NEW EVIDENCE FROM THE NORTHWESTERN SHELF FOR HOLOCENE MARINE TRANSGRESSION OF NORTHWESTERN BLACK SEA

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Key-words: sea level, peat, radiocarbon age, delta, foraminifera, palynology, ostracoda

Objective

For two decades, the timing and rate of Holocene marine transgression and the level of the Black Sea prior to the transgression has been the focus of many geological, paleoecological, and archaeological studies. The potential importance of confirming or rejecting the catastrophic flood hypothesis by refining the chronology of the marine transgression and determining the water level of the early Ilolocene Black Sea (Neoeuxinian) lake is the aim of many ongoing Black Sea paleoecological studies. In a new study, we undertook to review a vast array of previous geological and paleoecological studies, including the original sites of Ryan et al. (1997) which were used to hypothesize a catastrophic Holocene flood, and we have obtained new data on the onset and rate of the early Holocene marine transgression using multidisciplinary studies of 19 cores from different parts of the Black Sea.

Methods

We have applied, as much as possible, uniform methods of seismostratigraphic correlation, micropaleoecological, and palynological methods for re-examining selected reference cores used by Nicholas et al. (2011) to hypothesize a "prompt" Holocene flooding of the Black Sea shelves and to correlate our sites with the Ryan et al. cores. In addition, we focused on obtaining new palynological and microfossil data at three sites on the inner Ukrainian shelf (Fig. 1, 2). Core 342, located on the edge of the Dniester paleovalley on the NW shelf landward of the Ryan et al. sites, is particularly important because sieving methods and paleobotanical methods of inspection provided wood and leaf material from several peat and muddy peat beds, each up to -10 cm thick, inter-layered in a coastal succession with mud, clay, and shell coquina. AMS ages for wood fragments and sedge leaves in the peat layers provide critical new data that are free from marine reservoir effects and can be used for calibrating and "re-tuning" of the previously published shell and bulk detrital peat ages reported by Nicholas et al. (2011). The accuracy of the peat ages is further validated by palynostratigraphic data which is also independent of the marine reservoir and "old carbon" problems known for Black Sea carbonate samples. Furthermore, we use $o^{13}C$ values of the separated plant materials to confirm freshwater and brackish water origins of the dated plant materials and associated ostracode microfossils. All our results are reported as conventional (uncalibrated) radiocarbon ages in order to make the best use of the vast database for Ukrainian and Russian samples assembled for the Black Sea since 1963.

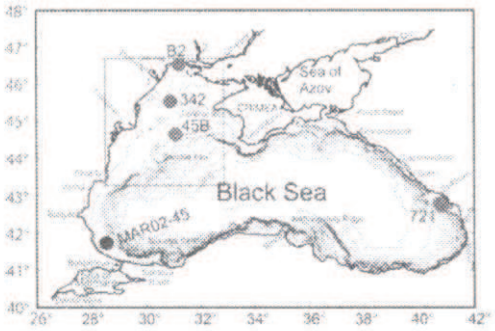

Figure 1. Map of the Black Sea and adjacent regions, showing the extent of the shelf areas, the connection to Marmara and Aegean seas via Bosphorus and Dardanelles Straits, and locations of key reference cores with 14C ages. Red circles mark location of cores described in this paper; blue circle is core of Hiscott et al. (2007, 2010). 1- Dniestrovian liman, 2-Berezan liman..

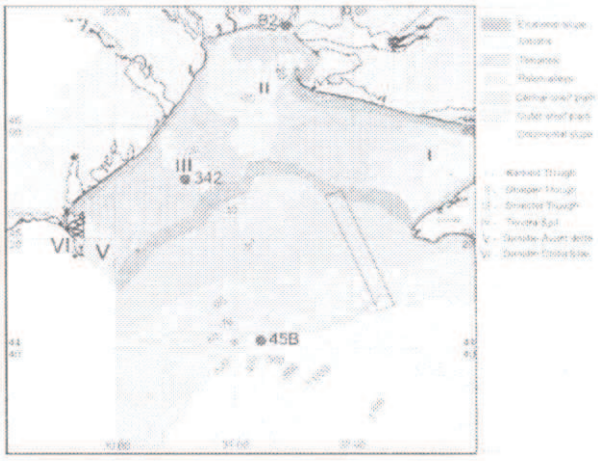

Figure 2. Northwest Black Sea study area showing present bathymetry (in m bsl), paleovalleys I – III, locations of cores in present study, shelf section (in rectangle) studied by Ryan et al. (1997), and other important geomorphological features I-VI, listed below.

Results

Our multidisciplinary study of geological material recovered from eastern, northern, and western shelf areas of the Black Sea further refmes the chronology of the marine transgression established fiom a wood sample by Soulet et al. (2011) and shows that many early Holocene shell ages are up to several hundred years too old. We also show that "bulk'[1] peat including detrital sediment of unknown source is decades too old. Our microfossil and palynological data clarifies conflicting interpretations of the water level and salinity of the Neoeuxinian lake prior to the initial Mediterranean inflow (IMI) and the transgression of Mediterranean water in the Holocene, and our refined chronology allows more accurate calculation of the rate of the transgression. We find the following. (1) The level of the Late Neoeuxinan lake prior to the early Holocene Mediterranean transgression stood around -40 m bsl but not -100 m or more as suggested by advocates of catastrophic/rapid/prominent flooding of the Black Sea by Mediterranean water. (2) At all times, the Neoeuxinan lake was brackish with a salinity not less than 7 psu. (3) By 8.9 ka BP. the Black Sea shelf was already submerged by the Mediterranean transgression, as was previously established by Bradley et al. (2012). The increase in salinity took place over 3600 years, with the rate of marine water incursion being estimated in the order of 0.05 cm to 1.7 cm.a"[1]. (4) The combined data set of sedimentological characteristics and microfossil data establish that the Holocene marine transgression was of a gradual, progressive nature in the early Holocene.

Acknowledgements

This paper is a contribution to IGCP 521-INQUA 0501 projects as well as to the Russian-Ukrainian project No. $28/428-2009 "The Northwestern Black Sea Region and Global Climate Change: Environmental evolution during the last 20 ka and forecast for the 21st century" sponsored by the State Fund for Fundamental Research, Ukraine, and EU FR6 HERMES Project, contract GOCE-CT-2005- 511234. Funding support for Petra Mudie from National Science and Engineering Research Council Discovery Grant is gratefully acknowledged. We sincerely thank "Prichernomor GRGP" for use of their coring material as well as archive data for our study

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