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Black Sea Morphotectonic Nature

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Abstract: *The presence of oceanic crust on the Black Sea bottom indicates that this sea basin was a section - a Pontic Ocean gulf at the northern margin of the Phanerozoic Tethys Ocean. The late Phanerozoic subduction of the Tethys oceanic crust under the European continental massif in this area took place in the subduction zone, whose modern traces are found today south of the Crimean Peninsula. On the surface of the subducted oceanic crust were numerous fragments of the destroyed continental crust on the northern margin of the Gondwana continent. These relatively lighter than oceanic crust crustal fragments (or a significant part of them) were not subducted. They accumulate in the immediate vicinity of the subduction zone on the unsub ducted remnants of oceanic crust. Such is the case with the Black Sea. It is not an imposed subcontinental basin, but a last modern relict of the northern margin of the Late Phanerozoic Tethys Ocean.*

Keywords: Tethys Ocean Gulf, Oceanic crust, Subduction breaking

Introduction

During the more than a hundred-year history of the study of the geological-tectonic structure of the Black Sea, the opinion was advocated that it is an epicontinental sea basin within the Euro-Asian continental

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massif [1-4]. This view was imposed in the conditions of the extremely insufficient scientifically substantiated information about the construction and evolution of the earth's crust (Figure 1).

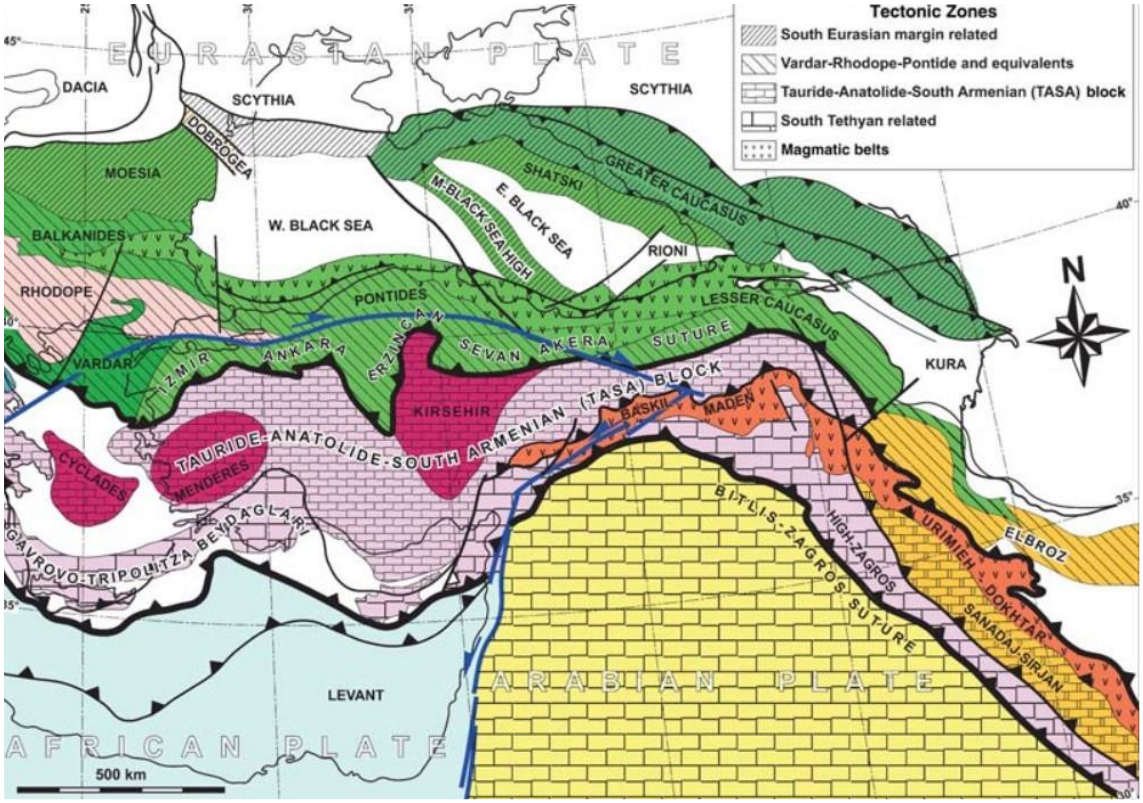


Figure 1. Tectonic outline of eastern Mediterranean region (according to [3])

The powerful imposed in the conditions of the extremely insufficient scientifically substantiated information about the construction and evolution of the earth's crust. The powerful development of geophysical, space, and various contemporary geological studies in the early and mid-twentieth century showed the unsustainability of accepted fixist dogmas and created the conditions for the very rapid well-scientifically reasoned imposition of the mobilist model of plate tectonics in the second half of the century. This necessitated a complete re-evaluation of the evaluation of the ideas about the geological-tectonic structure of the planet and, above all, of the earth's crust.

In the article, the authors make an attempt to evaluate the morphotectonic nature of the Black Sea based on the facts known so far. The analysis carried out is based on modern mobilist ideas about the earth's crust and the main processes in it.

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On the Late Phanerozoic evolution of the Black Sea region

The closure of the western part of the Tethys Ocean began 72 million years ago, by subduction of the ocean floor under the Paleo-European continental massif [5]. Fragments of various sizes from the northern margin of the Gondwana continental massif are moving northward on the subducting oceanic crust. On reaching the subduction zone, these relatively light (less relative weight) crustal fragments (or a very large part of them) do not sink together with the heavy oceanic crust. They piled up in front of the subduction zone, gradually compacted with each other, merged and formed the continental massifs of Neo Europe [5]. Their continental margins are involved in shaping parts of the Late Pleistocene northern coast of the now almost completely "closed" western part of the Tethys Ocean (Figure 2).

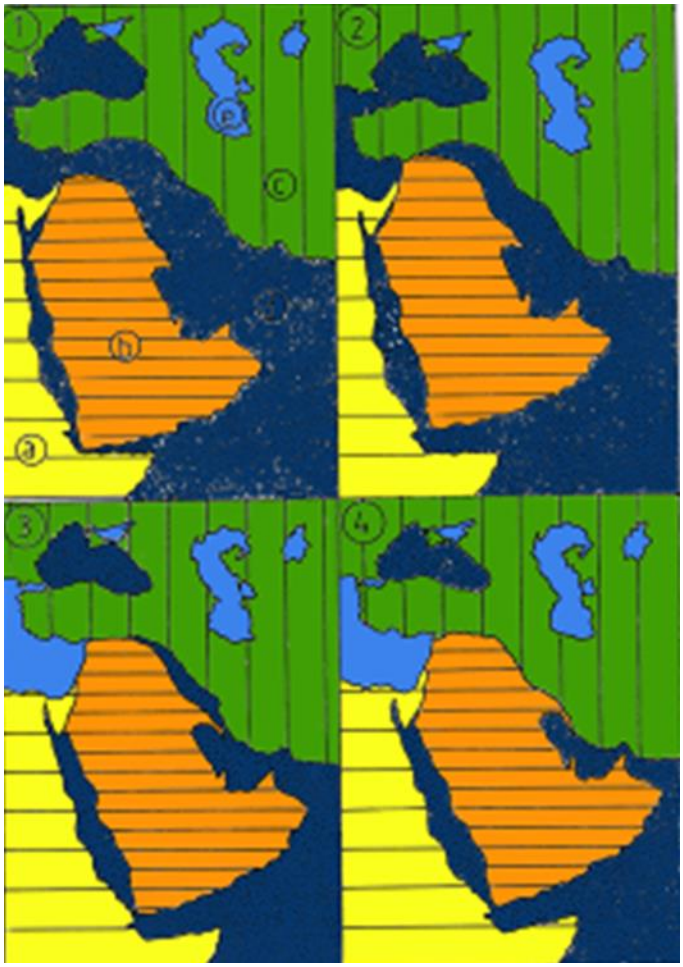


Figure 2. Consecutive moments from the Black Sea differentiation (according to [6])
a - Gondwana continental Massif, b- Arabian Continental plate, c- Euro-Asia Continental Massif, d- Tethys Ocean 1- time Arabian Plate Separation from of the Gondwana Continental Massif; 2- touching time between

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Arabian Continental Plate and Little Asia Continental Fragments*; 3- Mediterranean Sea Basin Building; 4 - contemporary situation

*Remark: the question of the Little Asia Continental Fragments Primary Tectonic Belonging to the Gondwana Continental Massif or to the Euro-Asia Continental Massif is debatable.

The western coast of the Pontic Ocean Gulf (the present Black Sea) coincides with the eastern margin of the Bulgarian continental microplate of the continental massif of Neo Europe, building the Balkan Peninsula [5]. Most of the northeastern coast of the Pontic Ocean Gulf is marked by the southeastern margin of the Caucasian continental massif of Neo-Europe. In both cases, it concerns modern passive ocean margins.

The central northernmost part of the coast of the Pontic Gulf (the peninsulas of Crimea, Kerch, Taman and the northwestern end of the northeastern coast) is part of the southern margin of the Paleo-European continental massif.

The southern coast of the modern Black Sea coincides with the northern edge of the Pontic Mountains of the Asia Minor peninsula. This marine boundary arose much later - during the Quaternary, in connection with the movement of the Anatolian continental plate to the west along the North Anatolian transform fault [5, 6].

The average depth of the Black Sea basin is 1253 m, and its maximum depth (south of the Crimean Peninsula) is 2245 m. Against the background of the relatively flat bottom, the Western and Eastern Black Sea basin depressions, separated by the Andrus Wall, are outlined. It is an underwater ridge 20 to 70 km wide. It is followed for 263 km in a northwest-southeast to sub meridional direction in the narrowest part of the Black Sea basin between Cape Sarich (Crimea Peninsula) and Cape Keremne (Sinop Peninsula) [7].

In the Western Black Sea basin depression, Paleocene-Eocene sediments are more than 5 km thick, and the Neozoic sedimentary ones are 13-14 km. In the Eastern Black Sea depression, Paleocene-Eocene sediments are up to 3 km thick, and the Neozoic sedimentary ones – 10-11 km. Above the Andrus shaft, the Oligocene-Lower Miocene sediments are of small thickness or completely absent [8].

The Moho boundary below the basin floor is between 20 and 30 km. In contrast, the same border in neighboring land areas is of the order of 40-55 km. The geophysical profiles made point to very serious differences in the Moho depth in different parts of the Black Sea. Under the Western Black Sea depression, it is about 19 km, under the Andrus Wall – over 30 km, and under the Eastern Black Sea depression - 22 km away [9, 10].

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Inferences and conclusion

The review of the available information on the main features of the relief and morphotectonic structure of the bottom of the Black Sea leads to the following conclusions:

1. The Earth's crust forming the bottom of the Black Sea consists of the ubiquitous basalt and the sedimentary layer covering it. Nowhere are there any traces of a proven granitic layer with traces of its characteristic medium acid (granitoid) magmatism.

2. The emphatically flat relief of the Black Sea floor shows all the similarities with extensive tectonically "quiet" sections of modern ocean floors. There are no traces of rift-forming tectonic processes.

3. The Black Sea floor is characterized by very weak (on the periphery of the basin) earthquake phenomena.

The prominent features definitely indicate that the modern Black Sea basin is the late Quaternary successor of the Pontic Gulf of the Tethys Ocean. The question arises: why exactly in this section was the oceanic crust "spared" during the global subduction process? Or in other words - why did subduction "stop" in the modern Black Sea sector during the Quaternary?

The explanation of this geotectonic phenomenon should be sought in the now continuing westward movement of the Anatolian continental plate under the pressure of the west-northwest moving Arabian continental plate from the Gondwana continental massif. During its movement, the Anatolian continental plate gradually bounded the Pontic Ocean Gulf (the present Black Sea) from the south. As it moved, the Anatolian continental plate gradually bounded the Pontic Ocean Gulf (present-day Black Sea) from the south and separated it from the rest of the Western Tethys. And this rest of the Western Tethys. And this meant the emergence of a new geodynamic situation in the Pontic Ocean Gulf, in which the subduction processes were (at least temporarily) suspended, and the oceanic crust along the bottom of the modern Black Sea was preserved.

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