal projections) of the deferred polygon points (further PP), axial regulation points (further ARP), and the TP-2 and the construction of the grid coordinates (further PQN) from 1977–1984 on the topographic map of the peninsula:

a) construction of the TT-2 (coordinates x = 984.57; y = 932.58) and ARP nos 10–11, 24–25, 37–39, and the PP 6'', 104, 2, 10 (Ognenova-Marinova, Chimbuleva A 1977, 3–4; A 1978, 7; A 1979, 7–8; A 1980, 6; A 1981, 4; A 1982, 7; A 1983, 6; A 1984, 7); control check of distances (horizontal projections) between ARP, PP and the TP-2 on the regulatory plan with those on the plans of NEC-Unesco and between the vertices of triangle: PP-6'' – TP-2 – PP-2 (PP-6'' – TP-2 = 355.40 m; PP-2 – TP-2 = 347.00 m, and PP-6'' – PP-2 = 316.90 m);

b) construction of the (work) PQN from 1977/78; 1979; 1982; 1983; 1984 by detection method (see Milev, Duhovnikov 1973, 97–98) from base PP-6″ – TP-2 = 356.00 m; from base ARP-10 – ARP-25 = 145.00 m and from base TP-2 – ARP-25 = 320.00 m; PQN 1980 is constructed by polar method with relation to PP-104 (coordinates x = 60130.87; y = 7607.98), orientation according to the North and verification – distances from the coastline to profiles "A" and profiles "B" along the perpendiculars lowered to the trapezoidal-line wall; PQN 1981 – oriented according to the North and the vertices of the hexagonal tower; PQN zigzag-line wall – detected against base ARP-10 – TP-2;

c) verification of the PQN, polygons, ARP, PP, TP-2, benchmarks, geodetic method, distance checks – horizontal projections.

I mapped the studied archaeological sites, surveyed and architecturally recorded by K. Shkorpil, arch. L. Marinov, arch. D. Saselov, arch. T. Petrov, arch. A. Mladenova, arch. G. Kitov, P. Petrov, E. Milanova, B. Kyuchukov, S. Dimova and H. Preshlenov on the 1:1000 scale topographic plan of the peninsula and its aquatory, by using and refining their position in the regulatory plans and/or attachment to the urban polygon grid. As a rule, I transformed the different scale maps and plans from a smaller scale (> 1:100; 1:100; 1:200; 1:500) to a larger scale (1:1000), as a downward transition from a scale of 1:2000 at a scale of 1:1000 is assumed only for the isobaths to the south of the peninsula due to a lack of a map substrate (Shkorpil A f. 165, a. e. 457, l. 17). Invaluable technical assistance was provided by eng. A. Kamenarov, who processed the original topographic and archaeological data and prepared a general archaeological map of the peninsula.

Costal-slope cartometry

The changes of the peninsular silhouette and the development of the coastal zone necessitated the correlation of archaeological information, geomorphologic data and historical information, which

reflect the dynamics of the regional geo- and hydrocratic relief-forming factors that have determined the formation of the Holocene coastal terraces around the peninsula. Presented in graphic form, this comparison became the basis for the elaboration and refinement of a working scheme for the timing and the distance at which the redesigned cliff slope of about 12 meters a.s.l. of the so-called "Young Karangatian" terrace drew back against the coastal terraced complex at 4–12 m depth b.s.l. Urban fortifications have been built in front of and on the slope and the timing of their destructions as a result of the destructive energy of the sea waves was also estimeted.

For this purpose, using map data from the general contour plan of Nesebar, I constructed topographic profiles nos I–XVIII, which represent the linear-, area- and 3D-parameters (slopes, distances, absolute and relative hypso- and bathymetric values) of the "Young Karangatian" sea terrace, the "Phanagorian" shelf terrace and the archaeological structures. This required projections of the outline of the "broken" profiles on the horizontal plane (of the general topographic plan of the city-peninsula), which would show the direction of "falling" altitude, crossing (almost at right angle) the horizontals (isohypses and isobaths) and (at different angle) the destructions of ancient and (early) Byzantine structures in the coastal zone. The starting point of the projection of the vertical sections along the route of the profiles on the vertical plane was consistent with the course of the highest isohypse in the respective zone of the peninsula (comp. Konstantinov 1986; Milev, Duhovnikov 1973, 20, fig. 1.19, 208, fig. 10.1–2). Due to the bends along the route of topographic profiles nos I–IV, VI–VII, IX–X, XII, XIV–XVI, which follow the course of the "bergshtrichi", the sum of their component linear distances (between the bends) exceeds that of the routes connecting "directly" their two endpoints. In these cases, I calculated the linear and surface parameters of the terrain and the relative position (and relative to them) of the archaeological structures in the built-up urban area by constructing right-angle "slope triangles". One of their kathetes, which can be measured from the general topographic plan, is the horizontal distance between the structures (geomorphological, archaeological and contemporary) (a_{1-2}) and the other is the difference between their altitudes (Δh_{1-2}). The absolute distance (the hypotenuse (c) of triangles) along the slope of the terrain is calculated by Pythagoras theorem ($c^2 = a^2 + b^2$); the slope as the ratio between the kathetes ($J = (b:a) \times 100\ \%$), and the compound distances (a_{1-n}) are obtained from the ratios of the similar triangles ($a_1:h_1 = a_{1-2}:\Delta h_{1-2}$). The criss-crossed archaeological sites (sometimes at a sharp angle) I presented only up to the upper edge of the destruction found during- surveys, without marking the elevation of walls made during conservation and restoration activities. The assumed routes and walls are marked with dotted lines. In cases of practical inability to accurately determine some actual distances, I put "~" on the profiles.

Terminology

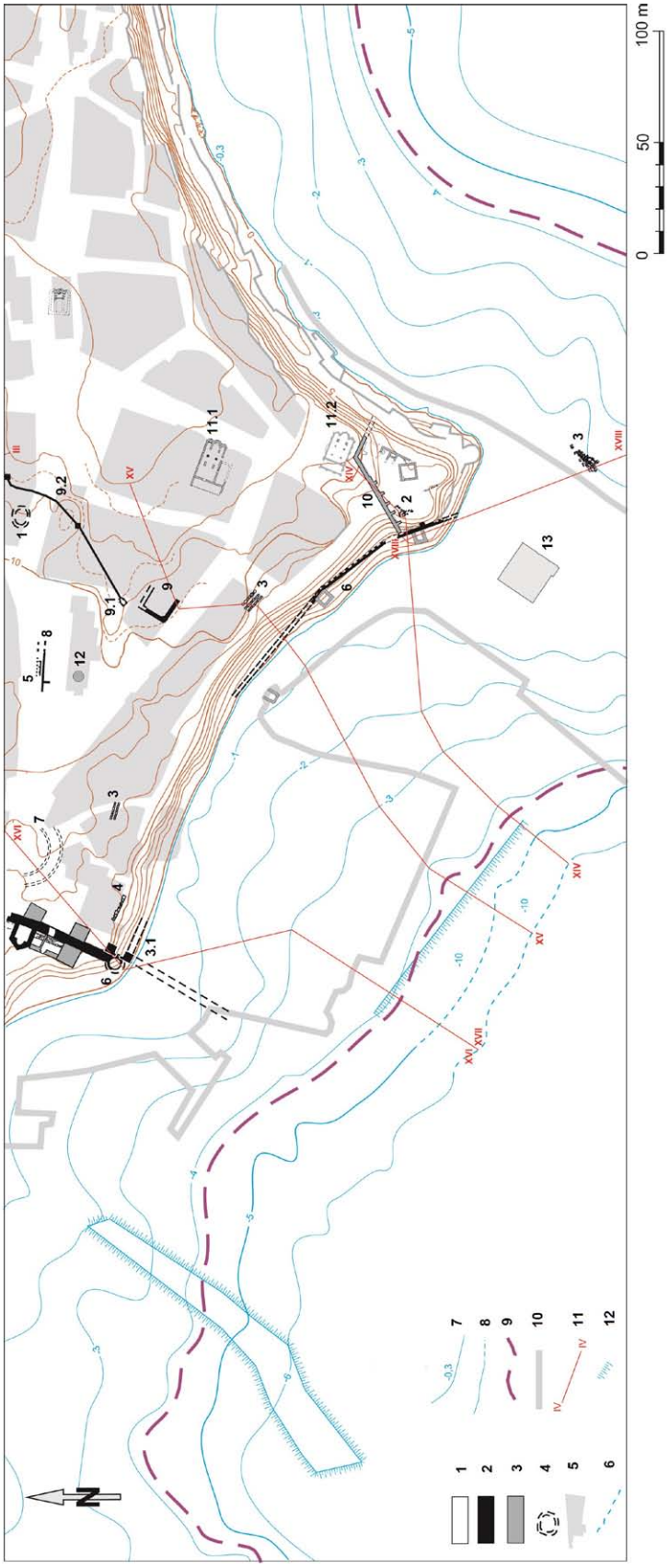
In colloquial language and in some (especially popular) publications the vocabulary, specific for sea geomorphology, is sometimes used interchangeably or a different territorial meaning is acquired. In order to avoid any possible terminological ambiguities in the description and interpretation of the morphosculpture zones of the territory and the waters of the Nesebar Peninsula, I include the following as part of the Nesebar seaside: 1) a strip of land with preserved ancient relief forms created during the transgressive phases in neogenic (pliocene) sedimentary layers (Krystev, Grigor'ev 1990, 300–301; Bol'shakov et al. 1990, 103) along higher (so-called "Young Karangatian" and "Novocher-nomorian") coastlines (Krystev et al. 1990a, 345–346, tabl. I) and currently beyond the influence of contemporary morphosculptural activity of the sea; 2) the contemporary coastline and 3) the zone of submerged shoreline with abrasion and reservoir landforms resulting from the sea level drop during the so-called "Phanagorian" regression. The coastal zone covers the coast and the coastline (underwater coastal slope) of the seafloor exposed to the waves, causing the destruction (abrasion) of the bottom and the shore. The shore includes a narrow strip, located immediately to the sea, within which are the relief forms created by contemporary water activities. Its upper boundary is marked by the

limit of the in-wash storm surge of the waves towards the land, and the lower – by the first distinctive bend along the underwater coast slope. Within these boundaries the forms, essential for the study, are the vertical plane of the coastal slope (cliff) and the partly above, partly underwater coastal shaft (beach), that are formed in the abrasive, and respectively accumulative, coasts in the band of the surf waves. During periods of prolonged stagnation of sea level, as a result of this destructive activity, eustatic sea terraces emerge in the ancient coastal areas – slightly sloping mostly underwater landscapes that fix the position of older coastlines. The latter mark the boundary line between the ancient water columns and the then dry-land. Apart from those, other significant for the study relative referent levels are the dynamic changes, usually rising, of the bottom of the port basin. In particular, this is the fine sediment layers that reflect the accumulation conditions and the presence of a floating water column (for details see Popov, Mishev 1974; Ivanov 1978; Boychev, Stoyanov 1980; Zenkovich, Popov 1980; Konstantinov 1986; Bonchev et al. 1992; Marriner, Morhange 2007).

Negative coastal processes – relief-forming factors

Tectonic and eustatic fluctuations

The fluctuations of the Black Sea level are among the factors determining the morphodynamics of the Nesebar Peninsula. Basically, the spatiotemporal changes in water stands are a result from river inflow, evaporation, precipitation and water exchange with the World Ocean through the Bosphorus. The average annual gradient of water level rise measured at three coastal points along the Bulgarian Black Sea coast – Varna, Nesebar and Burgas between 1924–1991 amounts to 2.786 mm/yr (Veselinov, Mangov 1998, 70–71, 76). Regional tectonic movements also have an impact on these changes. The relief of the Burgas lowland is linked to different neotectonic movements. To northwest they are manifested by some elevation, while to southeast – with sinking (Orachev 2002, 242–243; about the other destructive geodynamic factors of the southwestern Pontic coast see also Orachev 2019, 37–38). Oscillations of the continental plate near Orizare village, Nesebar municipality is very close to zero, according to the velocity profile of the contemporary movements of the Earth's crust along the Bulgarian Black Sea coast, with a very low sinking rate of about 0.1 mm/yr (Popov, Mishev 1974, 51–53, fig. 15). Seismic activity in the Circum Pontic region, for which data are available from the middle (279/278 BC) of the 3rd c. BC (Stoyanov 2000, 7–8; Orachev 2012, 66–68, 84), from the middle (63 BC) of the 1st c. BC (Orachev 2012, 70–71; possible in Mesambria (Bozhkova, Kiyashkina 2016, 344–345), from the 3rd–4th c. AD (Orachev 2011, 128–131), and from AD 1063, 1688, 1778 and 1855 in Mesembria-Nesebar (Konstantinidis 1945, 149; Velkov 1966, 272–273; Ognenova-Marinova 1992, 244–245) is also a geocratic factor that determines the formation of the contemporary relief of the coastal zone of the Nesebar Peninsula. Also important are the glacio-eustatic changes resulting from the uneven melting of glaciers since the last glacial period Würm III. A principal scheme of sea level fluctuations in Late Holocene along the Black Sea coast has not yet been unequivocally established in paleogeographic studies. In general, and especially regarding relatively tectonically stable coasts, the eustasy curve of P. V. Fedorov, as updated by him and K. Shilik, applies here in principle, too. The Black Sea's transgressive-regression cycles over the last four thousand years have been reconstructed by the two scholars as in-phases with different magnitudes of coincidental extremes. Due to the specificity of geomorphological and archaeological benchmarks, their values have been averaged (Shilik 1975a, 4, 10; 1975b, 72, ris. 11). In the 5th millennium BP, the rise in the Black Sea level exceeds its present value by 1.50–2 m. Geomorphologically, this maximum is evidenced by the so-called "Novochernomorian" terrace developed at 3–4 to 4–5 m a.s.l. depending on the height of the storm accumulative wash-up, and at amplitude of the vertical tectonic movements around zero (Fedorov 1963, 9; Popov, Mishev 1974, 77, 226–227; Orachev 1990, 33, 40–41, 46; Krystev et al.



Key: periods and topographic symbols
1. Antiquity
2. Late Antiquity
3. Middle Ages
4. Alleged location
5. Modern quarter
6. Sea bottom relief till the third quarter of 20th c.
7. Costal line, 20th c., Baltic system
8. Interrupted relief recording
9. Alleged costal line, 5th c. BC
10. Line of the modern coastal protection and port facilities
11. Topographical profile
12. Front of a rock bank/deepening

Location of urban spaces
1. Classical temple of Demeter (?)
2. Hellenistic temple of Apollo Kitharoidos
3. Late Classical-Early Hellenistic fortress wall
3.1 Diateikhisma
4. Hellenistic retaining wall
5. Hellenistic peristyle dwelling
6. (Early) Byzantine fortress wall
7. (Early) Byzantine "vestibule" square – southern portico
8. Early Christian basilica "St. Apostles"
9. (Early) Byzantine cistern
9.1 Catchment
9.2 Plumbing
10. Medieval retaining wall
11. Medieval churches
11.1 "St. Stephen"
11.2 "St. John Aliturgetos"
11.3 "St. Clement"
12. Mosque
13. Modern marine station

Fig. 4. Southwestern sector. Topographic-archaeological plan (thematical content H. Preshlenov)
Обр. 4. Югозападен сектор. Топографско-археологически план (тематично съдържание Х. Прешленов)

1990a, 346–347), that was also witnessed in 2006 on the northeastern coast of the Nesebar Peninsula, where burials have been carried out in 14th–15th c. AD (Bozhkova et al. 2007, 248). About the middle of the 2nd millennium BC and for most of the 1st millennium BC there is a regressive phase of the contemporary post-glacial transgression with a character of ingression, which has become known by P. Fedorov's works as "Phanagorian". During its peak, the formation of a 4 to 5 m Black Sea shelf terrace probably ends (Orachev 1990, 44). Based on the results of underwater archaeological studies in the second half of the 20th c., its amplitude peaks were identified at depths of 2/3–4/5; 4/5–7 and 7–9 m (b.s.l.), to which other coastlines would correspond (Shilik 1975b, 70–73; Shteglov 1978, 15–17, ris. 3; Krystev et al. 1990a, tabl. 1; Fouache et al. 2012, 169, fig. 6).

Surf niches carved by (the "Phanagorian"?) longstanding sea level at the rocky base of the cliff slope of the Nesebar Peninsula are documented in 1976 by Emil Clark and Sergey Kupriyanov in the dynamic harbour bottom of the southern port at a depth of 6 m, 35 m south of the wooden pier and at 6–7 m to the right [east, note H. Preshlenov] of the so called "Vertical cut" of E. Clark and H. Brankov from 1976 (fig. 4)[2]. Horizontal cracks have been found in the rock block, whose upper surface at 4 m depth has been significantly reworked by the surf (Ognenova-Marinova, Chimbuleva A 1977, 5, fig. 4; "Vertical cut" of E. Clark and H. Brankov (16–17.09.1976); about the harbour container see also Prahov et al. 2018b, 729). This geomorphological situation is consistent with the excavated destructions on the steep cliff of over 45° between the 5th and 6th isobaths, from a crescent-line fortress wall (classical, or early Thracian, or two construction phases of some of them ?) in the southeastern "Honolulu" Bay on the peninsula (Ognenova-Marinova, Chimbuleva A 1977, 6, figs 8–13; A 1978, 17, figs 10–11; A 1984, 9–10, Prilozhenie no. 3; Prahov et al. in press) (fig. 5)[3] and with the passages of walls between the 4th and 5th isobaths found during underwater reconnaissance of the sloping rocky bank in 1977, northeast of the peninsula (Ognenova-Marinova, Chimbuleva A 1977, 7; A 1977a, s.p.). About the so-called "Nimphean" transgressive phase (2nd half/end of the 1st millennium BC – 1st half/3rd quarter of 1st millennium AD) P. Fedorov assumes maximum values of sea level to 0.50–1.00 m above its present position (a.s.l.), while observations of K. Shilik in the region of Olbia limit the ingression to about 0.70 m below present sea level (b.s.l.) (Shilik 1975a, 6, 12, ris. 15; Krystev et al. 1990a, tabl. 1). The two authors establish one more, the so-called "Korsunian" regression, which they position at the end of the 1st half of the 2nd millennium AD, followed by a rise- that continues to the present days (Shilik 1975a, 7, 13, ris. 15). The Recent (according to E. Mihova, post-"Korsunian", so-called "Lazica") transgression slows down its course in the middle of the 19th c. and it is characterized by slight fluctuations until 1923–1925 when the current sea level rise has started (Mihova 1998, 67–68).

In both schematic curves, the asymmetry of the sea level rise and fall sections is an indication of the higher average velocity of the transgressive phases (Shilik 1975a, 6, 9). Along with the later slope processes, this explains the scanty geomorphological traces of changing coastlines.

The rest of the eustasy schemes (except for R. Fairbanks) contain an incomplete cycle of the long-term fluctuations at the Black Sea level. They have an ascending straight (V. P. Zenkevich, R. Fairbanks, P. Dimitrov), convex (I. A. Pravotorov), concave (A. N. Shteglov), or stepped-straight (E.

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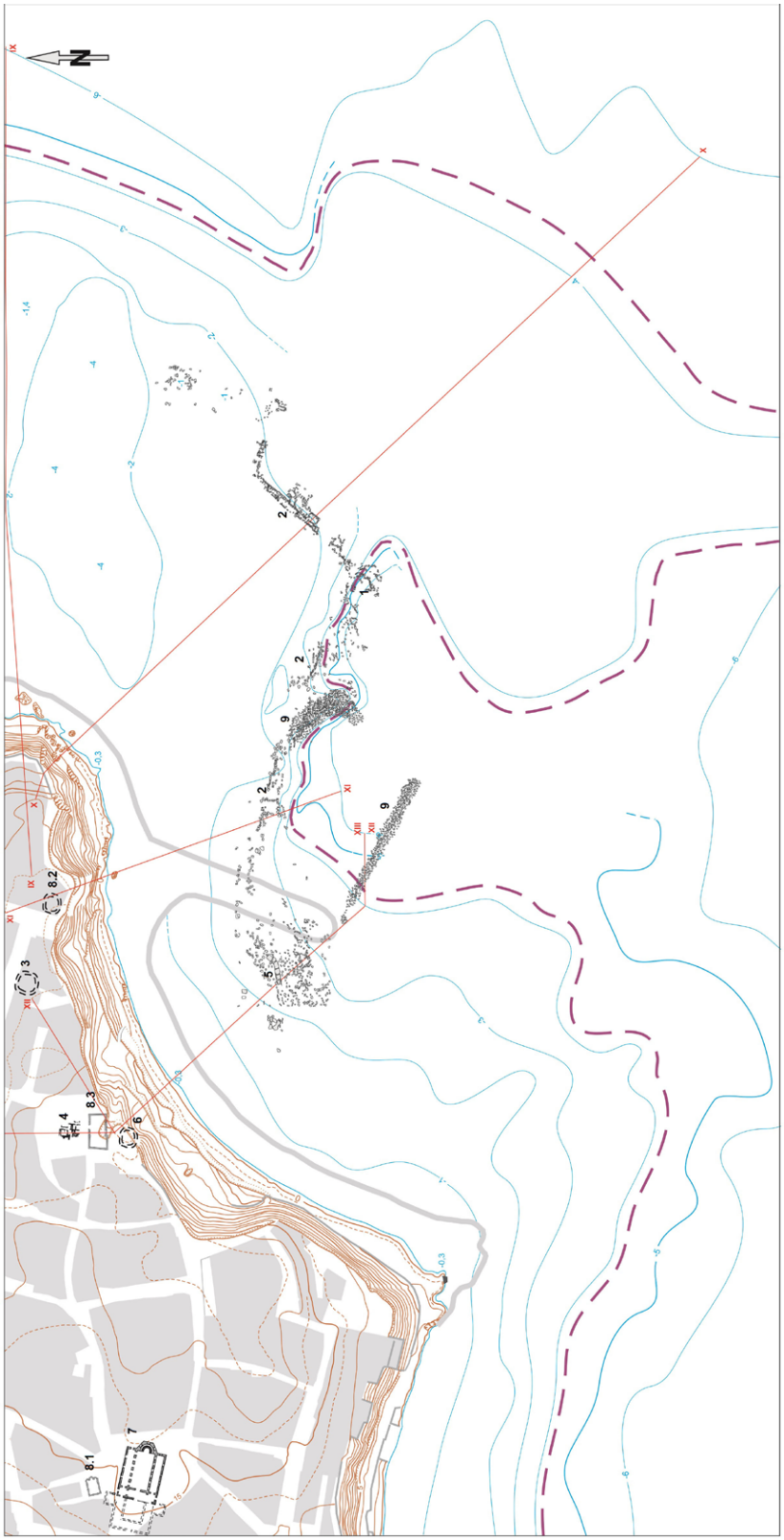
2 Thematical content H. Preshlenov, after Bozhkova, Kiyashkina 2013; 2015; Kiyashkina, Dimova 2007; Mladenova et al. A s.a.; Nesebar 2006; Ognenova A [1963]; Ognenova-Marinova 2009; Ognenova-Marinova et al. A [1986]; N. Prahov, underwater research in Nesebar in 2022; H. Preshlenov, architectural measurments; Rashenov 1932; D. Sasselov, architectural archive; Teoklieva 1988; Shkorpil A f. 165, a.e. 454; a.e. 457; Ognenova-Marinova 1969; 2005a; 2005b; Sasselov 2005; Venedikov 1969; Venedikov et al. 1969; topographical basis and graphical exposition A. Kamenarov.

3 Thematical content H. Preshlenov, after Ognenova-Marinova, Chimbuleva A 1977; A 1978; A 1979; A 1984; Prahov et al. 2018; 2020; 2021; Prahov et al. in press; Preshlenov 2021; Rashenov 1932; Bojadžiev 1962; Ognenova 1960; Ognenova-Marinova 2005a; Konstantinidis 1945; topographic base and graphic presentation A. Kamenarov.



Key: periods and topographic symbols
1. Antiquity
2. Late Antiquity
3. Medieval Period
4. Alleged localization
5. Modern quarter
6. Costal line, 20th c., Baltic system
7. Interrupted relief recording
8. Alleged costal line, 5th c. BC
9. Line of the modern coastal protection and port facilities
10. Topographical profile
11. Front of a rock bank

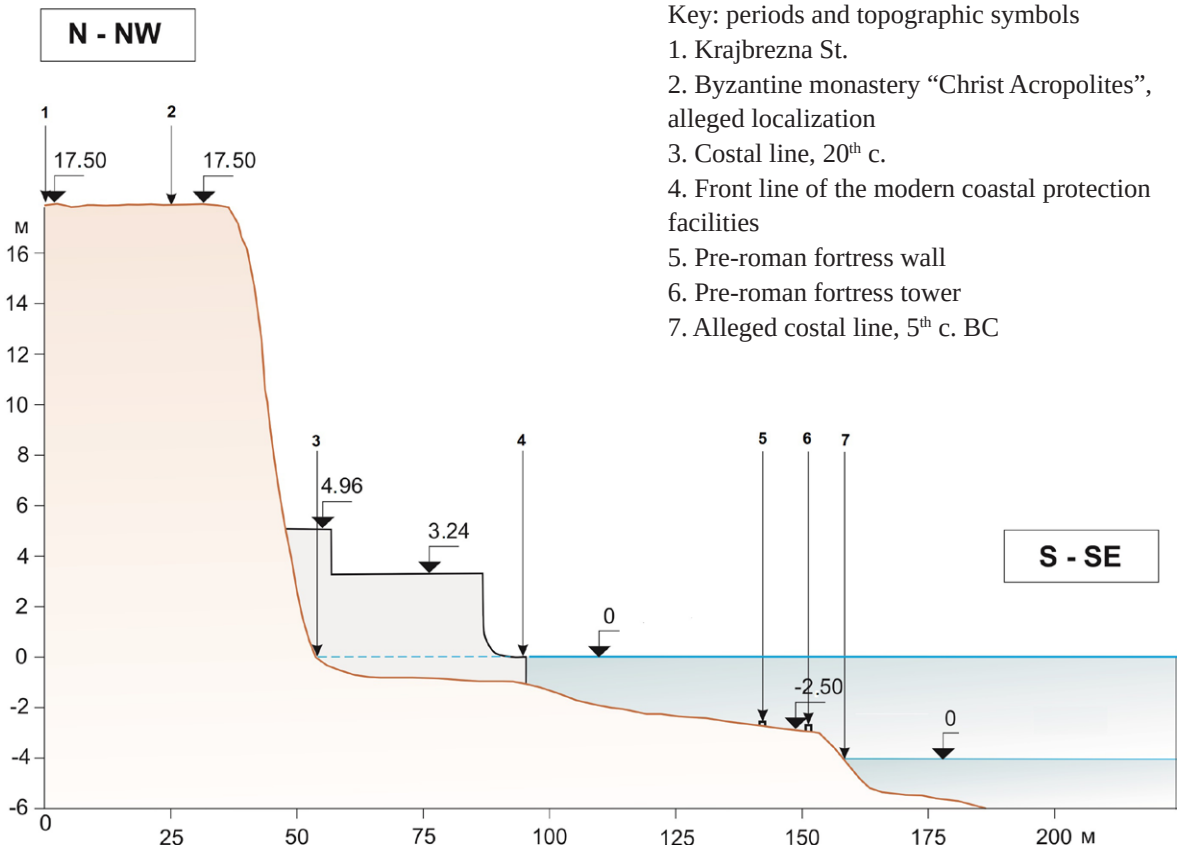
Location of urban spaces
1. Early Thracian (?) fortress wall
2. Late Classical-Early Hellenistic fortress wall
3. Hellenistic temple of Zeus and Hera
4. Hellenistic peristyle dwelling
5. Early Byzantine fortress wall
6. Early Christian Basilica
7. Early Christian Metropolitan Basilica, Byzantine and Bulgarian church “St. Sofia”
8. Medieval church
8.1 “St. Demetrius”
8.2 “Christ Akropolites”
8.3 “St. George Old”
9. Late Medieval port facilities

Fig. 5. South-eastern sector. Topographic-archaeological plan (thematical content H. Preshlenov)
Обр. 5. Югоизточен сектор. Топографско-археологически план (тематично съдържание Х. Прешленов)

Fig. 6. The monastery basilica of "The Holy Mother of God Eleusa" (after Welkow 1989, s.p.)
Обр. 6. Манастирската съборна църква „Св. Богородица Елеуса" (по Welkow 1989, s.p.)

N. Nevesskiy) course of the curve at sea level in the 1st millennium BC – the end of the 2nd millennium AD. The peaks of the water stands in them do not exceed 3 m (b.s.l.) by the end of the Antiquity (1m (b.s.l.) according to I. A. Pravotorov) (Shteglov 1978, 15, ris. 3; Dimitrov, Dimitrov 2003, 25, fig. 10; Preisinger et al. 2004, 14, Tab. 4b).

Correlation extremes of the post-glacial Black Sea transgression during the so-called "Novochernomorian" transgressive phase up to the middle of the 2nd millennium BC; "Phanagorian" regressive phase in the middle of the 1st millennium BC; "Nymphaean" transgressive phase to the 3rd quarter of the 1st millennium AD; "Korsunian" regressive phase around the middle of the 2nd millennium AD and Recent ("Lazica"?) transgressive phase in the 2nd half of the 2nd millennium AD – all form chronological intervals between two states of sea level, corresponding in cultural and historical terms to the late Bronze Age and Early Iron Age (ca. 1500–500 BC), the ancient (ca. 500 BC–500 AD) and the medieval period (ca. 500–1800) and the New Age (ca. 1800–2000). The values and relative chronology of these eustatic benchmarks will be compared to archaeological and historical data about fortress walls, sacred buildings and harbour facilities, discovered in the coastal zone of the Nesebar Peninsula, among which the ruins of the classical fortifications (end of the 5th – beginning of the first half of the 4th c. BC (Venedikov 1980, 74–75; Ognenova-Marinova 1980, 107, 109; Bozhkova, Kiyashkina 2013, 218–219), mark the coast during the "Phanagorian" regression; the



Key: periods and topographic symbols
1. Krajbrezna St.
2. Byzantine monastery “Christ Acropolites”, alleged localization
3. Costal line, 20th c.
4. Front line of the modern coastal protection facilities
5. Pre-roman fortress wall
6. Pre-roman fortress tower
7. Alleged costal line, 5th c. BC

Fig. 7. South-eastern sector. Topographic-archaeological profile XI (by H. Preshlenov; graphics A. Kamenarov); see also fig. 11
Обр. 7. Югоизточен сектор. Топографско-археологически профил XI (Х. Прешленов; графично представяне А. Каменаров; вж. и обр. 11)

route of the late Antique fortress wall (middle – 2nd half of the 5th c. AD) (Venedikov 1969, 156; Sasselov 2005, 156) aligns to the “Nymphean” rise in sea level; the collapse of the northern aisle and the renewal of the monastery basilica The Holy Mother of God Eleusa in 1341/42 (Preshlenov in press b) probably coincides with the first stages of the Recent (“Lazica”?) transgression (fig. 6), while the collapse of the church St Protomartyr Stephen in 1855 (Konstantinidis 1945, 149) appears to happen shortly before it slows down.

Different values of synchronous sea levels are explained by different pace/direction of the tectonic factor and velocity/sedimentation of the sludge, i.e. for the Nesebar Peninsula, the shelf terrace has been formed at 4–6 m (b.s.l.), the traces of the fortifications are mainly around the shelf slope of the “Young Karangatian” and “Novochernomorian” terraces, and the north and south *diateikhisma* (Preshlenov 2011, 295–296, obr. 1, 6; 2018, 396, 399; Prahov et al. 2019, 739, obr. 3) protect the area of the “Phanagorian” terrace, which is established in the Azov Sea as well (Fouache et al. 2012, 162–174).

Sea abrasion

The destructive morphosculptural activity of the sea waves is one of the most powerful exogenous factors that carve the shores of the Nesebar Peninsula. Of crucial importance for the formation and increase of their kinetic energy is the incline of the underwater and surface cuts of the shore slope in the shallow water area. The slopes of the seabed in the order of 1 % distinguish the accumulative from the abrasion shore. For values greater than 1 %, the dynamic load exerted on the shoreline rises, reaching its maximum at an incline above 45° or close to 90°, as is the profile of the contemporary

cliff coast of the Peninsula and the southeast shelf terrace of "Honolulu" Bay (Ognenova-Marinova, Chimbuleva A 1978, [Prilozhenie]; Marinski 1998, 121–122) (fig. 7).

The slope (J %) (slanting and steep part) of the coastal zone between the present (3rd quarter of the 20th c.) and the supposed ancient coast of the Nesebar Peninsula in the topographical profiles nos I–XVIII (see above), is expressed as a ratio in the so-called "triangle of the slope" between the sum of the cross-section (Δh) of the horizontals (isohypses and isobaths) and the sum of the placed (D) between them – (J % = Δh (m) : D (m) x 100) (comp. Konstantinov 1986, 20–21; Milev, Duhovnikov 1973, 124–125, fig. 5.30).

In the slightly inclined coastal sections, the destructive impact of the surf is reduced by contact with the slanting barrier. The beach is an ideal coastal protection that completely puts down the energy of the surf (Popov, Mishev 1974, 130). This elementary accumulative form is formed in the area of the coastline between the upper limit of the wave storm impact towards the land and the first noticeable bend of the underwater coast slope. The overwater part of the beach includes an upper (storm), middle and lower ("jut-in") area (in-washed by the waves in the last damping wave), corresponding to the different wave intensity (Bonchev et al. 1992, 48, 216–217). Along the southwestern Black Sea coast, the latter is formed at a slight wave height of 0.50 m, the middle one is about 10 m from the coastline at a height of 1.00 m, and the upper one is in-washed in the autumn and winter season by the storm waves of 2–3 m altitude and on average 30–40 m from the coast line (Popov, Mishev 1974, 96). The fossil and petrified fauna are most often detected in coastal sediments (beach deposits, sandy strips, storm surges, including their re-depositions) formed at the maximum oncoming of the sea into the land, and respectively at the maximum shelf drainage. They synchronize biostratigraphically abrasion and accumulation terrace landings, created at a prolonged stagnation of water and the corresponding Black Sea levels (Krystev et al. 1990c, 91–92). Thus, the established at 3–4 m "Novochernomorian" terrace b.s.l. along some sections of the Black Sea and the Azov coast, and depending on the limit of the storm wave surge, is associated with water stands of 1.50–2.00 m above the present sea level (Krystev et al. 1990a, 346–347). However, the effects of severe storms can practically be ignored. Winds that blow from the sea and cause storm surges along the Southwestern Black Sea coast make up only about 20 % of their total recurrence. Storms in the shallow shelf zone of 3–4 m height (a.s.l.) are statistically possible only once in a century, storms in the coastal zone of 3.00–3.50 m (a.s.l.) – once every 50 years, while waves of 2–4 m a.s.l. (height 2.50 m a.s.l.) are recorded every 10 years (Mihova 1990, 436–437). In accordance with the above, theoretically a non-floodable strip would be expected to exist of several to several tens of metres wide in front of the ancient fortifications and the built-up spaces in front of them, which would ensure their normal exploitation and protection from the frontal destructive force of the storm surge reaching in the Black Sea to about 2.8 t/m^2 (Ivanov 1978, 301). However, this safe distance depends on the coastal morphodynamics as well as on the spatial composition, functional zoning and parameters of the settlement structure. In the absence of pronounced morphostratigraphic levels, the provision of more specific values would be speculative, furthermore, in case of stagnation at sea level and naturally protected water area from wind drive of water masses, the fortification facilities could reach and even enter the zone of shallow water. Thus, the *diateikisms* of the Mesambrian fortifications, in addition to being a barrier, probably also perform some port functions (Preshlenov 2011, 295–296, obr. 1.) (fig. 8), while the two supposed passages of the northeast fortification wall between the 4th and 5th isobaths in front of the trapezoidal-line wall (Ognenova-Marinova, Chimbuleva A 1977a, s. p.) and the crescent-like so-called "Thracian" wall in the 5th isobath in the southeastern fortress sector (Ognenova-Marinova, Chimbuleva A 1977, 6, fig. 8) (fig. 9), are more likely reflecting the practice, of fortification "following" the sea, wherever possible. Non-floodable space between the urban structures and the coastline can also be planned for communication and military-tactical considerations with the aim of forming

Key: periods and topographic symbols
1. Early Thracian fortification wall
2. Classical and Hellenistic retaining wall
3. Temple of Zeus Hyperdexios
4. Pre-roman diateikhisma
5. Early Byzantine diateikhisma
6. Early Byzantine fortress wall
7. Early Byzantine "vestibule" square
8. Early Christian crypt
9. Early Christian Basilica and Middle Byzantine cross-domed church
10. Middle Byzantine necropolis
11. Medieval church
12. Reservoir (for water)
13. Medieval street pavement
14. (Late) Medieval port facility
15. Fishing base (today restaurant "Hemingway")
16. Mesambria St.
17. Modern coastal protection

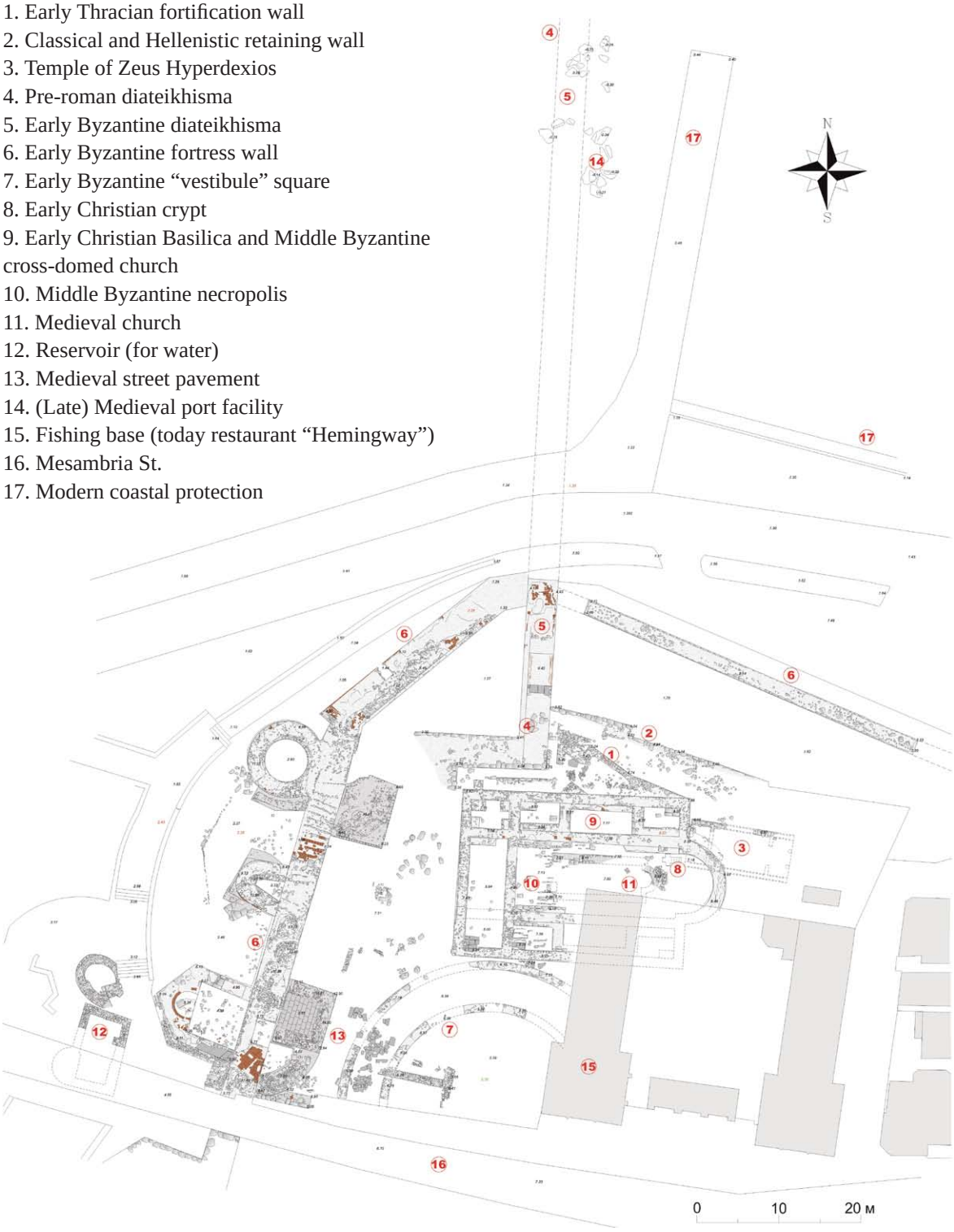


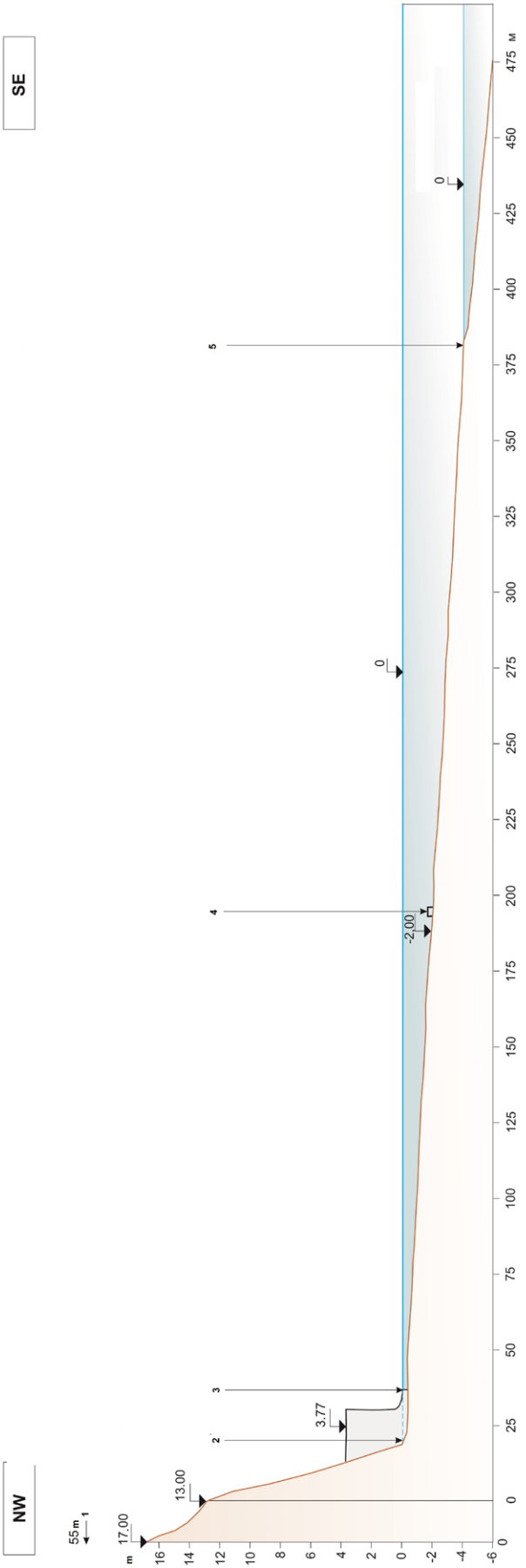
Fig. 8. North-western sector. Orto-photo topographic-archaeological plan (thematical content H. Preshlenov; see also fig. 14; orto-photo and graphics by A. Kamenarov and S. Nenchev)

Обр. 8. Северозападен сектор. Орто-фото заснемане и план (тематично съдържание Х. Прешленов, вж. и обр. 14; ортофото заснемане и графично представяне А. Каменаров, С. Ненчев)

Fig. 9. South-eastern sector. The "crescent-line", so-called "Thracian" wall (photo archive L. Ognenova-Marinova)
Обр. 9. Югоизточен сектор. Дъговидна, т. нар. „Тракийска стена" (фотоархив Л. Огненова-Маринова)

a berm at the defence front, facilitating movement in the coastal zone. An example of such a solution is found along the route of the eastern sector of the Mesambrian fortifications (Preshlenov in press a) (figs 5, 10). Of interest (especially the unprocessed sections) is the beach between its lower ("jut-in") area and middle zone, which is about 10 m wide and 0.50–1.00 m high.

More significant is the perceived risk of periodic seepage of seawater and caustic salts into deep-seated foundations and basements of buildings in close proximity to the coast. Therefore, when using archaeological data for reconstruction of presumed sea levels, they should not always be reconstructed along the lines of the fortifications or other urban structures (Shilik 1975a, 6–7; 1975b, 70, 73; Ognenova-Marinova 1980, 109, fig. 13). Such immediate proximity is possible if the walls are built directly on the bedrock, such as the trapezoidal-line wall in front of the church The Holy Mother of God Eleusa (Ognenova-Marinova, Chimbuleva A 1980, 9, figs 1–2), or if piles are embeddes below the provisionally accepted zero horizon at sea level, such as those in the substructures of the Southeast Early Byzantine curtain wall (Ognenova-Marinova, Chimbuleva A 1979, 13, figs 4–7; Prahov et al. 2020, 158, obr. 2), or if hydrophobic solutions and plaster, and shallow foundations are used, or if basements are not dug, etc. Otherwise, sea levels synchronous with the destructions of ancient and medieval fortifications and other urban structures should be expected to be lower than them along the slope of the Nesebar Peninsula. For the laying of the foundations and the construction of the cellars in Olbia and other settlements along the Northwest Black Sea coast, a "non-watered" layer of 2.00–2.50 m is assumed between the construction boundaries and the "Phanagorian" sea level, whose values, according to the updated idea of biostratigraphy and the construction of the



Key:
1. Krajbrezna St.
2. Costal line, 20th c.
3. Front line of the modern coastal protection facilities
4. Pre-roman fortress wall
5. Alleged costal line, 5th c. BC

Fig. 10. South-eastern sector. Topographic-archaeological profile X (by H. Preshlenov; graphics A. Kamenarov); see also fig. 5

Обр. 10. Югоизточен сектор. Топографско-археологически профил X (Х. Прешленов; графично представяне А. Каменаров; вж. и обр. 5)

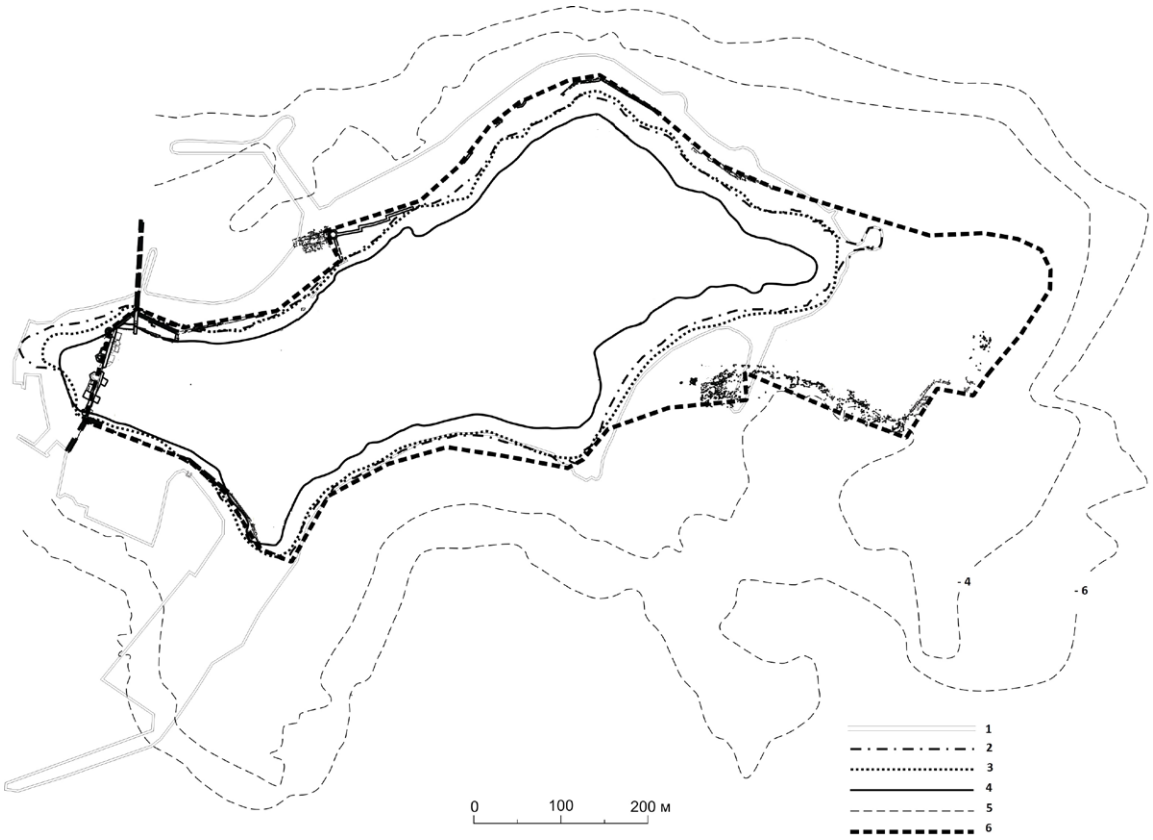
quaternary deposits of the Bulgarian shelf, are at a depth of 5–7 m b.s.l. (Shilik, Fedorov 1968, 132; Krystev et al. 1990a, tabl. 1).

For the safety of ancient and medieval urban structures, the pace of the litho- and hydrodynamic processes along the coastal area of Nesebar Peninsula is of importance. In the 20th c., and probably in several previous centuries, prominent cliff slopes characterize Nesebar Peninsula. In such cases, the destructive energy of the surf is taken by the coast, natural geographical barriers or coastal protection structures constructed at different times. An immediate threat as a result of prolonged destructive effects of waves near the sea level arises during periods of transgressive sea level rise. Even in rocky foundations, the waves carve out surf niches similar to those found in the northeastern slope under the National Border Police Office department during the archaeological surveys in 2006 (Bozhkova et al. 2007, Sektor D) and in the southwestern one in the aquatory of the contemporary south port in 1976 (Ognenova-Marinova, Chimbuleva A 1977, 5; observations and dimension "Vertical cut" of E. Clark, H. Brankov, and S. Kupriyanov from 16.09.–18.09.1976) (fig. 4). Overlying layers, losing balance under the action of their own weight, collapse into the sea. With multiple repetition of this process, the steep seashores give way to land, respectively urban construction boundaries. When the fortifications, public and private buildings are on the sloping landslide, they collapse with the landslide. Typical cases are the north aisle of the church The Holy Mother of God Eleusa (Preshlenov in press b) (fig. 6), the church St Protomartyr Stephen and the southeastern part on the Late Antique fortress wall (Preshlenov in press a; Prahov et al. 2020, 158). Such fate, according to indirect data, attains also other iconic structures in the southeastern sector of the peninsula, such as the Temple of Zeus and Hera, the early Christian basilica whose sacred space is reconstructed in the church St George the Old and the theatre of the antic polis (Ognenova 1960, 229, 231; Ognenova-Marinova 2005a, 12–13, 15) (fig. 5). Following the erosion and dispersal of the abraded mass in the sea and the destructions of urban buildings and structures, a slightly inclined abrasion terrace is formed. Expanded in this way, the shallow water area absorbs the energy of the waves and gradually the abrasion ceases (about sea abrasion (incl. Black sea) see in Ivanov 1978, 302–303; Bonchev et al. 1992, 11).

Modern measurements of the average abrading rate of the land between cape Emine and Nesebar show that in the 1980's, in linear terms, the retreat was in the order of 80 mm/yr, and the area lost is about 1000 m^2/yr (Peychev 1998, 141, Tablitsa 2; see also Hristov 2020, 169–171). However, since abrasion is also episodic in nature and at different speed, for example, when activated by eustatic and tectonic oscillatory movements, it is necessary to avoid the automatic use of its values reported for short periods to characterize its pace over longer periods, as well as to use them for comparison with established long-term averages (Mihova 1990, 435–437). As relatively good indicator for the latter, one may use urban cadastres from the 19th–20th c., the historical records and the destructions of the fortress walls, sunk in front of the northeast, east and southeast coasts of Nesebar Peninsula. At the end of the 20th c., the approaching sea waves give the sandstone, the limestone and the limestone clays of Nesebar Peninsula, being at a different stage of stability, an ingressive character, forming narrow and elongated bays and prominent capes (comp. Ivanov 1978, 301–303, 305) (fig. 11)[4].

Significant changes in the morphology of the shores of Nesebar Peninsula should be expected with the activating and simultaneous occurrence of several, often interdependent, destructive geodynamic processes including, in addition to abrasion, movements of the earth`s crust, earthquakes, landslides, erosion, etc.

4 Thematical content H. Preshlenov, after Nesebar 1922; 1950; 1980; 2006; Ognenova-Marinova, Chimbuleva A 1984; Shkorpil A f. 165, a.e. 457; Ognenova-Marinova 1980; Sasselov 2005; Venedikov 1980; topographic base and graphic presentation A. Kamenarov.



Key:
1. Strengthening of the sea shore, beginning of 21th c.; 2. Coastal line, 3rd quarter of 20th c.;
3. Coastal line, 1st quarter of 20th c.; 4. Sea terrace (8–12m), mid-20th c.; 5. Sea bottom, 20th c.;
6. Fortifications, mid-1st millennium BC – mid-1st millennium AD

Fig. 11 Nesebăr peninsula. Plan of the coastal line (thematical content H. Preshlenov)
Обр. 11. Несебърски полуостров. Брегови линии (План-схема) (тематично съдържание Х. Прешленов

Costal morphology and archaeological cartography

Upper Pliocene terraces

The formation of the "Young Karangatian" terrace, on which most of the urban structures of the ancient, medieval and present Nesebar are built, is associated with a transgressive phase in the development of the Black Sea basin, traditionally placed in the Upper Pleistocene 120.000 – 90.000 yrs ago (Popov, Mishev 1974, 29–30, 45, 47, 76; Krystev et al. 1990a, 345; Dimitrov, Dimitrov 2003, 20–21). The possibilities for absolute dating of this process are still ambiguous insomuch "Karangatian" sediments have been related to a later date (e.g. by ion-uranium method before 57.92 thousand yrs and before 36.9–25.7 thousand yrs by radiocarbon method) (Krystev et al. 1990b, 215). During this geological period, the Nesebar paleo-peninsula had a narrow and strongly elongated shape, formed by sedimentary Neogene strata (Krystev, Grigoriev 1990, 301). Wave processes reworked the shoreline, forming an abrasive-accumulating terrace at, on average, 12 m a.s.l. over almost horizontal Miocene limestone sandstones (Odarska Formation), marl lime stones and clays (Popov, Mishev 1974, 76, fig. 23, 223) compare the types of rocks of the adjacent (Cape) Emine Formation (Velev 2020, 178) (fig. 12). A plinth over the Sarmatian limestone abrasion terrace is also revealed on the continental coast opposite the peninsula-tombolo, but according to its hypsometric position its formation is attributed to the Pliocene (6.0 – about 1.7 million yrs). The crumbling accumulated cover

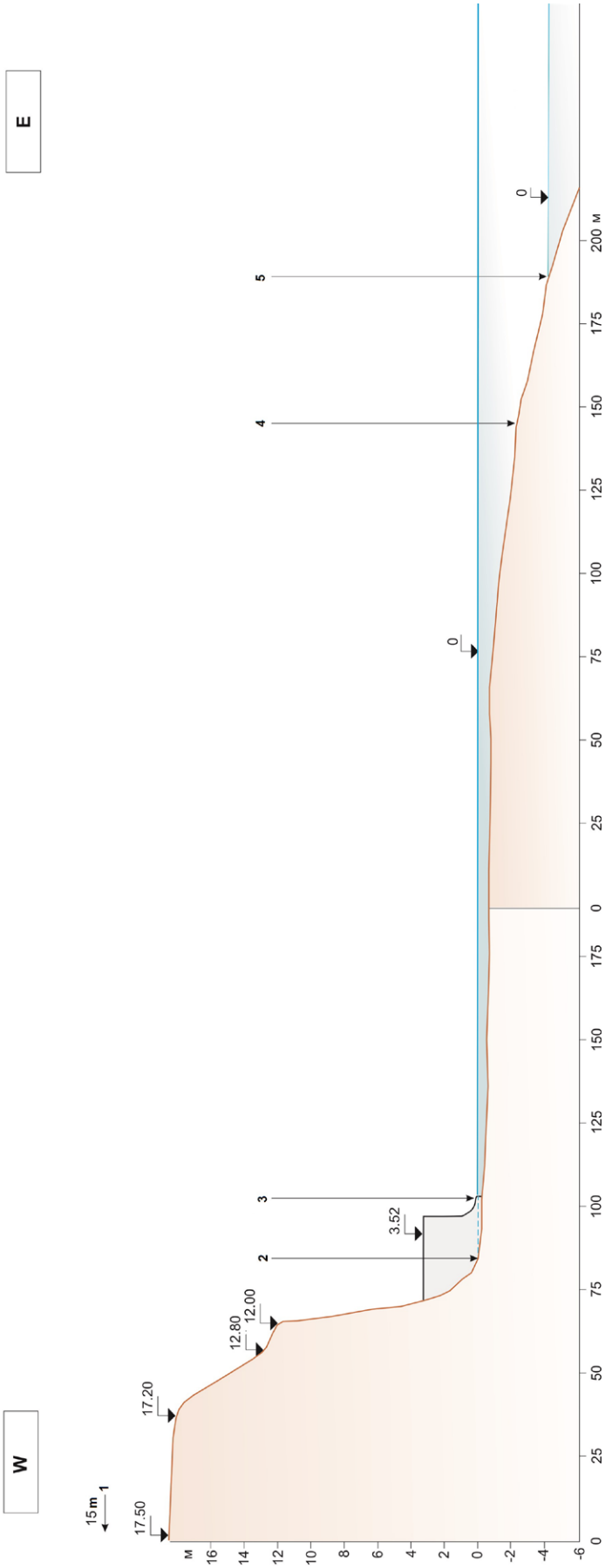
Fig. 12. Eastern sector. The eastern cliff slope of the peninsula (photo archive L. Ognenova-Marinova)
Обр. 12. Източен сектор. Източен клифов склон на полуострова (фотоархив Л. Огненова-Маринова)

consists of sandy clays, sandy small gravels, and ballast with a lens of fossil soil (Bol'shakov et al. 1990, 103).

During the "post-Karangatian" regression about 18 000 yrs ago, which lowered the Black Sea level to 90 m b.s.l. compared to its present stands, the receding waters reworked the underwater slope around the "Karangatian" land. The increased erosion activity of river runoff in the drained strip of the shelf washed away or relocated the "Karangatian" coastal sands and shells in the "post-Karangatian strata. "Karangatian" strata survive on some of the higher upland sites (Krystev et al. 1990a, 346, Krystev, Grigoriev 1990, 298). Probably among them is the Nesebar paleo-peninsula, which rises above the valley slopes of the ancient Hadzhiyska River. From a general theoretical point of view (comp. Orachev 1990, 39) and given the already very low rate of sinking of the Earth's crust between the Stara planina folded system and the Burgas synclinorium as a result of these sloping processes, the formation of a highly sloping abrasion surface along the previous underwater coastal slope of the peninsula could be expected.

Holocene terraces

The peninsula was again subjected to the destructive geological activity of the sea during the second ("Old"- and "Novochernomorian") transgressive phase. Geomorphologically, the Black Sea



Key
1. Krajbrezna St.
2. Costal line, 20th c.
3. Front line of the modern coastal protection facilities
4. Alleged localization of the eastern fortress route
5. Alleged costal line, 5th c. BC

Fig. 13. South-eastern sector. Topographic-archaeological profile IX (by H. Preshlenov; graphics A. Kamenarov); see also fig. 5)
Обр. 13. Югоизточен сектор. Топографско-археологически профил IX (Х. Прешленов; графично представяне А. Каменаров; вж. и обр. 5)

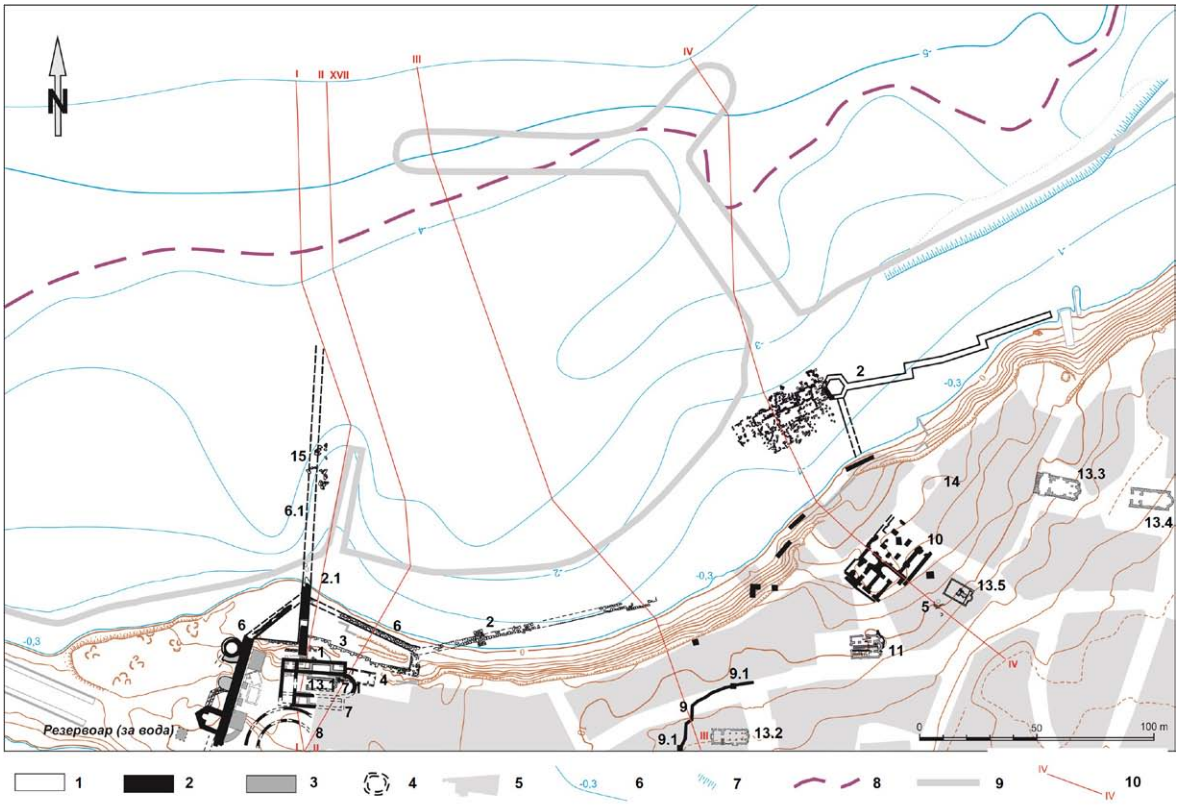
maximum is connected to the terrace developed at 3–4/4–5 m a.s.l. along the Black Sea and the Azov coast, depending on the height of the storm accumulative in-wash (Krystev et al. 1990a, 346–347). In the Burgas lowland to the west of the resort of Slanchev bryag, the "Novochernomorian" terrace is mainly accumulative and abrasion-accumulative in character (Fedorov 1963, 9; Popov, Mishev 1974, 77, 226–227). The "Novochernomorian" sea re-worked the inherited steep slope of the Nesebar paleo-peninsula. An abrasive slope with recesses cut to the root rocks up to 5.70 m high was found during an archaeological survey in Nesebar in 2006, on the northern slope below the "Karangatian" terraced area under the National Border Police Service department (Bozhkova et al. 2007).

During the "Phanagorian" regression phase of the postglacial stage transgression, the peak of which happens after the 7th–6th c. BC (Orachev 1990, 34), the coastline marked by the coastal terraced complex at 4–12 m b.s.l. (Popov, Mishev 1974, 56–57), is at least 300 m to the east of the present foothills of the peninsula slope (Nesebar 1980; Ognenova-Marinova, Chimbuleva A 1984, Prilozhenie no. 1) (fig. 13). During the contemporary with this regression maximum Doric settlement of the peninsula, the head of the steep, probably cliff slope of the peninsula rises above the "Phanagorian" sea, separated from it by a wide beach-terrace. At the end of the 20th c., the highest eastern part of the peninsula has raised 18 m a.s.l. Here, during the archaeological excavations at the "Zastavata" site between the "Kraybrezhna" and "Emona" streets, a tickness of the cultural layers from 3.50 to 4.25 m has been established (Ognenova 1958, s.p.; 1960, 226). During the "Phanagorian" regression, the sea level is at least 5 m below its present value, which implies that during this period the peninsular terrace area has approximately the same altitude (figs 5, 7).

This topographic feature provides opportunities for visual inspection of the seashore and the water area, providing tactical advantages in organizing the defence of the peninsular settlement during the Classical Antiquity.

The phasic Holocene transgression has an effect not only on the shelf terraces but also on the rhythm of the estuary deposits. Peat formation conditions occur during transgression deceleration during periods of relative dynamic "equilibrium" of the Black Sea level. The depth of the peat layers in the alluvium of the sand strip is similar to that of the underwater coastal shelf terraces. The depth of the "Phanagorian" terrace in relation to the present-day s.l. in the Gulf of Nesebar can be indirectly inferred from the peat layers in the estuary of the Hadzhiyska River, whose area of about 19.2 km^2 has been studied in several boreholes which were drilled during the construction of the Slanchev bryag resort. Three peat layers were found in the sand layer up to 25 m thick – at 4–5; 10–12.5 and 20–22 m b.s.l., which confirm the steady ingressive move in the development of the estuary (Popov, Mishev 1974, 152, 158, 162, 225, fig. 63). The first one, corresponding to the submerged terrace at 4–5 m depth b.s.l., established biostratigraphically at different sections along the Black Sea coast, draws attention to the relevant isobaths around Nesebar Peninsula at the hypothetical reconstruction of the coastal zone during the "Phanagorian" regression phase around the middle of the 1st millennium BC. Due to its alteration in the later geodynamic processes in the Gulf of Nesebar, the position of the ancient coastline may be approximately established only to east and south. A more noticeable decrease of the (underwater) relief, probably related to the "Phanagorian" coast, is observed in the aquatory north – northeast of the 4th–5th isobaths and east – southeast of the 2nd–3rd–5th isobaths of the peninsula (Ognenova-Marinova, Chimbuleva A 1977, Karta; A 1978, fig. 6; A 1984, Prilozhenie no. 1; Preshlenov 2018, fig. 4; Prahov et al. 2018a, 726–727; Prahov et al. in press) (fig. 5).

The final formation of Nesebar Peninsula is during the Recent ("Lazica"?) transgression phase that has emerged over the last five to six centuries (Popov, Mishev 1974, 76, fig. 23). As a result of the combined negative impact, the coastal slope of the peninsula has been reworked; all older coastlines have been blurred and obliterated. The upper boundary of the sea shore, which until the construction of engineering facilities with coastal protective and port functions at the end of the 20th



Key: periods and topographic symbols
1. Antiquity; 2. Late Antiquity; 3. Medieval Period; 4. Alleged localization; 5. Modern quarter; 6. Costal line, 20th c., Baltic system; 7. Front of rock bank; 8. Alleged costal line, 5th c. BC; 9. Line of the modern coastal protection and port facilities; 10. Topographical profile;
Location of the urban spaces
1. Early Thracian strengthening wall; 2. Late Classical fortress wall
2.1 Diateikhisma – North; 3. Late Classical retaining wall; 4. Early Hellenistic temple (Doric order) of Zeus Hyperdexios; 5. Hellenistic peristyle dwelling; 6. Early Byzantine fortress wall; 6.1 Diateikhisma – North; 7. Early Christian three-nave basilica, after reconstruction cross-domed Middle Byzantine church; 7.1 Crypt; 8.Early Byzantine "vestibule" square – northern portico; 9. Early Byzantine piping; 9.1 Shaft
10. Early Byzantine bath house; 11. "St. John the Baptist" – Early Christian three-nave basilica, domed Byzantine and Bulgarian church; 12. Middle Byzantine water reservoir; 13. Medieval churches; 13.1 One-nave church; 13.2 "Christ Pantocrator"; 13.3 "St. Archangels Michael and Gabriel"; 13.4 "St. Paraskeva"; 13.5 "St. Saviour"; 14. Hammam; 15. Late Medieval mole

Fig. 14. Northwestern sector. Topographic-archaeological plan (thematical content H. Preshlenov)
Обр. 14. Северозападен сектор. Топографско-археологически план (тематично съдържание Х. Прешленов)

c. was determined by the limit of the storm wave impact, is cut in the rear of the slightly inclined to the sea abrasion site of the steep abrasion cliff of the peninsula.

Prior to the coastal strengthening activities around the peninsula at the end of the 20th c., it had the specific appearance of indented bay ingressive shores – narrow and long bays – to northwest, north central, northeast, southeast, south central, southwest and similar prominent capes – to northwest, northeast, east, south central, southwest (fig. 11).

Building activities and withdrawing coasts

The ruins of the ancient and (early) Byzantine fortifications are situated between the seabed of the 4th–5th isobath on the southeastern coast of the peninsula (fig. 5) and the 13th isohypse along

the northwestern slope of the peninsula (fig. 14)[5]. This coastal strip, with submerged, present and ancient higher coastlines, is located also geomorphologically between the "Phanagorian" coast and the "Young Karangatian" terrace, which remains the core of the fortified urban area except for the early Thracian settlement, the Classical Greek-Roman polis, the late Antique city, and the medieval Nesebar (fig. 11).

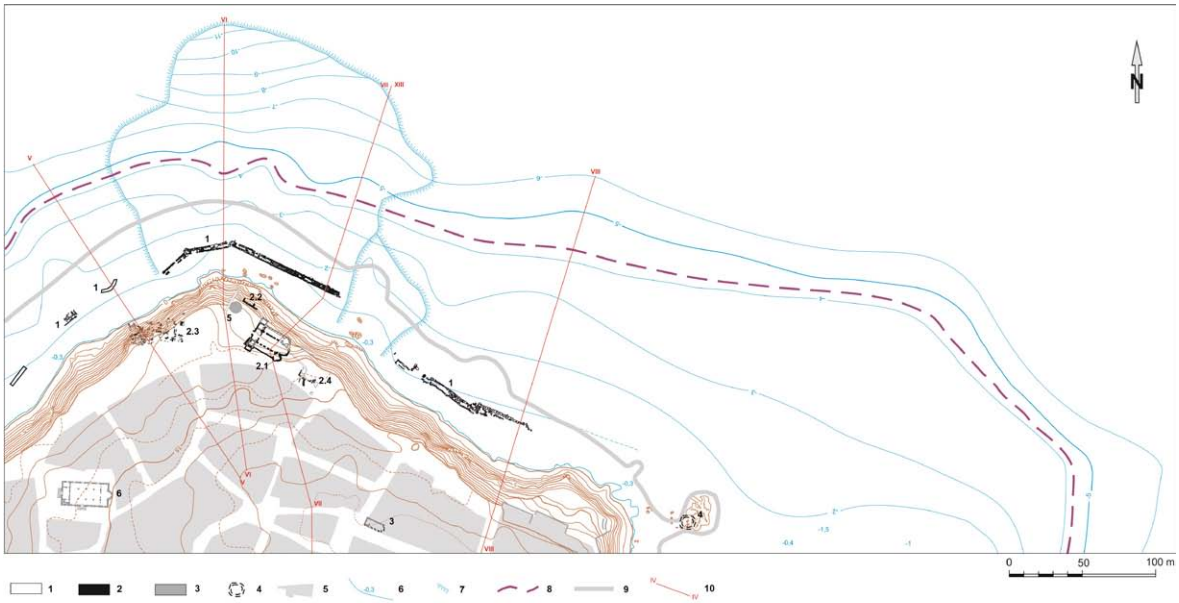
The dynamics of the tectonic movements of the earth crust in the valley of the Hadzhiyska River along the Durankulak–Tsarevo levelling line characterize the adjacent seashore as relatively stable (Popov, Mishev 1974, 51, fig. 15; Orachev 1990, 39, 46). The localization of the early Thracian and Classical fortification of the Doric polis in the area of the 4th–5th isobaths in the southeastern and northeastern sector of the peninsula suggests a predictable limit of sea fluctuations in the 12th–5th centuries BC to the same levels (Ognenova-Marinova, Chimbuleva A 1977, Karta; A 1978, fig. 6; A 1984, Prilozhenie no. 1; Preshlenov 2018, fig. 4; Prahov et al. in press) (figs 5, 7).

Therefore, the coastal zone during the nascence of the Mesambrian polis (before the creation of its monumental built environment) may be located on and in front of 4–5 m (b.s.l.) shelf terrace. It includes the strip of land, in which the landforms at that time sea level were developed, as well as a part of the former coastal underтwater stream, exposed to the wave action. The displacement of the northeast line of the curtain wall in the shallow water south of the 4th–5th isobaths (figs 15–16) could be due to both changed eustatic in the second half of the 1st millennium BC and other negative geodynamic processes (Shilik 1970, 110–111, 113; Popov, Mishev 1974, 96, 130; Ivanov 1978, 301–305).

The correlation of written and archaeological data with the main processes of terrace and estuary formation on the southwestern Black Sea coast (Orachev 1990, 44–45; 2002, 244, 247) and the eustatic scheme for fluctuations at the level of the Black Sea basin suggested by P. Fedorov, and accepted by E. Mihova (1998, fig. 2) and A. Orachev (1990, obr. 1) point to a gradual rise of water stands until the end of the 1st millennium BC, as periods of prolonged stagnation at sea level cannot be excluded (Shilik 1975b, ris. 15). Such a paleogeographic situation would not hamper the loading and unloading works on the pier-*diateikhisma* and in the warehouses, as well as ship repair activities in the docks in the northern coastal zone (Ognenova-Marinova 1994, 141; Preshlenov 2011, 295–296; Prahov et al. in press). The more intensive habitation in front of the northwestern sector of the Mesambrian fortifications can also be explained by the presence of three gates, located at the hexagonal tower, at the eastern end of the north retaining wall, and in *diateikhisma*, protecting this suburban space from the west (Preshlenov 2011, 296–297, 299–302, 304, 308) (figs 8, 14, 17). From the Classical period onward, the suburban areas with northern exposure have traditionally housed artisan quarters and associated shipyards and other seafaring facilities (Kolb 1984, 129; Vitruviy 1936, 110–111).

The changing paleo-ecological environment associated with the steady rise in sea level during the peak of the "Nymphean" transgressive phase in the 1st half – 3rd quarter of the 1st millennium AD, a process that in previous centuries necessitated the search for stable higher ground for the construction of fortress facilities and neighbourhoods in other western Black Sea settlements (Orachev 2002, 247), limits the possibilities for expansion of the fortified urban area. Parts from the built in the 5th c. AD Mesemvrian curtain wall in opus mixtum are discovered in the southeastern bay of the peninsula between the 2nd and 3rd isobaths at about 110 m (horizontal distance measured from its placement in the so-called "slope triangle") in front of the destroyed in the 1950s church St George the Old, which

5 Thematical content H. Preshlenov, after Bozhkova, Kiyashkina 2015; Kozhuharov 2003; Marvakov, Gyuzelev, Gospodinov, 2014; L. Marinov, architectural archive; Nesebar 1981; Nesebar 2006; Ognenova-Marinova, Chimbuleva 1985; A 1981; A 1984; N. Prahov, underwater research in Nesebăr in 2022; Preshlenov 2011; 2021; H. Preshlenov, architectural measurements; Rashenov 1932; Saselov 2000; Sirkarov 1965; Teoklieva 1988; Shkorpil A f. 165, a.e. 457; Ognenova-Marinova 1980; 2005b; Venedikov 1969; 1980; topographic base and graphic presentation A. Kamenarov.



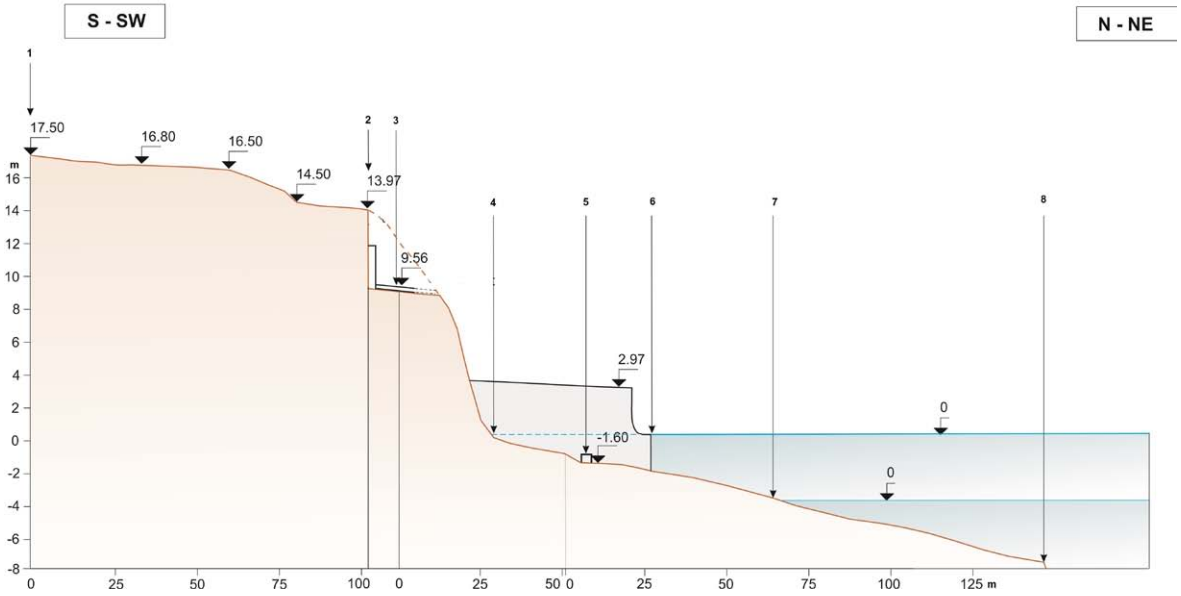
Key: periods and topographic symbols
1. Antiquity; 2. Late Antiquity; 3. Middle Ages Medieval period; 4. Alleged localization; 5. Sea bottom (4th–6th isobaths), 20th c.; 6. Costal line, 20th c., Baltic system; 7. Interrupted relief recording; 8. Alleged costal line, 5th c. BC; 9. Line of the modern coastal protection and port facilities; 10. Topographic profile; 11. Front of a rock bank
Location of the urban spaces
1. Late Classical-Early Hellenistic fortress wall; 2. Early Christian, Byzantine and Bulgarian monastery "The Holy Mother of God Eleusa"; 2.1 Cathedral Basilica; 2.2 Pilgrim (?) church; 2.3 Middle Byzantine necropolis; 2.4 Late Medieval necropolis; 3. Medieval church "St. Theodore"; 4. Revival church "St. Protomartyr Stephen"; 5. Revival windmill; 6. Modern church "Assumption of the Virgin"

Fig. 15. Northeastern sector. Topographic-archaeological plan (thematical content H. Preshlenov)
Обр. 15. Североизточен сектор. Топографско-археологически план (тематично съдържание Х. Прешленов)

has renewed the sacred space of an early Christian basilica that has fallen into the sea (Ognenova-Marinova, Chimbuleva A 1979 Prilozhenie nos 3,–4; Prahov et al. 2020, 158, obr. 1) (figs 5, 18).

The route chosen by the early Byzantine builders confirms the established by P. Fedorov and K. Shilik rate of rise of the Black Sea level in the 1st millennium AD with sin-phase extremes (see above) and shows that by this second period of more significant urban redevelopment of the peninsula, some sections of the Hellenic wall had not yet been flooded by seawater. At even higher sites along the edge and on the slope of the cliff, other sections of early (and/or middle?) Byzantine fortifications have been built, seen by K. Shkorpil in 1906 over the northwestern bay, to the southwest of the hexagonal tower (Shkorpil A f. 165, a. e. 457, l. 9, 17–18; Preshlenov 2011, 304–308, obr. 5) and detected by D. Kozhuharov and S. Dimova (Archaeological Museum "Ancient Nesebar") during the construction of hotel "Stankov" in the 1990s and in 2008, whom I thank for the provided information (fig. 14).

The "Nymphean" transgression that has established the sea stands before the end of the 1st millennium AD along the northern Black Sea coast (Nymphaeum, Olbia, Chersonesus) close to their present values, the "Korsunian" regression and the subsequent relatively intense first stages of the Recent ("Lazica"?) transgression in the 13th–15th c. (Shilik 1975a, 6–7), as well as the recorded by the Byzantine authors seismic activity in 1037 AD and 1063 AD appear to be manifested to some extent in the Nesebar Peninsula as well. Regardless of the possible differences in the minimum and



Key:
1. Emona St.; 2. Krajbrezna St.; 3. Monastery basilica "The Holy Mother of God Eleusa"; 4. Costal line, 20th c.; 5. Pre-roman fortress wall; 6. Front line of the modern coastal protection facilities; 7. Alleged costal line, 5th c. BC; 8. Front of a rock bank

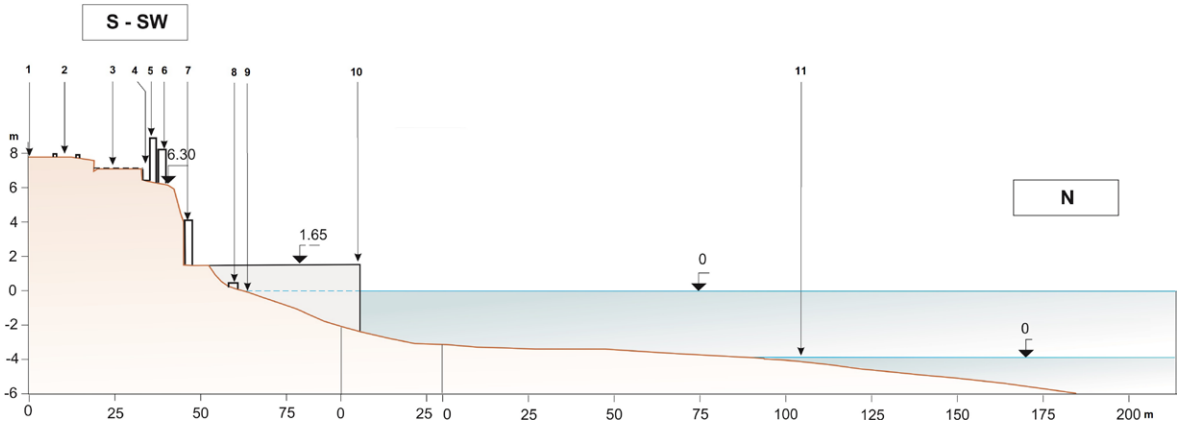
Fig. 16. North-eastern sector. Topographic-archaeological profile VII (by H. Preshlenov; graphics A. Kamenarov); see also fig. 15)
Обр. 16. Североизточен сектор. Топографско-археологически профил VII (Х. Прешленов; графично представяне А. Каменаров; вж. и обр. 15)

maximum values of the fluctuations of the water bodies on the two Black Sea coasts, the upward average annual gradient of the Black Sea trend is a prerequisite for the activation of abrasion and other destructive geodynamic processes such as landslides and collapses (Popov, Mishev 1974, tabl. 12; Mihova 1998, 67; Orachev 2002, 249–250; Ognenova-Marinova 1992, 244).

The destabilization of the cliff slope and the head of the peninsula terrace necessitated the abandonment of the north aisle and the naves, and probably the second renovation of the monastery basilica The Holy Mother of God Eleusa, an event, which is reported in a donation inscription on the silver obverse of the icon of The Holy Mother of God Eleusa from 1341/42 (Chimbuleva, Gyuzelev 2003, 28–30; Preshlenov 2009, 199). The church is built on the levelled northeastern zone of the peninsula at 8.90–9.50 m above sea level (Shkorpil A f. 165, op. 1, a. e. 454, l. 38, 43 g.) (fig. 16).

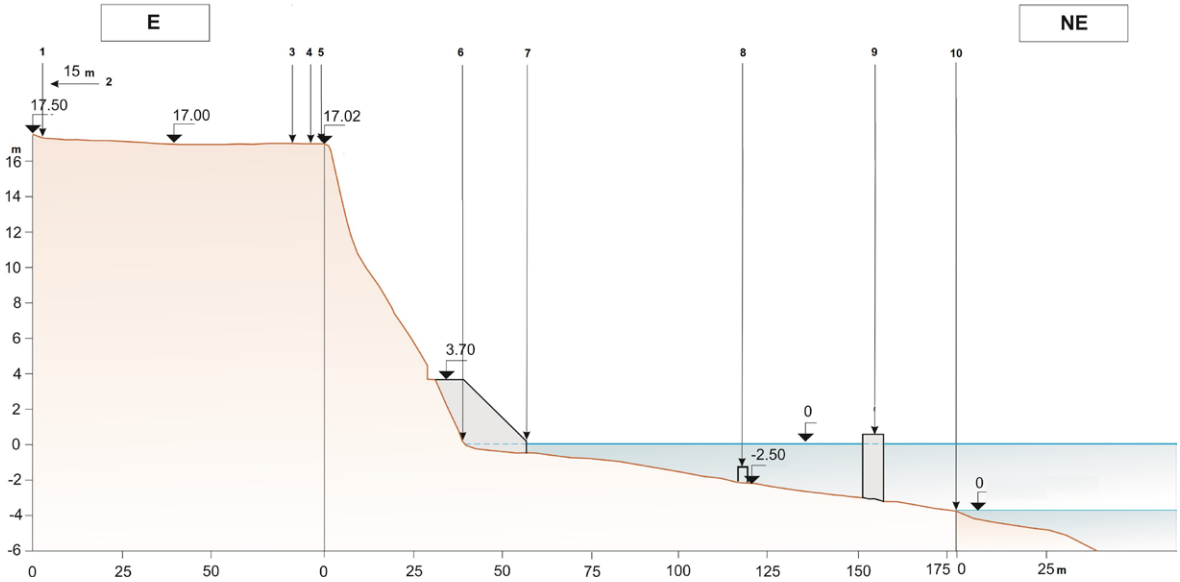
The rise in the sea level gradually affected the wind and wave protection functions of the tongue-shaped, slightly decreasing to the north and covered with broken and worked stone blocks sector of the sea bottom in front of the basilica. The rocky area of about 165 m in length and an area of about 3 ha according to the bathymetric plan of the underwater exploration in Nesebar in 1981 (Ognenova-Marinova, Chimbuleva A 1981, Prilozhenie no. 3) is a natural barrier, which until its flattening by the sea abrasion was manifesting at different Black Sea levels, was capable to provide, at least by the end of Antiquity, relatively calm waters in the northern bay of the Nesebar Peninsula. Wave guard functions can be expected for some time after the area was flooded while it was still capable to destroy the base of the waves passing over it (figs 15[6] and 16).

6 Thematical content H. Preshlenov, after Bozhkova et al. 2007; Venedikov A s.a.; Kiyashkina, Marvakov, Gospodinov 2012; Ognenova-Marinova, Chimbuleva A 1979; A 1980; A 1981; Ognenova, Chimbuleva 1985; Preshlenov 2011; Rashenov 1932; Sasalov 1982; Shkorpil A f. 165, a.e. 454; Velkov 1946; Konstantinidis 1945; topographic base and graphic presentation A. Kamenarov.



Key:
1. Mesambria St.; 2. Portico, alleged localization; 3. Floor level of the North-western Early Christian Basilica, reconstruction; 4. Early Christian crypt (staircase); 5. Basilica apse, 5th – beginning of 9th c.; 6. Temple of Zeus Hyperdexios, northern wall; 7. Retaining wall, 5th–4th c. BC; 8. Late Antique fortress wall; 9. Costal line, 20th c.; 10. Front line of the modern coastal protection facilities; 11. Alleged costal line, 5th c. BC

Fig. 17. North-western sector. Topographic-archaeological profile II
(by H. Preshlenov; graphics A. Kamenarov; see also fig. 14)
Обр. 17. Северозападен сектор. Топографско-археологически профил II
(Х. Прешленов; графично представяне А. Каменаров; вж. и обр. 14)



Key:
1. Temenos of Zeus and Hera, alleged localization; 2. Emona St.; 3. St. George Old, 18th – middle of 20th c.; 4. Early Christian Basilica, alleged localization; 5. Neptune St.; 6. Costal line, 20th c.; 7. Front line of the modern coastal protection facilities; 8. Late Antique fortress wall; 9. Front of a modern mole; 10. Alleged costal line, 5th c. BC

Fig. 18. South-eastern sector. Topographic-archaeological profile XII
(by H. Preshlenov; graphics A. Kamenarov; see also fig. 15)
Обр. 18. Югоизточен сектор. Топографско-археологически профил XII
(Х. Прешленов; графично представяне А. Каменаров; вж. и обр. 15)

By the beginning of the 18th c. the southeastern slope of the peninsula, also subjected to negative geomorphological processes, gives way towards the land near the Doric temenos of Zeus and Hera, the early Christian basilica, topographically inherited in 1704 by the medieval church St George the Old and the medieval monastery Christ Acropolites (Konstantinidis 1945, 149–150; Ognenova 1960, 229; Ognenova A 1958 s.p.; see also above). The ruins of the Temple of Zeus and Hera, probably built near the pit-bothros between Kraybrezhna Street, Emona Street and the cliff slope at 17–18 m, have slid to the bottom of the southeastern bay of the peninsula, where up to 250 m to the south-east are found parts of the bodies of square pillars, smooth and channelled columns, stepped blocks, rectangular polished slabs and square blocks with grooves for horizontal connection (Ognenova-Marinova, Chimbuleva A 1977, 6, figs 14–16, 22; A 1979, 21, figs 15–16; A 1983, 10–11, figs 7–11; A 1984, 10, figs 16–19, Prilozhenie no. 3) (figs 5, 7, 18).

The memory of the spirit of this sacred area of the ancient polis is preserved topographically and toponymically. According to M. Konstantinidis (1945, 149–150), the ruined nave with a dome cover and the wall decoration of the church of the Byzantine monastery Christ Acropolites was preserved until the 2nd half of the 19th c. to the east of the pagan temenos of Zeus, revered also as Soter. The destroyed church on the eastern cape, known to K. Irechek (1974, 865–866) as "Christ Acroterios" and "Metamorfos Sotir" [sic.!] to K. Shkorpil, is located on the territory of the "Karaul" military post that is currently a division of the National Border Police Service (Shkorpil A f. 165, op. 1, a. e. 454, l. 21; a. e. 457, l. 10) (figs 5, 7).

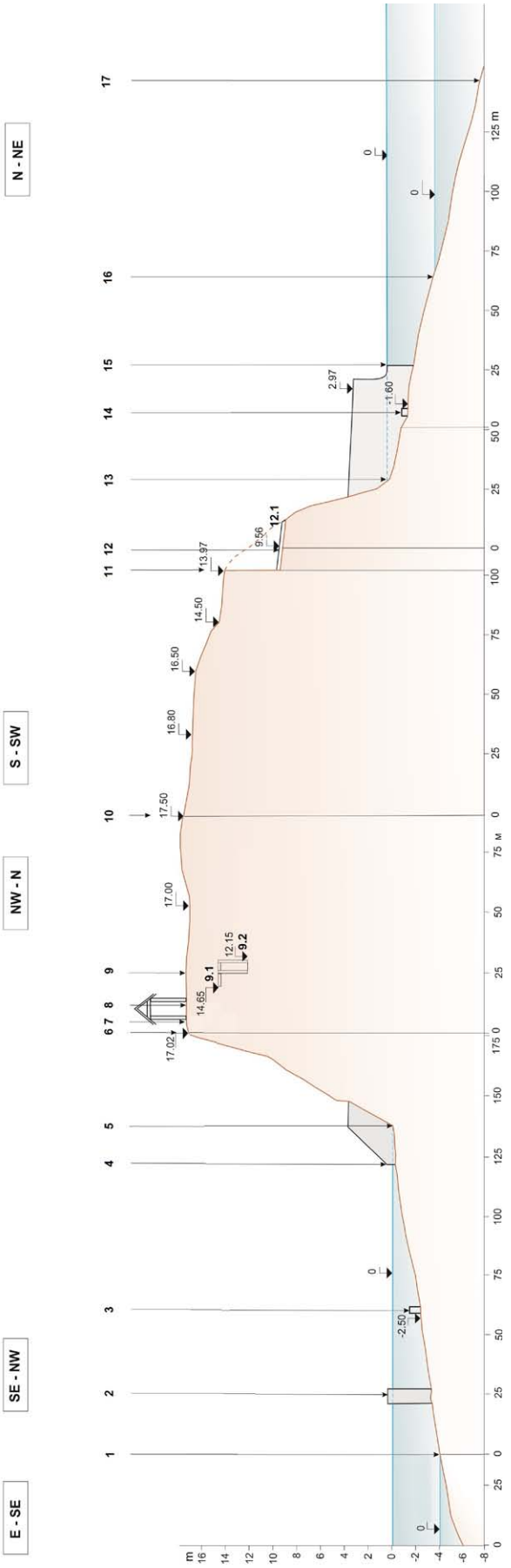
Coastal strengthening

Abrasion morphosculpture

Earthquakes, recorded in AD 1352, 1688, 1778 and 1855, sometimes accompanied by collapses and displacement of large quantities of land to the sea, have an impact on the formation of the present coastline of the peninsula (Ognenova-Marinova 1992, 244–245). One such impact is the sliding of the church St Protomartyr Stephen, whose location according to local toponymy is on the eastern coast near the rock block known as "St Stephen" (Konstantinidis 1945, 149).

In the second half of the 20th c., when the draining of the sunk coastal areas begins, the average gradient of rise at the Black Sea level is approximately 2.8 mm/yr (Veselinov, Mangov 1998, 71, 76; this and a few next facts have been presented also in Preshlenov 2022), the average speed of the abrasion process is about 8 cm/yr (Peychev 1998, 141, tabl. 1, tabl. 2), and the peninsula is 850 m long, 300 m wide and about 24 ha in area (fig. 11). Most intense is the abrasion of the southeastern slope of the peninsula, where under the influence of the surf, the cliff limiting the "Young Karangatian" terrace, steps back to the land. While in the northeastern coastal area between the trapezoidal Greek curtain wall and the monastery church The Holy Mother of God Eleusa, a strip is abraded with a width of least 15 to 25 m (figs 15–16) till the end of the 20th c., and along the southeastern coast between the church St George the Old and the late Antique curtain wall – at least 70 m are abraded (figs 5, 7, 19); and finally the zone to the east of the National Border Police Service department up to the rocky blockage "St Stephen" has seen an increase of shallow waters by 40–45 m only in the last hundred and fifty years (figs 5, 13). According to the horizontal distances, after the -various scales have been matched, the remnants of the washed ballast by rock abrasion and reworked stones are carried along the underwater slope to the 2nd isobath of 180 m southeast (Ognenova-Marinova, Chimbuleva A 1980, Prilozhenie nos 1–2; Nesebar 1980).

With the successful completion of the coastal strengthening along the borders and in the contact zone of the National Archaeological, Architectural and Urban Planning Reserve Nesebar, a significant part of the memory of the three-thousand-year-old cultural heritage of the city-museum is preserved for the future.



Key:
1. Alleged costal line, 5th c. BC
2. Front of a modern mole
3. Late antique fortress wall
4. Front line of the modern coastal protection facilities
5. Coastal line, 20th c.
6. Neptune St.
7. Early Christian basilica, alleged localization
8. St. George Old, 18th – middle of 20th c.
9. Peristyle house of "Artemidoros"
9.1 Courtyard pavement
9.2 Cellar – floor level
10. Emona St.
11. Krajbrezna St.
12. Monastery basilica "The Holy Mother of God Eleusa"
12.1 Floor level
13. Coastal line, 20th c.
14. Pre-roman fortress wall
15. Front line of the modern coastal protection facilities
16. Alleged coastal line, 5th c. BC
17. Front of a rock bank

Fig. 19. South-eastern sector. Topographic-archaeological profile XIII (by H. Preshlenov; graphics A. Kamenarov; see also fig. 15)
Обр. 19. Югоизточен сектор. Топографско-археологически профил XIII (Х. Прешленов; графично представяне А. Каменаров; вж. и обр. 15)

Hydrotechnical morphosculpture

In a recent paper (Preshlenov 2022) I have already mentioned that the strengthening of the coastal zone takes into account a complex of hydrodynamic factors (waves, currents, wind and carried by them materials), climate, rock stability, sedimentation and the eustatic fluctuations of the sea level. The sea terrace on which the urban structures of Nesebar are located is formed on almost horizontal Miocene limestone sandstones, marl limestones and clays. It is limited by the steep abrasion type of the coast, that until the end of the last century was subjected to the destructive energy of the sea surf (Popov, Mishev 1974, 76, fig. 23).

In the course of the urban building of the peninsula, stone mined in the suburban area has also been used. The analysed petrographic samples, taken by ing. N. Gospodinov (Topolovgrad, Bulgaria), present white sandy limestones from a natural outcrop of the Odarzi Formation on the southern coast of the peninsula. Limestones of probable Odarzi Formation origin (or of Miocene age) and such, originating from rocks of probable Late Cretaceous age are also recognized (fig. 20).

The sea borders of the city-peninsula and the power of the Mesabrian fleet does not require the construction of massive fortifications on the northern, eastern and southern coasts of the peninsula. In some sections, the walls also have retaining functions, reinforcing the peninsular slope. The levelling of the terrain seems to allow the formation of a flat surface along the inner side of the curtain wall, which allows the free manoeuvring of the defenders and does not require thickening of the walls. Clearly distinguishable on the sea horizon, the city's fortifications also have aesthetic functions, following Aristotle's (*Pol.* 7.11.1331a10) prescriptions, to preserve but also to decorate. In addition, the "sea" walls save the polis resources for the delivery of building stone, processing and construction of the fortifications. In the process of outlining of the fortifications, the ancient coastline is not followed, but rather the proximity to the base of the peninsular slope is sought.

Geomorphologically, the constructions along this coastal strip, including coastlines, are situated between the "Young Karangatian" transgression terrace at 8–15 m a.s.l. and the "Phanagorian" ingression terrace at 4–5 m b.s.l. (Popov, Mishev 1974, 58, 211, 213; Bonchev et al. 1992, 128–129; Orachev 2002, 244, 247).

The upper boundary of the northern coast of the peninsula, which until its strengthening was determined by the limit of the wave influence, is a narrow, slightly inclined to the sea, abrasion terrace up to 5 m wide. The starting point of the cliff slope stands between the 5th–6th and 11th–12th isohypses (Venedikov 1980, 23; Nesebar 1981). In the middle of the 20th c. it is 850 m long, about 300 m wide and about 24 ha area (fig. 11). The aquatory of the peninsula, part of which is intended for withdrawing from the sea, falls in the contact zone of the National Archaeological, Architectural and Urban Reserve of Nesebar, where the over three thousand years of cultural and historical heritage of the city-peninsula-museum is preserved (Krastev et al. 2012, 7–9).

The designed in the 1980's engineering facilities with coastal preserving and port functions confirm the optimal choice of the ancient and medieval builders. In 1981, as part of the project for strengthening of the northern coast of the Nesebar Peninsula, the construction of a "beam"-breakwater no. 3 was planned in the northwestern waters of the peninsula. It follows the tongue-shaped elevation of the seabed, which goes down to the north of the 3 m isobath about 70 m from the shore – a route also chosen by the ancient poliorcetics in the construction of the northern *diateikhisma* of the Classical polis and the early Byzantine city (Nesebar 1981).

As a result of the present-day coastal protection activities, the aquatory east of the northwestern "beam" ("beam"-breakwater no. 3 under the 1981 Project for coastal protection) is filled up, as the 103.40 m section of the pre-Roman fortification wall falls below the car park adjacent to the south part of "Kraybrezhna" street. The present coastal protection structures (walls no. 2 and no. 3 under the 1981 project in this sector), following the line of the 2nd isobath, pass around 25 m to the north

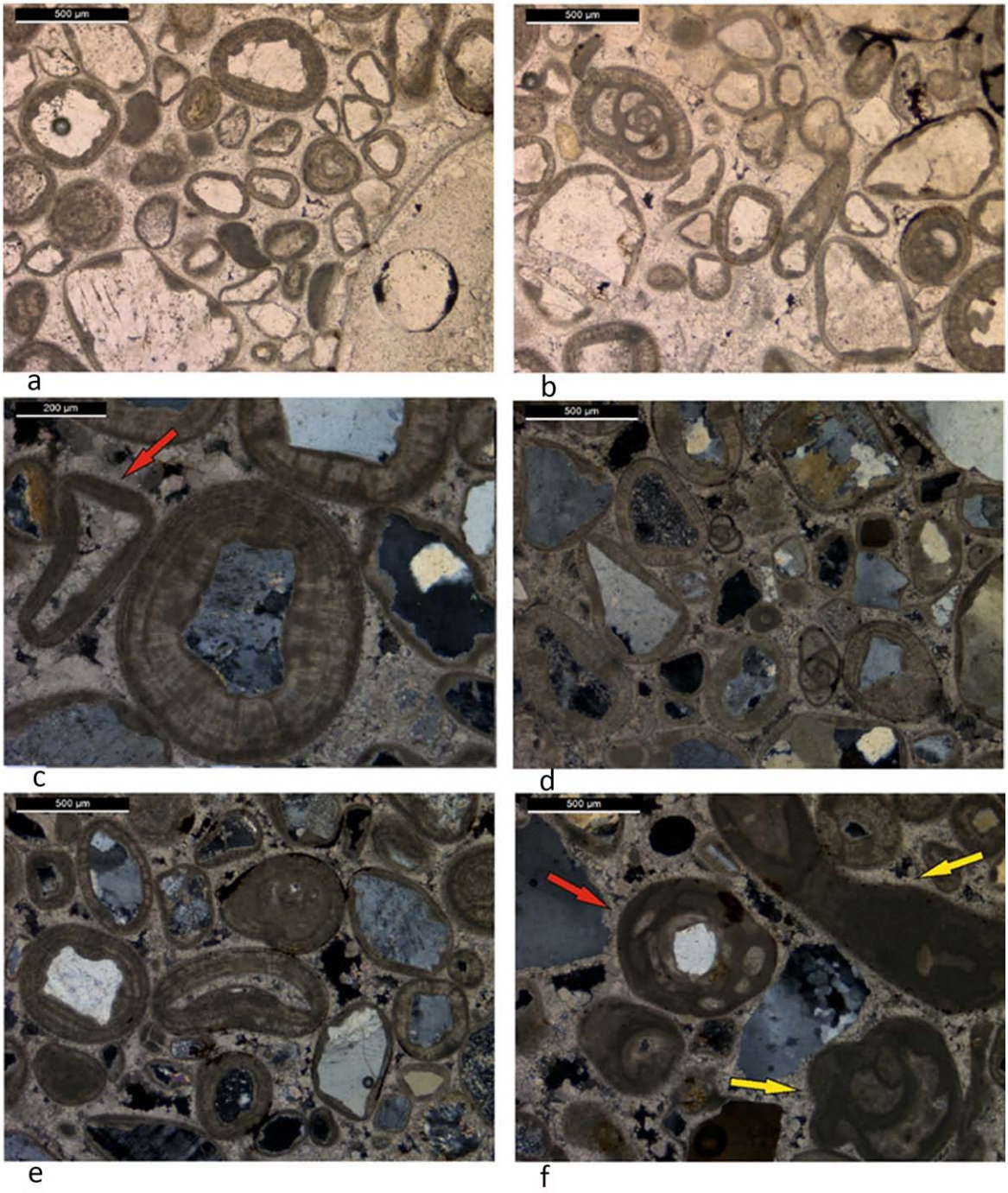


Fig. 20. a-f. South-western sector. Geological probe no. H-22-5. Sandy limestones, Odarska Formation (authors N. Gospodinov, M. Vetseva)
Обр. 20. a-f. Югозападен сектор. Геоложка проба № H-22-5. пясъчников варовик, Одърска свита (автори Н. Господинов, М. Вецева)

and in front of the Classical rectangular fortress tower. The remaining "submerged" ancient fortress walls in front of the northern coast of the peninsula are found at similar depths of 0.40 m to 1.80 m (Ognenova-Marinova 1980, 102; Ognenova-Marinova, Chimbuleva A 1979, 22; A 1980, 9; A 1981, 12–13). They are filled up during the reclaiming of territories flooded by the sea along the northern coast of the Nesebar Peninsula and remaining from 10 m to 50 m to the south of the coastal protection

constructions built between the 2nd and 3rd isobaths (Nesebar 2006) (fig. 14).

As I have recently discussed (Preshlenov 2022), the northern bay of the peninsula is vulnerable to the surges and storms caused by the prevailing strong northern, northeastern and easterly winds during the autumn and winter periods, sometimes at speed exceeding 15 m/s, (Popov, Mishev 1974, 105, 124, figs 38, 50). During the Antiquity period the calm waters in the bay provide a natural geographical barrier – the tongue-shaped rocky coastline of the peninsula is plunged around 165 m to the north, where the edge of the 8–12 m b.s.l. shelf terrace runs (Ognenova-Marinova, Chimbuleva A 1977a). During the early Byzantine epoch, in the "Nymphean" transgressive rise of the sea level, the wave guard functions are carried by the dry land that has remained above the sea, though reduced to the 2nd–3rd isobaths (in the late Antiquity isohypse), respectively about 60 m to the north (figs 15–16).

The natural advantages of this coastal sector were also appreciated in 1981, when a "beam"-breakwater no. 1 was planned along the western edge of the underwater peninsular slope (its construction was abandoned in the final coastal protection project for the north coast of Nesebar). Its straight section, providing protection against northern and eastern wind waves, was 60 m long – identical to that of the ancient natural barrier (Nesebar 1981) (fig. 14). The part of the coast that was flooded during the Late Antiquity period has the capacity to serve as an underwater defence against the northeastern wind waves at least up to the 6th–7th isobaths – the depth which would have been reached by the northwestern planned bend of 46° W of the unbuilt "beam"breakwater no. 1 (Nesebar 1981). At the end of the 20th c., the functions of the levelled in the second half of the 2nd millennium AD northeastern natural wave guard barrier is taken over by a "beam"-breakwater ("beam"-breakwater no. 2 under the 1981 project), built to the west in the bay opposite the hexagonal tower of the Classical fortress wall. Between its northwestern bend at 53° W (section "B" of the 1981 project) ending at the 5th isobath, the multifunctional structures for coastal protection (coastal protection walls no. 2 and no. 3), and the northwestern "beam"-breakwater no. 3 are located the quays of the new northern port, which match the outline of the waters of the ancient port in the northern bay.

After the completion of the coastal strengthening activities on the northern coast of the peninsula, a strip of around 50 m (about 0.8 ha) is regained from the sea only from the submerged rocky coast in front of the church The Holy Mother of God Eleusa, whose outer boundary to the north and southeast of the ancient fortress curtain wall passes between the 2nd and 3rd isobaths.

At present time the restored/newly-created spaces of the coast of the Nesebar Peninsula is in total, about 10.5 ha (fig. 11).

Conclusions

During the Classical and Hellenistic period, the coastline, fortification, religious and secular spaces of coastal Mesambria, the provincial Roman pilgrim city, and the (early) Byzantine bipolar municipality were limited by the steep abrasion of the coast, and subjected to the destructive energy of the sea surf right up to the end of the last century. The strengthening of the coastal zone has taken the complex hydrodynamic factors, climate, rock stability, sedimentation and eustatic fluctuations at sea level into account. With the successful completion of the coastal restoration works along the coast and in the contact zone of the National Archaeological and Architectural and Urban Planning Reserve at Nesebar, a significant part of the memory of the three-thousand-year-old cultural heritage of the museum city is being preserved for the future.

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Месамбрия Понтика – „морско“ общество и крайбрежие

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(резюме)

Проучването на устройствените и строителните дейности в крайбрежната зона на Несебър попада в обсега на морската археология. Пристанищните басейни и залетите и/или подвластни на морето крайбрежни селищни зони (брегови линии, фортификация, сакрални и профанни пространства) на Месамбрия през класическия, елинистическия, римския и ранновизантийския период са описани, картографирани и анализирани, като данните са сравнени хронологически, стратиграфски и типологически с други синхронни археологически структури с изяснен контекст и интерпретация.

Проучени са топографски, батиметрични и кадастрални карти и планове на полуострова, изработени през XIX–XX в., които са изследователски средства по темата, но и предмет на проучване като модел, заместващ вече несъществуващи реалии, или такива, чието изучаване е практически невъзможно. За реконструиране на дънния релеф са използвани батиметрични карти, чиито изобати са съставени преди изграждането на брегоукрепващите и пристанищните съоръжения, променили облика на морското дъно в северния залив, акваторията източно и южно от полуострова. За целите на изследването от споменатите карти и планове е реконструиран и „морфологичният скелет“ на града – улични трасета, площадни пространства, улични регулационни линии и осови точки, хоризонтали.

По време на кабинетната работа са поставени в съответствие археологическата планквадратна мрежа и правоъгълната координатна система на градския регулационен план. Върху топографския план на полуострова и акваторията му са разположени плановете на проучените археологически обекти, геодезично и архитектурно заснети от К. Шкорпил, арх. Л. Маринов, арх. Д. Съселов, арх. Т. Петров, арх. А. Младенова, арх. Г. Китов, П. Петров, Е. Миланова, Б. Кючуков, С. Димова и Х. Прешленов, като е прецизирано тяхното ситуиране в регулационните планове и/или привързване към градската полигонова мрежа.

Корелацията на археологическа информация, геоморфоложки данни и исторически сведения, отразяващи/следващи динамиката на регионалните гео- и хидрократични релефообразуващи фактори, определящи за формирането на терасния комплекс на крайбрежието около полуострова през холоцена, е представена и в графичен вид. Картометрични данни, извлечени от общия теренно-ситуационен план на Несебър, са построени топографски профили, които включват линейните, площните и обемните параметри на морската и шелфовата тераса, както и на археологическите структури, изградени/разкрити върху тях през последните две и половина хилядолетия.

Колебанията на черноморското ниво са сред определящите фактори в морфодинамиката на Несебърския полуостров. „Новочерноморската“ му трансгресивна фаза до средата на

II хил. пр.Хр., „фанагорийската“ регресивна фаза в средата на I хил. пр.Хр., „нимфейската“ трансгресивна фаза към третата четвърт на I хил. сл.Хр., „корсунската“ регресивна фаза около средата на II хил. сл.Хр. и „лазката“ трансгресивна фаза през втората половина на II хил. сл.Хр. формират интервали, съответстващи културноисторически най-общо на къснобронзовата и ранножелязната (около 1500–500 г. пр. Хр.), античната (около 500 г. пр.Хр. – 500 г. сл.Хр.) и средновековната (около 500–1800 г.) епоха и на „новото“ време (около 1800 – 2000 г.). Стойностите и относителната хронология на тези евстатични и културно-исторически репери са в съответствие с археологическите и историческите данни за крепостни стени, култови сгради и пристанищни съоръжения, открити в крайбрежната зона на Несебърския полуостров. Деструкциите на класическите укрепления (края на V в. пр.Хр. – първата половина на IV в. пр.Хр.) маркират брега по време на „фанагорийската“ регресия; трасето на късноантичната крепостна куртина (средата – втората половина на V в. сл.Хр.) е съобразено с „нимфейското“ покачване на морското ниво; пропадането на северния кораб и обновяването на базиликата „Св. Богородица Елеуса“ през 1341/42 г. вероятно съвпада с „лазката“ трансгресия, а срутването в морето на църквата „Св. Първомъченик Стефан“ през 1855 г., изглежда, става малко преди забавянето ѝ.

Разрушителната морфоскулптурна дейност на морските вълни е другият мощен екзогенен фактор, релефообразуващ брегове на Несебърския полуостров. Два пасажа на североизточната (класическа?) куртина между четвърти и пети изобат, открити северно от трапецовидната крепостна стена, както и дъговидната стена пред пети изобат по югоизточния крепостен сектор по-скоро отразяват практика при възможност фортификацията да „следва“ отблизо морето. Незаливаемото пространство между укрепената градска структура и бреговата линия на източния сектор на месембрийските укрепления вероятно е оставено с цел формиране на „берма“ пред фронта на отбраната и улесняване на придвижването в крайбрежната зона.

През XX в., а възможно и в предходни столетия, изявени клифови откоси характеризират Несебърския полуостров. В резултат на разрушителната енергия на прибоя укрепителните съоръжения, обществените и частните постройки на приръбовия свлачищен откос пропадат в морето заедно със свлачищните земни маси. Това се случва със северния кораб на базиликата „Св. Богородица Елеуса“, църквата „Св. Първомъченик Стефан“, югоизточната куртина на късноантичната крепостна стена, храма на Зевс и Хера, театъра на античния полис и ранохристиянската базилика, чието свещено пространство е обновено през 1704 г. от църквата „Св. Георги Стари“.

Формирането на морската „младокарангатска“ тераса, върху която са изградени повечето структури на античния, средновековния и съвременния Несебър, се свързва с трансгресивна фаза в развитието на Черноморския басейн, традиционно поставяна в горния плейстоцен, когато вълновите процеси формират абразионно-акумулативна тераса на средно 12 m надморска височина върху почти хоризонтални миоценски варовити пясъчници, мергелни варовици и глини. На разрушителната геоложка дейност на морето палеополуостровът е подложен и по време на „новочерноморската“ трансгресивна фаза, когато е „преработен“ унаследеният стръмен склон на Несебърския палеополуостров. По време на „фанагорийската“ регресивна фаза на следледниковата стадиална трансгресия, чийто връх настъпва след VII–VI в. пр.Хр., бреговата линия, маркирана от прибрежния терасен комплекс на 4–12 m дълбочина, отстои на около 300 m източно от съвременното подножие на полуостровния склон.

Стадиалната холоценска трансгресия намира отражение и в ритмичността на лиманните отложения. За батиметрията на фанагорийската тераса спрямо съвременното морско ниво в Несебърския залив косвено може да се съди по торфените прослойки в лимана на р. Хаджийска. В пясъчния слой с дебелина до 25 m са установени три торфени слоя – на 4–5, 10–12,5 и

20–22 m, които потвърждават стадиалния ингресионен ход в развитието на лимана. Първият от тях, съответстващ на подводната тераса на 4–5 m дълбочина, установена биостратиграфски и на други участъци по черноморското крайбрежие, корелира със съответните изобати около Несебърския полуостров в акваторията източно от четвърти–пети и южно от трети–пети изобат.

Окончателно Несебърският полуостров е формиран по време на „лазката“ фаза на съвременната трансгресия, проявила се през последните пет-шест столетия, когато бреговият склон на полуострова е преработен и са размити и обезличени по-старите брегови линии. Горната граница на морския бряг, която до изграждането на инженерните съоръжения с брегозащитни и пристанищни функции в края на XX в. се определя от предела на щормовото вълново въздействие, е изрязана в тила на слабо наклонена към морето абразионна площадка на стръмния абразионен клиф на полуострова.

Преди началото на брегоукрепващите мероприятия около полуострова той притежава специфичния облик на разчлененит заливовидни ингресионни брегове с тесни и дълги заливи (северозападен, северен централен, североизточен, югоизточен, южен централен, югозападен) и издаващи се носове (северозападен, североизточен, източен, южен централен, югозападен), и има дължина 850 m, ширина 300 m и около 24 ha площ. В североизточната крайбрежна зона между „трапецовидната“ антична крепостна стена и манастирската църква „Св. Богородица Елеуса“ е абрадирана ивица с ширина 15–25 m, на югоизточния бряг между църквата „Св. Георги Стари“ и късноантичната куртина са „загубени“ около 70 m, а източно от полуострова за последните сто и петдесет години зоната на плитководието е увеличена с 40–45 m. След завършването на брегоукрепителните дейности в края на XX и началото на XXI в. от морето са възвърнати/новоусвоени площи, възлизащи на около 10,5 ha.