



Национална конференция с международно участие „ГЕОНАУКИ 2021“
National Conference with International Participation “GEOSCIENCES 2021”

Comparative study of the marine terraces along the Bulgarian and Turkish Black Sea coasts for determination of the tectonic effect and environmental change

Сравнителни изследвания на морските тераси по българското и турското черноморско крайбрежие за определяне на тектонския ефект и промените в околната среда

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The marine terraces are excellent geomorphic markers, which store the geological record of the past sea level positions. The Black Sea is the world's biggest semi-closed basin, where several nations with ~140 million inhabitants share its coastline. The Quaternary history of the Black Sea is a long-studied phenomenon with offshore drilling programs, focusing on the sedimentary record of the sea while the coastal records, especially for the southern part, is relatively understudied. The dating of the rocks and landforms, based on methods of absolute geochronology, is a rarity in the geological and geomorphological studies of the Bulgarian and Turkish Black Sea coasts.

At the end of 2020, a team of Bulgarian and Turkish geologists and geomorphologists was formed to contribute to solving this problem. Scientists from the Geological Institute at the Bulgarian Academy of Sciences and the University of Sakarya, Turkey,

as a leading organization from the Turkish side, proposed a common project “*Comparative study of the Black Sea terraces in Turkey and Bulgaria for determination of tectonic and environmental effects on uprising coasts*”, approved by the Bulgarian Academy of Sciences and TUBITAK.

Our primary aim is to contribute to building up the timescale for the last ~125 thousands of years with respect to past environmental changes by detailing fluvial and coastal records of the SW and S part of the Black Sea. The determination of the differential rate of regional vertical tectonic deformation controlling the coastal morphology is another major aspect of the study.

The novel approach of the team is based on the previous observations and preliminary results on coastal sedimentary archive led to a complex methodology. The methods of the study can be simplified as mapping, dating and analysis, which will be

applied to the studied sites within the wide range of the Bulgarian and Turkish coastline, SW Black Sea.

Prospection and conventional mapping of the sedimentary record along more than 800 km long coastal zone will be accomplished with precise measurement tools. The measurement of the terrace surfaces will be held by using real time kinematic GPS and UAV photogrammetry with centimeter scale resolution.

Systematic absolute dating by techniques focusing on inorganic (luminescence) and organic (radio-carbon and uranium series) sediments is a key for building a precise timeline of events and for correlation as well. The provided dating techniques are Optically Stimulated Luminescence (OSL) and p-IR-IRSL for quartz and feldspars and AMS-¹⁴C and U-series dating for organic materials. Karst sediments (speleothems) from caves in marine terraces at the Northern Bulgarian Black Sea coast may also be dated by U/Th method.

The sedimentary records will be detailed by conventional methods (grain size and shape analysis) and also by faunal assemblages and analytical (stable isotopes ¹⁸O/¹⁶O and ¹³C/¹²C, trace elements) signatures searching for clues on environmental changes, in contrast the connections between the Mediterranean-Marmara-Black Sea and Caspian realms.

Macro- and microfossils within the sedimentary layers will be carefully examined, identified and correlated to determine the palaeoenvironment of the Black Sea (i.e. salinity, temperature and depth) during the depositional period. The identification of the collected samples will be held by using refer-

ence collection of Ponto-Caspian fauna. Trace element analysis (ICP-OES) from inorganic sediments and shells will aid prospection of environmental changes during and post-deposition. The grain size distribution and SEM imaging of coastal/dune sands will help to quantify the maturity and determine the distance of aeolian transportation. The stable isotope analysis ($\delta^{18}\text{O}$, $\delta^{13}\text{C}$) from the mollusk shells within a sedimentary sequence is a tool to understand the characteristics of the water column at a specific time period.

During online meetings of the team were discussed and identified the sites of the field work: coastal zone of Varna and NE Bulgaria, Kamchia River, coastal zone of the Burgas region, Ropotamo, Veleka and Rezovo Rivers (Bulgaria), Igneada, Sile, Sakarya River and Karasu Delta, Melen River, Filyos River, Sinop Peninsula and Kızılırmak Delta (Bafra Plain) (Turkey). The study area covers significant SW part of the whole Black Sea coastline.

To achieve our goal we will investigate the Late Pleistocene sedimentary record preserved as fluvial terraces, coastal dunes and coastal terraces. The obtained results will undoubtedly contribute to the clarifying of the Pleistocene evolution of the Black Sea coast in our two neighboring countries.

Acknowledgements: This study is funded by joint research project “Comparative study of the Black Sea terraces in Turkey and Bulgaria for determination of tectonic and environmental effects on uprising coasts” between Bulgarian Academy of Sciences and TUBITAK (Turkey).