Ancient coastlines of the Black Sea and conditions for human presence – Black Sea Expedition in 2011

Древни брегови линии на Черно море и условия за човешко присъствие – експедиция в Черно море през 2011 г.

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Introduction

In June of 2011, with financial support from the Bulgarian Science Fund – Project DO 02-337, a cruise on the R/V “Akademik” was carried out. The area of cruise was the west part of Black Sea. During the Black Sea expedition, 17 cores and 8 grapple samples was carried out. Initially, the cores were taken in the submerged shorelines. After a few cores were obtained, we began to core into the deep water. During the expedition we also mapped the submerged shoreline, taking samples for dating, isotope analysis and pollen sampling. Actually, we had a lucky expedition because, without a vibracorer, we managed to penetrate into the hardened shelly gravel of the submerged shoreline. The flood hypothesis suggests there was a decrease in water level, creating shorelines (now submerged) that can be dated to 8.5 ky BP (Ryan et al., 2003). The outflow hypothesis maintains that there was no drawdown and that Black Sea level remained high after the drawdown 11 ky BP, continuing to outflow through the Bosphorus into the Marmara Sea (Hiscott et al., 2007). In this expedition with collected data and future analysis, we hope to prove whether it supports an abrupt Holocene flood scenario, or a gradual, fluctuating Holocene sea-level rise.

Materials and Methods

We embarked on the R/V “Akademik” from Varna, Bulgaria on June 27-th. The R/V “Akademik” is operated by the Institute of Oceanology – Bulgarian Academy of Sciences. The R/V “Akademik” is a 55.5 m ship with a beam 9.8 m. There are two labs on the R/V “Akademik” – the sonar lab and the core lab. We used two echo sounders of R/V “Akademik”. Echo sounders are SIMRAD (Norway). They are working at frequency 12 kHz и 38 kHz.

Coring

The area of cruise was the west part of the Black Sea (Fig. 1). In order to sample the coastal dunes we would have to core them. In order to taking samples for dating, isotope analysis and pollen sampling, we would have to core the deep water cores. On board of R/V “Akademik” we used 12 cm gravity coring device and grapple device. The gravity coring device had a 280 kg head on the end of a 4-meter metal tube, 12 cm in diameter. At the bottom end of the corer there was a core catcher. A clear nylon plastic sleeve was inserted into the tube of the soft sediment and thus it could be recovered once the core had been hoisted on deck. The corer was then hoisted up on the A-frame on the stern and dropped in the water. The main hydraulic winch would control the descent of the coring device until it was about 20 m above the seafloor. The mechanic would then stop the winch and allow the device to free-fall into the seafloor. Once the corer had hit the seafloor and the cable went slack, the hydraulic winch would be reattached and the device would be hoisted on board. Once on deck the top on of the corer was opened and plastic sleeve full of to the core lab in 1-meter sections. Actually, we had a lucky expedition, because without a vibracorer we succeed to penetrate 120 cm into the hardened shelly gravel of the submerged shoreline.

Sampling

There are submerged cliffs, beaches, coastal dunes, and other evidence of shorelines at depths between –70 and –120 m that indicate that the Black Sea surface was somewhere in this depth range prior to the proposed time of the inundation. The flood hypothesis suggests there was a decrease in water level, creating shorelines (now submerged) that can be dated to 8.5 ky BP (Ryan et al., 2003). Because of that the more cores were taken
from the depths of submerged shorelines. In order to core into the shoreline we used the gravity coring device with a 280 kg head. Thanks for this contrivance we were able to penetrate into the coarser sediments. Once the cores were recovered, they were taken the wet lab mid ship. The cores were cut into approximately 1-meter sections on the fantail immediately after recovery and brought to the wet lab. The sections were then cut open and observed. Nearly all the cores were sampled every 10 cm for isotope analyses and pollen. Prof. William Ryan and team would sample for mollusks using sieves for isotope analyses and 14C dating. During the expedition we took 10 samples for 14C dating from Core Akademik 11–17. The first sample is from Unit 1 – cocolithic ooze and it was material of first appearance of *Emiliana huxley*. The next two samples were from Unit 2 – sapropel dark green grey – finely laminated at 1 mm. The next sample will show the age of beginning of protosapropel. We decided that it is more important to determine the different periods in the history of red-brown clay and, because of that, we were taken six 14C data from Unit 3. The last core of the expedition was Core Akademik 11–19. This was our successful attempt to penetrate the submerged coastal dunes. The core was remarkable with a few special features. The first one is that we found a wood in 80 cm of core and we gave it for 14C dating. The second one is that the appearance of first *Cardium* was found just at 43 cm, at the boundary between Old Black Sea and Neoeuxinian sediments and we gave it for 14C dating too. *Cardium* is mollusk genus that lives only in salty water. At 42 cm we found mineral sand, one *Dreissena* at contact and no more after. The last *Dreissena* shells represent the first marine colonizers of the seabed when the shoreline was submerged. From 43 cm to 36 cm the sediments were represented mostly by clay. From 50 cm to 51 cm we have whole *Dreissena*, not polished and at 58 cm we found articulated *Dreissena*.

**Conclusions**

The submerged shoreline where we cored consisted of shelly gravel. Leading us to believe that once Black Sea had a water level above these shorelines, which allowed the mollusks to thrive. Then there was a drawdown leaving these mollusks exposed. Their shells were then weathered forming the shelly gravel observed in the core. Second one is that a series of reddish-brown clay layers were deposited at deep water cores. The occurrence of the red layers may be linked to high latitude climate variations.

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**References**
