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# The Black Sea Region as a Natural Region

*Translated by Paul Vickers*

Any exploration of the Black Sea area as a site of historical relations and developments should consider the sea basin and the adjacent coastal area together with its hinterland in terms of a natural region. Indeed, all of the established societies there, across a variety of temporal and spatial conditions, have encountered this space in such a manner. That the natural region shaped the practices of historical actors does not imply a geodeterministic perspective. Awareness of the Black Sea developed early, with the foundation of Greek colonies in the first millennium BCE demanding and developing spatial knowledge. With the appropriation of this space, there was no question of pleading ignorance—or at least not with any conviction.

## 1 The Black Sea Basin

### 1.1 A Complex Geological History and Tectonic Structure

The Black Sea does not, in fact, have a uniform basin. An extensive shelf area constitutes almost one third of the entire area of the Black Sea and the Sea of Azov. Its northern section first acquires a depth of 50 meters (164 feet) only between the Danube Delta and the western tip of the Crimean Peninsula, some 150 kilometers (93 miles) off the coast of Odesa. The main basin reaches depths of up to 2,245 meters (7,366 feet), while the steepest continental slope is located off the Turkish coast north of the Küre Dağları mountain range within the Pontic Mountains ("Pontides"). This deep sea basin comprises a larger, deeper western subbasin and somewhat more reliefed eastern subbasin, which are separated by an undersea mountain range formed of the Andrusov Ridge and the Tetiaev and Arkhangelskii elevations. The Tuapse Trough is separated from the eastern subbasin by the Shatskii elevation, while there is another subbasin off the coast near Batumi. The primary consequence of these different depths is the diverse currents and levels of fishing potential in the Black Sea.

The division into the shelf area and deep sea area is based upon the emergence and position of the Black Sea along the southern edge of the Eurasian supercontinent and within the geological-tectonic superstructure of the Eurasian folded mountain belt. The latter includes the Caucasus Mountains with their northwestern foothills, the Crimean Mountains, and the foothills of the Bulgarian Balkan Mountains, which together form the northern limits of the deeper sea basin, while the southern limits are formed by the Pontides. During the transition from the Palaeozoic to the Mesozoic period, a mountain range existed between the other two ranges that was partially eroded and

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tectonically sunken.[1] The Black Sea is therefore a remnant of the larger Thetys Ocean, which emerged in the Mesozoic period. During the lifting of the Pontic Mountains severing the connection to the Mediterranean Sea in the late Tertiary period of the Cenozoic Era, the Caspian and Black Seas still formed a large, single inland sea that was divided by a slight incline north of the Caucasus. Until the Pleistocene period there was always a connection from the Atlantic via the Mediterranean to the Black Sea, and from there via the Kuma-Manych Depression to the Caspian Sea. The connection from the Black Sea to the Mediterranean via the Bosporus and Dardanelles emerged later, following the course of ancient rivers.

In terms of plate tectonics, it is generally argued that the Anatolian and the Eurasian Plate meet in the Black Sea. This is evident in the fault lines that run from west to east in the northern half of the Black Sea and in the mountain ranges of North Anatolia, as well as in the formation of the Sea of Marmara. The fault line running southeast to northwest through the Black Sea and the high level of seismic activity on the southern edge of the Pontides are a result of the Anatolian Plate pushing westwards against the Eurasian Plate owing to pressure from the Arabian Plate. The Sea of Azov follows a slight depression at the edge of the Eurasian Plate, which was filled with water as sea levels rose. Today, earthquakes are indicative of ongoing tectonic movements. A tremor measuring 5.3 on the Richter scale occurred on October 15, 2016 around 120 kilometers (76 miles) north of the Turkish coast and 230 kilometers (143 miles) east of the Bulgarian coast without causing significant damage.[2] Istanbul is highly susceptible to seismic activity, as the most recent significant earthquake, measuring 5.7, in September 2019 showed.

There have been diverse opinions regarding the significance of fluctuations in sea levels and their impact on terrain in the geological past, starting in the Pleistocene, i. e., in the prehistoric period. Experts today reject the "deluge hypothesis," which claimed that a former inland sea experienced catastrophic levels of flooding when water levels increased rapidly following rising temperatures in the post-glacial period, some 8,400 years ago, before a gradual and more or less continuous rise in water levels took hold.[3]

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**1** For more details of the geology and tectonics of the Black Sea, see Aral I. Okay and Gültekin Topus, "Variscan Orogeny in the Black Sea Region," *International Journal of Earth Sciences (Geologische Rundschau)* 106 (2017): 569 – 92, https://doi.org/10.1007/s00531-016-1395-z.

**2** Lukas Rentz, "Starkes Erdbeben im Schwarzen Meer, " *Erdbeben news*, October 15, 2016, accessed January 1, 2021, https://erdbebennews.de/2016/10/starkes-erdbeben-im-schwarzen-meer-spuerbar-in-bulgarien-und-in-der-tuerkei/.

**3** Igor P. Balabanov, "Holocene Sea-Level Changes of the Black Sea," in *The Black Sea Flood Question*, ed. Valentina Yanko-Hombach et al. (Dordrecht: Springer, 2007), 711 – 30; Wolfgang Behringer, *Kulturgeschichte des Klimas: Von der Eiszeit bis zur globalen Erwärmung* (Munich: C. H. Beck, 2007), 63 – 64; Liviu Giosan, Florin Filip, and Stefan Constantinescu, "Was the Black Sea Catastrophically Flooded in the Early Holocene?," *Quaternary Science Reviews* 28, no. 1 – 2 (2009): 1 – 6, https://doi.org/10.1016/j.quascirev.2008.10.012; Helmut Brückner et al., "The Holocene Sea Level Story since 7500 BP – Lessons from the Eastern Mediterranean, the Black and the Azov Seas," *Quartenary International* 225 (2010); Eric Fouache et al., "The Late Holocene Evolution of the Black Sea – a Critical View on the so-called Phanagorian

According to this argument, in the first centuries of the Common Era, the Black Sea was around two or three meters shallower than it is today. In the Sea of Azov, the *Phanagorian regression*—which is disputed in research—saw sea levels decrease between 2,800 and 2,500 years ago, with the breadth of the Bay of Taganrog decreasing during the Holocene by up to half, before the *Nymphean transgression* saw sea levels rise again some 2,300 years ago.[4]

## 1.2 A Heterogeneous Body of Water

The extent of the body of water in today's Black Sea basin can be described in rather dry figures: The entire amount of water in the basin measuring 421,713 square kilometers (163,000 square miles) is calculated to be 530,000 cubic kilometers (127,154 cubic miles).[5] The inflows come primarily from the East and Central European drainage basin, totaling some 350 cubic kilometers (84 cubic miles), which are supplemented by 300 to 400 cubic kilometers (72 to 96 cubic miles) from precipitation. Some 80 percent of the inflows come from the Danube, Dniester, Dnipro, Rioni, and Çoruh (Georgian: Chorokhi) rivers that flow into the Black Sea. Evaporation over the sea causes the loss of some 350 to 400 cubic kilometers (84 to 96 cubic miles) of water from the sea, while outflow into the Bosporus sees some 600 cubic kilometers (144 cubic miles) leave the Black Sea, with countercurrents ensuring around half of that amount flows back into it.[6] This means that just 0.2 percent of the entire volume of water in the Black Sea is exchanged annually, with this amount coming primarily from the upper decameters. Fluctuations in water levels hardly exceed a few decimeters, while there are no tidal fluctuations.

This limited exchange brings about two clearly discernible "floors" or levels in the body of water. The transition layer between the two different masses of water, known as the pycnocline, can be found between 35 and 150 meters (between 115 and 490 feet)

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Regression," *Quarternary International* 266 (2012): 162–14; Hannes Laermanns, "A Palaeogeographic and Geoarchaeologic Study on the Colchian Plain along the Black Sea Coast of Georgia" (PhD diss., University of Cologne, 2018).

**4** Gennady Matishov, "The History of the Azov Sea and the Northern Azov Sea Area During the Holocene," in *Between Grain and Oil from the Azov to the Caucasus: The Port-Cities of the Eastern Coast of the Black Sea late 18th–early 20th century*, ed. Gelina Harlaftis, Victoria Konstantinova, Igor Lyman, Anna Sydorenko, and Eka Tchkoidze (Rethymno: Centre for Maritime History, 2020), 180–81, 184.

**5** Innokentii P. Gerasimov et al., eds., *Ukraina i Moldaviia: Prirodnye usloviia i estestvennye resursy SSSR* (Moscow: Nauka, 1972), 161. There are significant disagreements concerning the figures in the literature, but they cannot be discussed here.

**6** Emil V. Stanev, "Understanding Black Sea Dynamics: An Overview on Recent Numerical Modelling," *Oceanography* 18, no. 2 (2005): 58. The data given are long-term averages showing considerable variability. Cf. The Commission on the Protection of the Black Sea Against Pollution, ed., "Black Sea State of Environment Report 2009–2014/5" (Istanbul, 2019).

below the surface.[7] While the upper level has lower salt content thanks to the inflows of freshwater from East European rivers, the water with higher levels of salt remains because of its higher density in the lower, significantly more powerful layer. In the central basin, salt content reaches 1.8 percent and 2.2 percent in deeper waters (half the level of the salinity of the Mediterranean), while the inflows in the north and west reduce the concentration of salt significantly along the respective coastlines.[8] There are few vertical exchange flows between the layers. The water in the deeper basin experiences hardly any oxygenation, making it the world's largest source of hydrogen sulphide and thus the largest body of anoxic water. It is for this reason that this "lower floor" is almost entirely deprived of life forms.[9] Furthermore, the limited force of the upper layer containing higher levels of oxygen is what makes the water appear dark, hence the name Black Sea. Between 1955 and 2015, the depth of the pycnocline shifted, most likely as a result of global climate change, from an average depth of 140 meters to 90 meters (460 to 295 feet), which has had a negative impact on the habitat of fish stocks.[10]

## 1.3 A Body of Water in Continuous Motion

The upper layer of water is in continuous motion, driven by winds, the inflows and outflows of water in the sea basin, and the Coriolis force caused by the Earth's rotation. In both subbasins of the Black Sea, as well as in its central part, they form individual anticlockwise "cyclonic" gyres in the upper levels of the waters, while in the deeper waters there is a common gyre that drives the seawater into a rim current. Smaller, "anticyclonic" eddies off the coast of Ajara, over the graben of Novorossiisk, and west of Crimea, as well as along many points of the Turkish Black Sea coast, flow in the opposite direction. Off the Georgian coast, a northwest to southwest current prevails north of the Rioni estuary and a south to north current off the Ajarian coast.[11] In winter, the current follows just one gyre, while the eddy off the coast of Batumi remains inactive. The formation of eddies in the sea water has an impact on the transportation of materials in the Black Sea. Not only waste on the coast is set in motion

**7** Mehmet Berkun, Egemen Aras, and Semih Nemlioglu, "Disposal of Solid Waste in Istanbul and Along the Black Sea Coast of Turkey," *Waste Management* 25 (2005): 853.

**8** Gülfem Bakan and Hanife Büyükgüngör, "The Black Sea," *Marine Pollution Bulletin* 41, no. 1–6 (2000): 27–28.

**9** Arthur Capet et al., "Decline of the Black Sea Oxygen Inventory,"abstract, *Biogeosciences* 13, no. 4 (2016): 1287–97, https://www.biogeosciences.net/13/1287/2016/.

**10** Capet et al., "Decline"; The Commission, "Black Sea State," 473.

**11** Stanev, "Understanding," 61.

and concentrated by the eddies, but also crude oil from exploratory oil wells, which then threatens sections of coastline.[12]

Because the Black Sea and the Sea of Azov have significant inflows from the Danube, Dniester, Dnipro, Don, Kuban, and Rioni, as well as series of smaller rivers, while the Mediterranean region experiences a higher degree of evaporation that leads to relatively smaller outflows, the main flow of water from the Black Sea leads into the Mediterranean. As a result, the specifically lighter water of the Black Sea lies above the weaker countercurrent from the Mediterranean.

## 1.4 A Transitional Climate Zone between Continental Europe and the Mediterranean Subtropics

The most significant differences in air temperature are evident in January, when it can be -4°C (24.8°F) at the Don estuary in the Sea of Azov, while off the east coast of Turkey it can be +7°C (44.6°F). In July, temperatures are more comparable (between 21°C and 25°C / 69.8°F and 77.0°F), with the highest values off the coast of Georgia. Precipitation is also highest there, however, as a result of masses of humid air ahead of the Ajarian Mountains. In Crimea, the Crimean Mountains form a regional climate barrier between the dry north and the Mediterranean south coast. The Sea of Azov can temporarily freeze over between Kerch and the Ukrainian mainland, as well as on its east coast. Equally, the shallow sea area between Odesa and the northwest coast of Crimea can experience some surface freezing during particularly severe winters, a phenomenon that until the late nineteenth century significantly hindered shipping.[13] The average water temperatures in the colder half of the year reveal a significant gradient, ranging from between 7°C and 7.5°C (44.6°F and 45.5°F) in the northwest (the Gulf of Odesa) and 13.5°C (56.3°F) in the southeast off the coast of Batumi and Trabzon.[14] The average annual precipitation is 2,440 millimeters (96 inches) near Batumi but only 441 millimeters (17 inches) near Odesa.[15]

Storms and heavy thundershowers are unique events that depending on their intensity and length can influence the development of the coast and impact shipping.[16]

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**12** Konstantin A. Korotenko, "Effects of Mesoscale Eddies on Behavior of an Oil Spill Resulting from an Accidental Deepwater Blowout in the Black Sea: an Assessment of the Environmental Impacts," *PeerJ* 6: e5448 (2018), https://doi.org/10.7717/peerj.5448.

**13** Apostolos Delis, "Navigating Perilous Waters: Routes and Hazards of the Voyages to Black Sea in the Nineteenth Century," in *Linkages of the Black Sea with the West: Navigation, Trade and Immigration,* ed. Maria Christina Chatziioannou and Apostolos Delis (Rethymno: Centre of Maritime History, 2020), 18–19.

**14** Stanev, "Understanding," 68.

**15** "Climate Data for Cities Worldwide," Climate-Data.org, accessed March 9, 2021, https://en.climate-data.org/.

**16** Ekaterina V. Trifonova et al., "Critical Storm Thresholds for Morphological Changes in the Western Black Sea Coastal Zone," *Geomorphology* 143–144 (2012): 81–94, on the basis of studies on the Bulgarian Black Sea coast.

Well into the nineteenth century, wind direction determined the routes ships could take.[17] The heaviest storms emerge in the winter half of the year, when there are easterly and northeasterly air currents. A catastrophic storm occurred on November 11, 2007 off the south coast of Crimea, causing several freight ships to capsize, including a Russian oil tanker that broke up and released 2,000 metric tons (2,200 short tons) of oil into the sea.[18]

## 1.5 Critical Environmental Conditions

As long as the rivers flowing into the Black Sea discharged untreated industrial wastewater and urban sewage, the water quality deteriorated further. Since 1992, the riparian countries have been party to the Convention for the Protection of the Black Sea Against Pollution, which in 2009 was followed by the Strategic Action Plan for the Environmental Protection and Rehabilitation of the Black Sea.[19] Implementation is organized by the Commission on the Protection of the Black Sea Against Pollution, which presented a comprehensive report on the environmental situation. Nevertheless, the Ukrainian coast off Odesa, the densely populated southeastern coastal area of Crimea, the area around the Kerch Strait, as well as sections of the Turkish coast near Istanbul, are highly polluted. Less affected areas are the Russian Black Sea coast near Sochi, as well as the coastline of Bulgaria. There is evidence of oil spills along the shipping routes from Istanbul to Odesa, Novorossiisk, and Tuapse.[20] Heavy pollution of beaches by plastic waste affects the coast near Istanbul. The economic transition after 1990 in Eastern Europe involved deindustrialization, which consequently reduced levels of polluted water inflows. Now, the biggest environmental threat is posed by oil transport. Azerbaijan had been planning to export crude oil via the Black Sea to Europe, but Turkey closed the Bosporus and Dardanelles to oil tankers.[21]

## 1.6 A Partial Use of Potential Resources

The Black Sea basin contains several mineral resources: There are proven oil and natural gas deposits in the elongated basin zone in the north, while further deposits are assumed to exist in the internal section of the basin. There are also proven deposits of

**17** Delis, "Navigating."

**18** Vitaliy A. Ivanov et al., "Atmospheric Modeling for Advanced Warning of Weather Disasters in the Black Sea Region," *Geography, Environment Sustainability* 6, no. 4 (2013): 31–32, https://doi.org/10.24057/2071-9388-2013-6-4-31-47.

**19** The Commission, "Convention on the Protection of the Black Sea Against Pollution," accessed January 1, 2021, http://www.blacksea-commission.org/Official Documents/The Convention/full text/.

**20** The Commission, "Black Sea State," 101.

**21** Bakan and Büyükgüngör, "Black Sea," 32.

manganese and chromium off the Turkish coast. However, geological research in the off-shore area remains in its infancy.[22]

The Black Sea, or at least its upper levels, provides a habitat for fish. The most significant species, the European anchovy (*Engraulis encrasicolus*), has different seasonal migration patterns in the eastern and western halves of the main sea. After catch yields dropped dramatically in the 1980s due to overfishing, efforts were made to introduce protective measures. But because fishing in the Turkish areas of the Black Sea serves growing middle-class demand, with alternative sources of supply unavailable, relative poverty has forced fishermen to remain in their trade.[23] The EU member countries Bulgaria and Romania are subject to fishing quotas on sprats (*Sprattus sprattus*) und turbots (*Scophthalmus maeoticus*).[24] In these cases, too, catches are declining. Climate change-induced warming could further restrict fish habitats and thus fishing.

Since time immemorial, the surface of the Black Sea has served as a transport space, with coastal routes prevailing. Previously, even long-distance connections followed the coastlines, although today they cross the open seas. The connection to the Mediterranean via the Bosporus, the Sea of Marmara, and the Dardanelles, declared an international shipping route in 1936, and the Kerch Strait are both of high strategic relevance. Today ferry connections exist between Georgia on the one side and Bulgaria, Ukraine, and Russia on the other. A new practice involves using the seabed to lay natural gas pipelines. After the Blue Stream Pipeline between Beregovaia on the Russian coast and the Turkish terminal Durusu near Samsun went into operation in 2005, the South Stream Project was discontinued following the annexation of Crimea in 2014. However, since early 2020, Russia has been delivering its natural gas to Turkey via the Turkish Stream Pipeline, a project that was negotiated within a different geopolitical framework.[25]

## 2 The Coasts

The rim of the Black Sea basin is marked by highly diverse sections of coastline. Terrain, water discharge of the rivers, bedrock, and geological-tectonic processes have

**22** Mike D. Simmons, Gabor C. Tari, and Aral I. Okay, eds., *Petroleum Geology of the Black Sea* (London: Geological Society, 2018).

**23** Ståle Knudsen, Mustafa Zengin, and Mahmut Hakan Koçak, "Identifying Drivers for Fishing Pressure: A Multidisciplinary Study of Trawl and Sea Snail Fisheries in Samsun, Black Sea Coast of Turkey," *Ocean & Coastal Management* 53 (2010): 252–69.

**24** Council of the European Union, "Council Regulation fixing for 2018 the Fishing Opportunities for Certain Fish Stocks and Groups of Fish Stocks in the Black Sea," December 5, 2017, accessed January 27, 2021, https://data.consilium.europa.eu/doc/document/ST-14897-2017-INIT/en/pdf.

**25** Roland Götz, "Erdöl und Erdgas im Südkaukasus: Binnenversorgung, Export, Transit," *Osteuropa* 65, no. 7–10 (2015): 365–82; Andreas Heinrich, "Exportoptionen für russisches Erdgas nach dem Scheitern von South Stream," *Russland Analysen* 303 (2015): 2–5; "TurkStream," Gazprom, accessed March 22, 2021, http://www.gazprom.de/projects/turk-stream/.

all shaped whether steep cliffs or flat coasts, lowland or upland coasts, coastal bights, or delta areas emerge.[26] Let us take a journey along the coast at the Danube Delta and proceed in a clockwise direction around the Black Sea.

The most extensive delta (4,142 or 5,800 square kilometers/1,599 or 2,239 square miles, depending on the delimitation) is the Danube Delta. It has built up since the post-glacial period from unconsolidated sediment transported by the Danube and its central and southeastern European tributaries, accounting for almost half of the sediment load entering the Black Sea. Narrow elevations trace previous coastlines.[27] For several decades, inland damming of the Danube, creating retention basins, straightening sections of the river, and sedimentation in the delta lakes have prevented it from expanding significantly. The Delta includes four wetland areas that are protected under the Ramsar Convention and it has been designated a biosphere reserve since 1990/1998. In 1993, it was designated a UNESCO World Heritage Site.[28] In Romania, this brought to an end the practice of draining swamps and lakes, initiated in the 1960s in order to expand the amount of land available for growing grain. In terms of fauna, the delta area has the world's largest populations of white pelicans and pygmy cormorants. For the local population, the abundance of fish, the use of reeds for thatch, and tourism are of fundamental economic significance. A conflict flared up when in 2004 Ukraine announced plans to expand the Bystroe Canal in the north of the Delta for shipping so that it could avoid Romanian usage fees. It was feared that the ground water level would decline, water pollution would increase, and bird nesting sites would be disrupted. Protests meant that the project was abandoned.

The southern Ukrainian rivers end in limans, wide estuaries. They emerged with the recent tectonic submersion of some sections of the coast and concurrent rising of the sea level. Sedimentary spits mark the coast between Odesa and the Perekop Isthmus, the stretch of land connecting Crimea and the Ukrainian mainland. While a natural bay provides favorable harbor conditions around Odesa, it is effectively impossible to establish harbors on the isthmus and navigation channels must be kept continuously clear.

The Kerch Strait—known in ancient times as the Cimmerian Bosporus—connects the Sea of Azov with the Black Sea. It has been of great strategic significance since time immemorial, as it provides access to the southern Russian-Ukrainian steppe regions

**26** Ruben D. Kosyan and Violeta N. Velikova, "Coastal Zone – Terra (and Aqua) Incognita – Integrated Coastal Zone Management in the Black Sea," *Estuarine, Coastal and Shelf Science* 169 (2016): A2, http://dx.doi.org/10.1016/j.ecss.2015.11.016.

**27** Max Pfannenstiel, *Die Quartärgeschichte des Donaudeltas* (Bonn: Geographisches Institut der Universität Bonn, 1950); Fabio N. Güttler, Simona Niculescu, and Francis Gohin, "Turbidity Retrieval and Monitoring of Danube Delta Waters Using Multi-Sensor Optical Remote Sensing Data: An Integrated View from the Delta Plain Lakes to the Western–Northwestern Black Sea Coastal Zone," *Remote Sensing of Environment* 132 (2013): 86–101, http://dx.doi.org/10.1016/j.rse.2013.01.009.

**28** Petre Gâştescu, "The Danube Delta Biosphere Reserve: Geography, Biodiversity, Protection, Management," *Revue Roumaine de Géographie* 53, no. 2 (2009): 139–52.

from the south and the entrance to the Black Sea from the north. Currents, however, do not offer a secure passage for shipping. A shipping channel was first cleared in 1874, while presently the sea route is crossed by a road and rail bridge constructed by Russia a few years after the annexation of Crimea.

The coast between Novorossiisk and Sochi, as in Abkhazia, is divided by the foothills of the Western Caucasus into coastal yards used for agriculture and tourism. Seasonal floodwaters continuously re-deposit the gravel accumulated by relatively short mountain rivers.

The Georgian Black Sea coast forms a flat coastal plain between the Kelasuri River in Abkhazia and the Chorokhi River (Turkish: Çoruh) in Ajara, which is being expanded by the sediments deposited by the rivers forming the delta there. As sea currents close to the coastline transport loose material, former lagoons lost contact with the sea again, such as Lake Paliastomi near Poti. The coastal sediment is a highly sought-after raw material; in the region between Ajara and Abkhazia, some 20 million cubic meters (70 million cubic feet/2.6 cubic yards) of material were extracted between the 1960s and 1980s, primarily for construction purposes.[29] This section of the coast is largely unsuitable for harbors. This is why Redut-Kale, founded in 1804 at the mouth of Kopi River, was abandoned in favor of Sukhumi after the Crimean War had rendered the largely abandoned fortress obsolete. Batumi benefits from a coastal promontory which, like a peninsula, closes off the bay with its harbor to the south.

On the Turkish Black Sea coast, only the estuary areas of the rivers Sakarya, Kızılırmak near Bafra, and Yeşilırmak near Çarşamba have developed into larger coastal yards. Before dams were constructed in the hinterland for hydro-energy production, these rivers delivered around one third of the entire sediment deposited in the Black Sea. Now it is only around one sixth, at some 76.2 million metric tons (84 million short tons) per year. Another challenge for coastal protection measures is abrasion, which is wearing away the coastline.[30] The largest part of the Turkish Black Sea coast is formed of steep cliffs, where the foothills of the Pontides drop off into the sea. In the past, bandits and pirates could easily find shelter in such surroundings, where the hidden nooks and crannies provide a location for launching raids or planning slave trading. The Turkish Black Sea coast is not really suitable for large-scale trading ports. There are, on the one hand, few promontories that can offer protection from the northerly and northwesterly winter storms, while on the other hand the hinterland is difficult to reach over the mountains.[31] Trabzon and Samsun both make use of a small bay for their ports, while the harbor of Ereğli was established inside a west-facing bay. Agriculture is limited to the coastal strip. The mountain areas are generally only used for pas-

**29** Bolashvili et al., *National Atlas of Georgia*, 34.

**30** Mehmet Berkun, Egemen Aras, and Ummugulsum Ozel Akdemir, "Water Runoff, Sediment Transport and Related Impacts in the South-Eastern Black Sea Rivers," *Environmental Engineering and Management Journal* 14, no. 4 (2015): 781–91.

**31** Wolf-Dieter Hütteroth and Volker Höhfeld, *Türkei* (Darmstadt: Wissenschaftliche Buchgesellschaft, 2002).

toral livestock farming, unless mineral resources such as coal deposits (Zonguldak) enable local development. Resource extraction and the strengthening of the shore in connection with the coast road impair the natural development of the coastline.[32]

Between the Bosporus and the Danube the foothills of the Iskander Mountains and Stara Planina reach the coast. Due to the alternation of flat and steep coasts, this section of coastline features numerous landmarks that provide orientation for navigation.[33] In terms of vegetation, Cape Emine near the seaside resort of Zlatni Piasatsi marks the border between the southern, sub-tropical-influenced formation and the northern formations that belong to temperate climates.[34] Anthropogenic influences, such as straightening rivers, resource extraction, establishing ports, roadbuilding and shoreline reinforcement, have brought about an increase in coastal erosion while cutting sediment shifts.[35]

## 2.1 Crimea—a World of its Own

Crimea is a peninsula that is connected to the southern Ukrainian lowlands only by the Perekop Isthmus, a strip of land barely above sea level. To the east, the Syvash, a wetland of international importance and recognized under the Ramsar Convention, is bordered by several lagoons. Because their only source of freshwater is precipitation, the salinity is higher than in the Black Sea and Sea of Azov, thus enabling commercial salt extraction. The north of the peninsula is formed of lowlands that through irrigation have been turned into fertile farmland, although since the Russian annexation in 2014 it can hardly be used because freshwater supplies from the Ukrainian mainland have been cut. In the south, the Crimean Mountains culminating in the Roman Kosh (1,545 meters/5,069 feet) separate the inland area from the south coast that together with the city of Yalta traditionally formed one of the most popular tourist destinations in the Black Sea region. The mountain range prevents cold air from penetrating the region, thus giving the south coast a favorable climate.

## 2.2 Potential Uses of the Coastal Areas

The economic potential of the coast goes beyond the extraction of sediments. Since ancient times, a crucial issue has been finding suitable locations for harbors. Early histor-

**32** Bakan and Büyükgüngör, "Black Sea," 35.

**33** Delis, "Navigating," 11.

**34** Rossen Tzonev, Marius Dimitrov, and Veska Roussakova, "Dune Vegetation of the Bulgarian Black Sea Coast," *Hacquetia* 5, no. 1 (2005): 7–32, with a detailed vegetation survey.

**35** Veselin Peychev and Margarita Stancheva, "Changes of Sediment Balance at the Bulgarian Black Sea Coastal Zone Influenced by Anthropogenic Impacts," *Dokladi na Balgarskata akademiia na naukite* 62, no. 2 (2009): 277–84, for Bulgaria.

ical settlement attached great significance to the location of harbors that could offer a starting point for connections to the hinterland providing goods for trading. Since then, it is only the kind of goods that are traded that has changed, as well as the quality and safety of transport routes. Thus, the Ottoman conquest of Constantinople in 1453 caused a deep rupture in trading relations in the Old World. With the expansion of Russian rule in the Black Sea area, shipping routes across the Sea regained importance. Odesa and Istanbul developed into significant trading posts, while their military significance declined after the Crimean War.

Growth potential with respect to tourism is evident both in the flatland coastal areas and coastlines marked by cliffs with sand-filled bays. The delta areas attract visitors because of their apparently untouched natural landscapes and vast wealth of birdlife. Indeed, the Black Sea region is a breeding area for twenty-one species of bird and a wintering location for another twenty eight.[36] Bulgaria has attractive sandy beaches, including the seaside resorts of Zlatni Piasatsi (Golden Sands) und Slanchev Briag (Sunny Beach), which are aimed at international mass tourism. Romania offers the Danube Delta, Crimea beaches set against the backdrop of the Crimean Mountains, while the North Caucasus has the pebble beaches of Sochi. Abkhazia can offer the coastal resorts of Pitsunda, Gagra, and Sukhumi, developed during the Soviet era, while in Georgia there is Batumi, Kobuleti, and the recent addition of Anaklia. The Turkish Black Sea coast has numerous smaller destinations that do not share the same level of international recognition as those on the Mediterranean Riviera. Furthermore, many coastal cities with historical monuments and modern cityscapes attract tourists.

## 3 The Hinterland

Whereas in the north and northwest, the coastline is largely formed of lowland areas, in the east, south, and southwest mountains stretch all the way to the coast, with the exception of the Colchis alluvial plain in Georgia. The extent of the hinterland depends on the question being explored. A delineation of a Black Sea region that would be applicable to all historical periods is therefore hardly possible.[37]

In Romania, the hilly region of the Dobruja (Romanian: Dobrogea) separates the Black Sea coast from the agricultural area of Wallachia. The Danube cuts through the hilly region at the Prut confluence, before this great European river splits into the various channels of the delta, while the northern Chilia river forms the border with Ukraine. Moldova, on the other hand, is marked by the hills located between the river systems of the Prut and the Dniester.

**36** The Commission, "Black Sea State," 435.

**37** For more on this, see Stefan Troebst, "The Black Sea as Historical Meso-Region: Concepts in Cultural Studies and the Social Sciences," *Journal of Balkan and Black Sea Studies* 2, no. 2 (2019): 11–29; Nasuh Sofuoğlu, "Theoretical Approaches to the Black Sea Region: 'Is the Wider Black Sea Area a Region?'," *Journal of Balkan and Black Sea Studies* 3, no. 5 (2020): 171–90.

In Ukraine, the coastal plain contrasts with the loess-covered and now cultivated steppe landscapes that are marked by large rivers. The steppe merges into the hill country of Podolia and the Dnipro uplands, both of which are wide-open agricultural landscapes that emerged from the steppe, although anthropogenic steppe gorges (Russian: *ovrag*) limit their usability. North of the Sea of Azov, the hills of Azov (highest peak 324 meters/1,063 feet) separate the coast from the steppe on the lower Dnipro. The Donetsk Massif and the hills of Azov are tectonic uplifts of the East European platform forming part of the Eurasian plate. The Donetsk Massif dips down to the coal deposits of eastern Ukraine. Southeast of the Sea of Azov, the flat terrain of the seabed continues in the agricultural landscape of the Kuban lowlands with the Taman Peninsula, before turning into the small hills of the North Caucasus steppe.

The transition to the Great Caucasus occurs near Novorossiisk, with its steepness and thick forests giving the impression of an impenetrable barrier. Several foothills reach the coast. The lowland sections in between are crossed by rivers, which usually have low runoff, but can transport and deposit large amounts of gravel after heavy rains in the mountains. In southeast Abkhazia, the coastal lowlands are extensive, although the mountains also form a barrier here.

The Georgian lowlands of Colchis and Rioni offer a broad opening into the hinterland, although large parts of these areas were only meliorated in the course of the twentieth century and even today parts remain difficult to traverse. It is for this reason that the most important areas of settlement and agriculture in Mingrelia and Guria are located away from the coast on the lower mountain slope. The mountain region, accessible only through a few valleys, continues south of the Çoruh in the Pontides. These mountains are difficult to open up, meaning that the area is cut off from the Anatolian highlands to the south. It is only in the metropolitan area around Istanbul that the mountain ranges subside and the low density of settlement is transformed by the sprawl of the metropolis.

West of the Bosporus and Dardanelles, the low mountains of the Istranca Dağları (Bulgarian: Strandzha) emerge. North of Burgas, the climatic divide of the Eastern Balkan Mountains rises up, separating the milder south from the harsher climate of the north. Heading northwards until the Romanian border, agriculture dominates a loess-covered tableland that is considered part of Dobruja.

## 3.1 Fertile Soil and Natural Resources as Development Potential

Extending southwards into Crimea, the Chernozem of the Ukrainian steppe changes into Kastanozem (“chestnut soil”) under drier climatic conditions. The regional climatic conditions thus transform a sequence of soil types which have developed a relatively rich humus horizon over calcareous loess deposits. While the relatively dry summer conditions prevent minerals from being washed away, the cold winters hinder the biological and chemical degradation and hence the humus layer can grow. At the same time, the soil fauna provides significant water storage capacity, with the accumulation

of lime in dead root tubes enabling the vertical movement of soil water.[38] The narrative of Ukraine as a breadbasket was already familiar in Antiquity, as the region was used for grain cultivation. Unsuitable agricultural technology damaged the black earth, primarily in the Soviet period, leading to soil erosion and deflation. Further west, in the Carpathian foothills, podsolization increases. Soil leaching also affects soil formation in Georgia, albeit under much warmer conditions.

Among mineral resources, the iron ore deposits around Kryvyi Rih and the coal deposits of the Donetsk area (Donbas) have been known for centuries. Alongside the manganese deposits of Nikopol, they have formed the basis for heavy industry in the area since the 1880s. There are some mineral deposits in the hilly hinterland of Georgia. In Soviet times, coal deposits were developed in Tqvarcheli (Abkhazia), close to the coastal region. Further to the east are the coal deposits of Tqibuli and the manganese ore deposits of Chiatura, which were once of global significance.

## 3.2 Climate and Landscape Development

Any examination of earlier phases of climate change must apply terminology drawn both from paleoenvironmental research and from archaeology to the postglacial period, too.

The last period of cooling in the late glacial era, the Younger Dryas, was succeeded around 10,200 years ago by the warming during the postglacial climate optimum of the Boreal. During the Atlantic period (between 8,000 and 4,800 years ago), the melting of ice masses in the North Pole region and in the European mountain ranges had passed its peak, meaning that that the water flow of many East European rivers receded. When sedentary cultures developed during the Neolithic Era, forest steppe vegetation on the loess plateaus and in the mixed forests in the river valleys shaped the southern Ukrainian hinterland, the Chernozem emerged, and a favorable climate enabled the development of agriculture.[39] During the Chalcolithic Age (6,000 to 5,500 years ago), high levels of humidity led to increased humus formation before the Subboreal period (around 3500 BC onwards) brought in a dryer climate that reached a peak around 3000 BC. This probably initiated a new period of steppe formation in parts of the North Pontic region. The third century BC was marked by climate volatility, including extended dry periods and—at its end—a catastrophic drought that resulted in a withdrawal of the human population from many areas.[40]

**38** Jörg Stadelbauer, *Die Nachfolgestaaten der Sowjetunion: Großraum zwischen Dauer und Wandel* (Darmstadt: Wissenschaftliche Buchgesellschaft, 1996), 379 – 80.

**39** Galyna Pashkevich, "Environment and Economic Activities of Neolithic and Bronze Age Population of the Northern Pontic Area," *Quaternary International* 261 (2012): 175 – 82.

**40** Elke Kaiser, *Das dritte Jahrtausend im osteuropäischen Steppenraum: Kulturhistorische Studien zu prähistorischer Subsistenzwirtschaft und Interaktion mit benachbarten Räumen* (Berlin: Edition Topoi, 2019), especially 139 – 43.

The late Subboreal period, with increased precipitation from around 2000 BC, marked the start of the Bronze Age. Another period of cooling from around 800 BC on led to the abandonment of previous settlements in mountain areas. In the seventh century BC, Greek colonization began from Miletus with the founding of trading ports and settlement colonies. This was followed by a renewed warming at the turn of the century, which also coincided with the heyday of the Roman Empire. A rapidly growing population sought new areas of settlement. Burgundians and Goths had settled in the south of today's Ukraine, but by the end of this warmer phase Xiongnu ("Huns") invading from Mongolia had overrun these kingdoms, initiating a decline in steppe agriculture.[41] Colder winters and a more humid climate preceded the warming of the High Middle Ages around 1000. This was succeeded around 1350 by the Little Ice Age before a renewed period of warming emerged in the mid-nineteenth century. Climate change since then, and particularly since the middle of the twentieth century, is mainly attributed to the burning of fossil fuels.

## 3.3 High Biodiversity

The traditional landscape division in Ukraine notes a transition from the dry steppe in the south to the forest steppe in the north of the country, where forest steppe incorporates a mosaic of sites with different moisture supply, where steppe-like features prevail under dry conditions and forests predominate in wet river floodplains. As a result of human interventions, tree coverage in Ukraine is very limited. It is limited in the south to the pine forests of the lower Dnipro and to deciduous forests of the Crimean Mountains, while the Carpathian Mountains are densely forested. In the steppe areas, forests were pushed back by steppe husbandry and agricultural colonization, with the latter also reducing forest steppe formations through grasses such as feather grass (*Stipa*) and fescue (*Festuca*) to a few remnant sites.

On the Russian Black Sea Coast and in Abkhazia forests stretch right up to the shore where they have not been cleared for settlements or transport infrastructure. At the foot of the mountains, there are stands of oak, beech, hornbeam, and chestnut. Alder and Caucasian wingnut are common in the Rioni lowland. In addition, some plant species that have survived the ice age, such as the Pitsunda pine (*Pinus pithyusa*), Eurasian smoke tree (*Cotinus coggygria*), and Cretan rockrose (*Cistus cretica*). Deciduous forests prevail up to an altitude of 1,200 meters (4,000 feet), above which the proportion of conifers increases. Above the tree line (in western Georgia at about 1,700 – 2,000 meters / 5,600 – 6,600 feet), there are still some beech trees, while above 2,400 meters (7,900 feet) Alpine grasslands take over. In Ajara, cultivated vegetation (es-

**41** Behringer, *Kulturgeschichte,* 89.

pecially citrus fruits) has largely replaced the natural vegetation in the coastal hinterland, while beech and chestnut stands dominate in the mountains.[42]

In Turkey, too, natural vegetation has largely disappeared. In the immediate coastal hinterland, tea and citrus plants replaced the original moist forests and hazelnut plantations the deciduous beech forests. In the subcolchic moist forests, beech trees prevail alongside other deciduous trees, while in higher altitudes on the mountains firs, spruces, beeches, and rhododendrons grow in what sometimes resemble primeval forests. Where land has been turned over to use, vegetation has generally suffered degradation.[43] In the western section of the Turkish hinterland, the expansion of the megacity of Istanbul has led to the loss of sub-Mediterranean dry forests with pines and deciduous oak trees. In Bulgaria, oak forests can be found in the lower levels of the mountains, beech forests up to 1,800 meters (5,900 feet), while the highest altitudinal belts are occupied by pastureland.

### 3.4 Landscape Change in the Holocene and Anthropocene

Long- and short-term climate change, together with the resulting changes to inflows and outflows, are important natural drivers shaping the terrain at river estuaries. The expanding delta areas, small-scale changes to the coastline, as well as shifts in nature of flora and fauna are all striking consequences of landscape change. However, even long-term fluctuations in climatic elements such as temperature and precipitation contribute only marginally to changes at the coast. More significant is human impact, because clearance and agricultural use lead to soil erosion and sedimentation. Likewise, the stripping back of forests and the natural steppe, which have been replaced by cultivated plants, is anthropogenic. In the catchment of the upper and middle reaches of the Danube, deforestation dates back to Roman times, whereas in its lower reaches it only occurred in the past millennium.[44]

## 4 Conclusion

The Black Sea region is a highly diverse space marked by contrasts and transitions: from a temperate continental climate to the subtropical; from barely accessible mountain ranges to flat coastlines; from wetlands of particular ecological value to dry areas bearing little fauna and flora. Whether the area is seen as a single unit shaped by its proximity to a large body of water, or instead as a neighborhood featuring various spaces, depends on the perspective adopted. There is no uniform picture of the forma-

**42** Bolashvili et al., *National Atlas of Georgia*, 72–75.
**43** Hütteroth and Höhfeld, *Türkei*, 105–9.
**44** Giosan et al., "Anthropogenic Transformation," 4–5.

tion and shaping of landscapes that would pertain throughout history; instead, the area has been altered constantly by climatic changes. In this way, many classifications and constructs that might seem to have scientific basis are actually a product of mental imaginaries. Indeed, treating this expansive albeit navigable sea as a spatial unit is itself something that is based on mental constructs.