

## GEOMORPHOLOGIC DEVELOPMENT OF THE BAY OF SOZOPOL

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### **Abstract**

*The region of the current bay of Sozopol has been inhabited nearly constantly from the VI millennium BC up to present day. The changes of the coastline and the basin near the shore were followed, along with the geological development along two main profiles one is most typical for the bay, while the other passes through the Eneolite and the Bronze villages, and through a region, promising for future archeological explorations.*

The geological structure and geomorphologic formations are elements from the complete ecological situation on Earth and their role in the existence, development and the activities of man has always been primary. From their emergence, people have been significantly dependent from the protective function of the terrain, the existence of water sources, etc. For the development of certain skills, such as farming, mining, building of homes and other facilities, the geological structure is a determining factor. On the other hand, the technical abilities of people during every age have been a precondition for a certain decrease in the dependence of humans on the geology and geomorphology, without this influence to be considerably decreased. An example of this is the successful and useful interference in this area, along with those, that have lead to ecological disasters of smaller or greater magnitude.

The anthropogenic layers, with their content and structure, as a result of people lifestyle and activities, provide the biggest part from the information about the life of men. This information can be extracted using a wide range of investigations and analyses. The position of the anthropogenic layer in depth and its interactions with the natural geological materials and geomorphologic formations are very important for completing the ecological picture. The investigations in this area can be valuable, if they are performed specifically for every separate area, using modern interdisciplinary methods (Lazarov, 1996).

Under the influence of many and various factors, Earths relief is subjected to continuous, slower or faster changes. In this respect, the sea coastal zone exhibits the greatest dynamism. The changes in the geomorphology in this zone actively influence both on the life and activities of the inhabiting people, and on the character of their settlements and the duration of their existence. The investigations for following the evolution of this zone are much more expensive than in other regions, but the information obtained is richer and more valuable because stages from cyclic processes can be observed fully.

The Sozopol bay and the adjacent territory are a segment of the Black Sea coast, in which many archeological sites have been found and investigated. They are situated both on the shore and underwater, and mark the active presence of humans in different periods from the Eneolite up to present day.

However, straightforward, detailed investigations of the geomorphologic phenomena and processes at the Black Sea coast, and, in particular, in the region of the bay of Sozopol, have not been performed.

In the territory and aquatory of the bay, except the underwater and ground archeological investigations, geophysical investigations, geological and prospective drilling, detailed bathymetric measurements, sonar snapshots on separate areas from the bay and terrain and underwater observations have been carried out. However insufficient and unevenly distributed, the data obtained from those investigations gave us the ability to create a geomorphologic reconstruction for the region of the bay for different stages in the last 9000 - 10000 years of its evolution.

The development of the bay during this period is determined by its complex geological structure, which includes magma and volcanic rocks, Neogene materials, represented by clays, sands, pebbles, and Quaternary materials, represented by lake slimes and accumulated sea sands. The primary structure is the

caldera (sunk volcano crater), which, in turn, is a predisposition for a diverse and complex relief. The scheme for the behavior of the position of the coastline, which is a result from the mutual position of the sea level and the land in their independent movements in time (Stoev, 1997) was used when creating the reconstruction.

The results from the reconstruction of the paleo-relief in the studied region have been presented as maps of the bay during different periods, characterizing its development, as well as geological sections from two profile lines. Their position was chosen so that they characterize the development of the various geological formations. One profile line (AOD) runs from north to south and best reflects the development of the bay. The second profile line (BOC) goes from east to west. The eastern part of the profile passes through the Eneolite and Bronze villages, discovered in this area, which have been investigated with complete underwater archeological excavations. The western part of this profile passes through a region, which has the same geomorphologic characteristics as the area, on which the villages were situated.

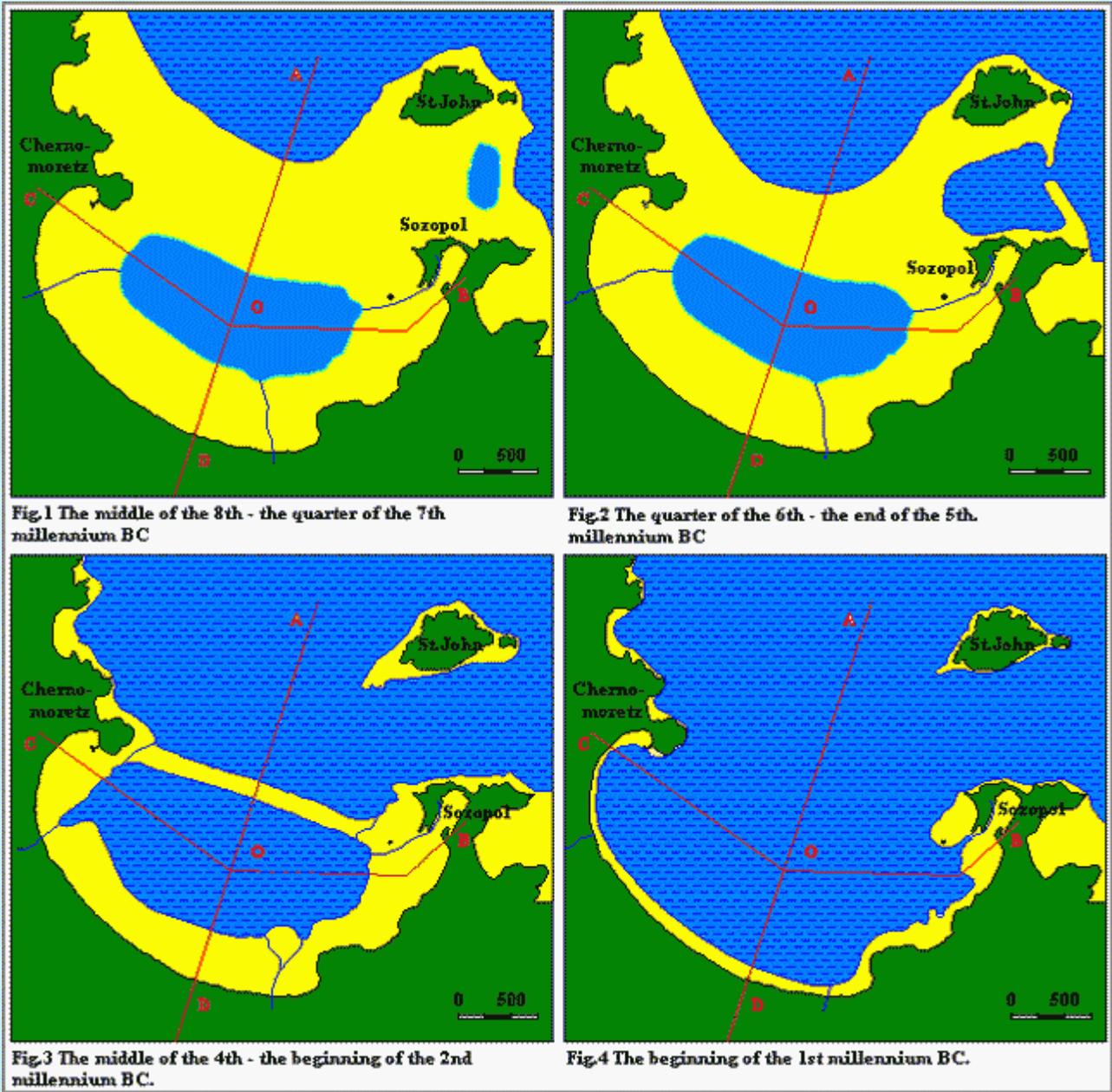


Figure 1-4. Maps of coastline.

In the middle of the eighth millennium BC, the position of the coastline was lower than the current level by about 20 meters. The Sozopol bay was completely within the land. The current islands of St. Ivan, St. Peter and St. Kirik formed a small peninsula in its northeastern part (Fig. 1). The coastline was not very fragmented. In the central part of the region, there was a fresh-water lake. A positive rock formation, connecting the present island of St. Kirik and cape Chernomoretz, acted as the northern shore of that lake. The level of the ancient lake was 13 to 14 m lower than current sea level. The basin had no connection with the sea and was fueled by three rivers, flowing into it from west, south and east.

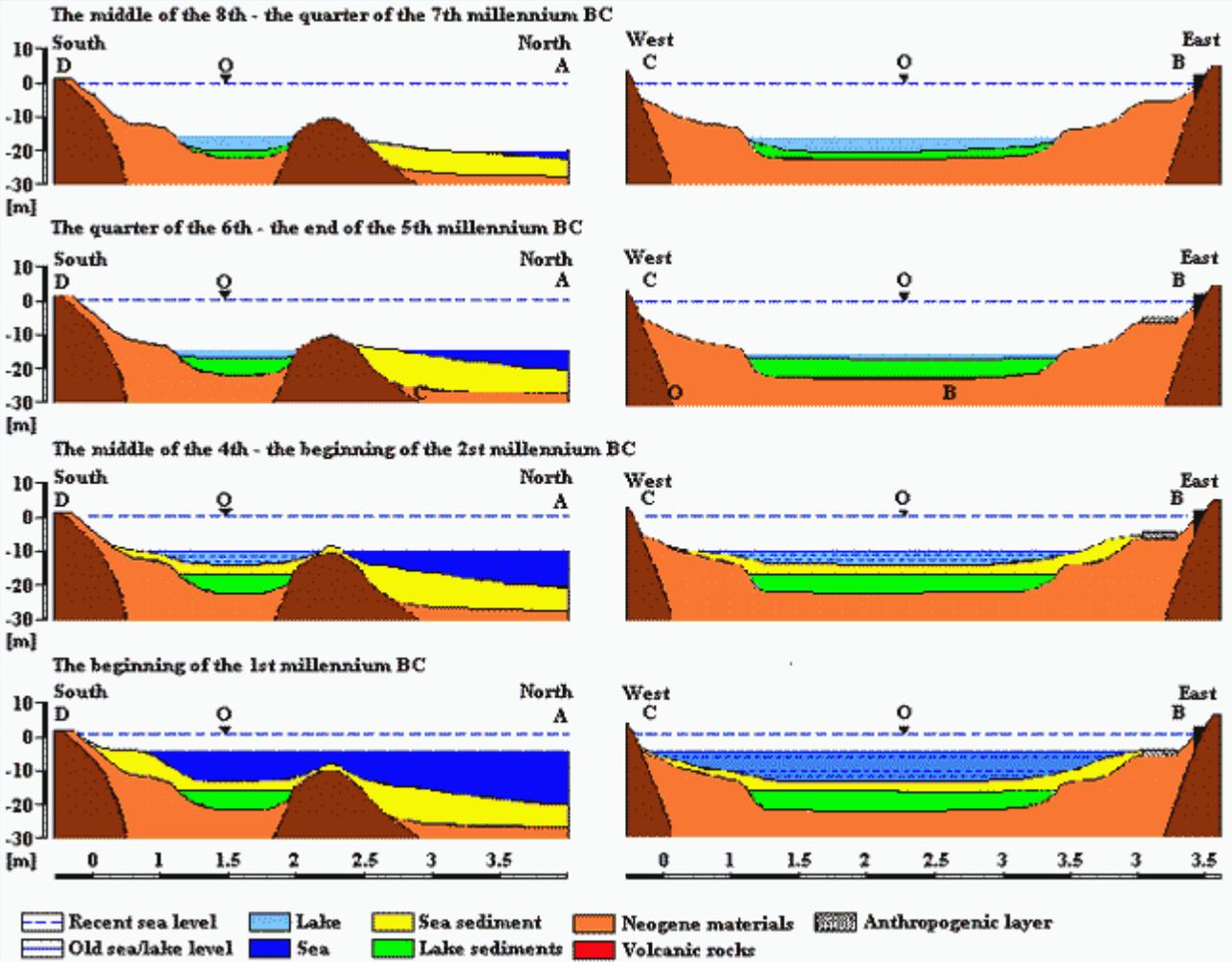


Figure 5. Geological sections of Sozopol bay along line North-South (AOD) and along line East-West (BOC).

A rock formation existed between the present-day Sozopol peninsula and the islands of St. Ivan and St. Peter. In the studied period, the coastline ran along its eastern part, while on its western part, in a deep negative formation, a small lake probably existed.

In the following centuries, the position of the coastline quickly raises and by the first quarter of the sixth millennium BC, the position stabilizes at around 15 m from the current one. The sea advances towards the land. It manages to pass through the rock formation between the peninsula and the islands of St. Peter and St. Ivan, but it does not separate them completely. The lake in the middle of the bay continues to exist without change (Fig. 2). This position coincides with the Eneolithic and remains until the end of the fifth millennium BC.

In the second half of the fifth millennium BC, the position of the coastline quickly raises its level again. During

this period, considerable changes in the situation of the region occur. The sea continues to advance actively towards the land and it completely separates the islands of St. Ivan and St. Peter and comes close to the northern shore of the lake. The prolonged positive rock formation in this area, as well as the sand strip accumulated on it, are not serious obstacles for the entrance of sea water in the lake. The salt content of the lake increases, which is proven by the emergence of fauna, inhabiting salty water. The lake increases its level and size. This is the period, in which an interruption in the continuity has been established.

In the middle of the fourth millennium, the position of the coastline stabilizes at 10 meters below the current one (Figure 3). With small changes, this position remains until the beginning of the second millennium BC. In historical respect, this interval coincides with the phases of the Bronze age.

A new stage of increasing coastline position follows. The sea has completely run over the sand strip and the region was transformed in a deep sea bay, with form and size close to current ones. The accumulation of sea sands is carried on in the southern part of the bay, where a small firth on Patovska river was probably formed. The Bronze settlement was close to the sea, not to the calm lake.

In the beginning of the first millennium BC, the position of the coastline had already stabilized at 5 meters below the current one (Figure 4). This coincides with the period of Greek and Roman colonization. The settlements near the coast are created not near firths and lagoons, but on rock capes, like Sozopol. In the middle of the first millennium AD, the calm stage finishes and a new raise of the position coastline begins, so that it reaches its current position in the beginning of our millennium.

We must point out again, that the region has a very complex geomorphologic structure, and the source data is insufficient, which in turn determines the sketchiness of the reconstruction. Probably, some details from the configuration of the coastline have been left out, along with the consequences from the small changes in the position of the coastline within the main phases of evolution.

On this stage, the west segment from the bay, in the region of Chernomoretz is interesting. There, the geomorphologic conditions are very similar to those in the harbor of Sozopol, where villages from the Eneolite and Bronze age have been discovered.

Continuing and expanding the investigations will lead to refining the reconstruction.

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