

Problemata et disputationes

The Pleistocene-Holocene boundary in the Black Sea Shelf sediments

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Владимир Шопов — Плейстоцен-голоценовая граница в черноморских шельфовых осадках. Принято считать, что граница между плейстоценовой и голоценовой эпохами соответствует климатическому событию — сокращению ареалов распространения вюрмского континентального ледника. Это событие было стандартизовано в разрезах озерных глин в Швеции. Его приблизительный возраст — 10 000 лет. Хроностратиграфия более древних систем основана на данных по морским разрезам. В четвертичных черноморских отложениях граница между плейстоценом и голоценом не стандартизована и соответствующее климатическое событие не отмечено. Радиоуглеродные данные, полученные по болгарским четвертичным шельфовым отложениям, показывают, что эта граница проходит в интервале между 11 000—9 000 лет. Автор полагает, что голоценовая эпоха в Черноморской области началась около 9 000 лет тому назад и что она совпадает с проникновением соленых и теплых средиземноморских вод. Разрез, в котором нижняя граница голоцена может быть стандартизована — это скважина МС-26 в Несебромском заливе.

Abstract. The boundary between the Pleistocene and Holocene epoch has been referred to the beginning of a climatic event — the first retreat of the Würm continental ice-sheet which was standardized in the sections of varve clays in Sweden and dated ca. 10 000 yrs. B. P. The chronostratigraphy of the older systems is based on data from marine sections. For the Quaternary Black Sea sediments such a climatic event has not been proposed and correspondingly the Pleistocene-Holocene boundary has not been standardized. According to the radiocarbon dates obtained from the Bulgarian Quaternary Shelf sediments such a boundary should be passed within an interval of ca. 11 000-9 000 yrs. B. P. That is why I suggest the penetration of warm and saline Mediterranean water, which shows the beginning of the Holocene epoch in the Black Sea region, to be dated at ca. 9 000 yrs. B. P. and standardized in the section of Black Sea Quaternary Shelf sediments from Borehole MC-26 in Nessebar Bay.

Discussion

The Holocene should be considered as a separate series within the Quaternary System despite of its biostratigraphic and climatic proximity to the last interval of the Pleistocene and the very short duration of the Holocene Epoch. This follows from the consideration that the Holocene Epoch represent the geological present and even because of this fact it should be opposed to the geological past; it was during Holocene that man become an independent geological factor and had powerful influence on the plant and animal world and the landscape.

The boundary between the Pleistocene and Holocene epochs has been referred (8th INQUA Congress in Paris, 1969) to the beginning of a climatic event — the first retreat of the Würm continental ice-sheet from its frontal moraines in Northern Europe.

This event which corresponds to an age of 10 000 yrs. B. P. was standardized in the section of varve clays in Sweden (H a r l a n d et al., 1982). Most of the stratigraphers (particularly the phytostratigraphers) dealing with Quaternary deposits in Northern Europe, as well as in Bulgaria (B o z i l o v a, 1982) stick to this boundary.

The chronostratigraphy of the older systems is based on data from marine sections. For the Quaternary marine sediments such a climatic event has not been proposed and correspondingly the Pleistocene-Holocene boundary has not been standardized. This boundary for the marine sediments from the Black Sea is connected with a climatic event which was a consequence of the one mentioned above. That was the penetration of warm and saline Mediterranean water into the Black Sea as a result of the global transgression of the World Ocean (known in the Mediterranean Basin as Grimaldian) caused by the melting of the Würm ice-sheet. Most probably the establishment of a H₂S layer in the deep part of the sea is due to this event dated by D e g e n s, R o s s (1972) ca. 7 000 yrs. B. P.

According to the radiocarbon dates listed by Д и м и т р о в (1982), the youngest age determined for the shell accumulations, belonging to the Upper Novoeuxinian Regional Substage (Upper Pleistocene Subseries) and deposited under conditions of the prevailing Caspian water in the outer part of the Bulgarian shelf, is ca. 11 000 yrs. B. P. The lower part of the Holocene Series (respectively the Drevnochernomorian Regional Substage) has been dated by the same author on the basis of eurihaline Mediterranean molluscs: *Cardium edule* L., *Mytilus galloprovincialis* L m k. etc. as ca. 9 000 yrs. B. P.

The example given above, concerning the radiocarbon dating of stage boundaries in the Quaternary sediments from the Bulgarian Black Sea Shelf, emphasizes one of the basic characteristics of regional stages in general and more particularly of the Quaternary Black Sea stages — they lack (and they could not have) global isochrone boundaries. The investigation of redeposited molluscan fauna in the Quaternary Black Sea deep-water sediments (Ш о н о в, 1984) showed that the chronostratigraphical boundary between the Pleistocene and Holocene series according to biostatigraphic data passes inside the uppermost parts of the deep-sea facies of the Upper Novoeuxinian Regional Substage. Similar data have been presented by the authors investigating diatom sequences (Ш и м к у с и др., 1973).

The data presented suggest two possible solutions concerning the Pleistocene-Holocene boundary. It may well be that the difference in the ages is due to the washout between the sediments of the two regional stages, the Novoeuxinian and the Chernomorian, recorded by all investigators of the Bulgarian Shelf. If so, the international agreement of INQUA for the boundary between the two series in the continental deposits falls within the hiatus of 11 000 to 9 000 yrs. B. P.

The situation for the marine sediments is somewhat different. The age difference between the two events — the standardized one in the continental deposits of Northern Europe (10 000 yrs. B. P.) and the established one for the marine sediments of the Bulgarian Shelf (9 000 yrs. B. P.) should not rise a confusion. It is logical to presume that time was needed for the water accumulated in the ice-sheets to melt and reach the World Ocean, the Mediterranean and finally the Black Sea which was a semi-isolated intercontinental basin.

That is why I propose that the penetration of warm and saline Mediterranean water into the Black Sea Basin (i. e. the beginning of the Holocene Epoch in that area) is to be dated at ca. 9 000 yrs. B. P. and standardized in the sediments of the Lower (Drevnochernomorian) Substage of the Chernomorian Regional Stage. A section suitable for such a procedure is Borehole MC-26 from the Nesebar bay in the South Bulgarian Black Sea shelf (Ш о н о в, 1983) where the sediments of the Drevnochernomorian Substage, well characterized by the first Mediterranean mollusc immigrants in the Black Sea — *Abra ovata* (P h i l.), *Mytilaster lineatus* (G m. in L.), *Hydrobia*

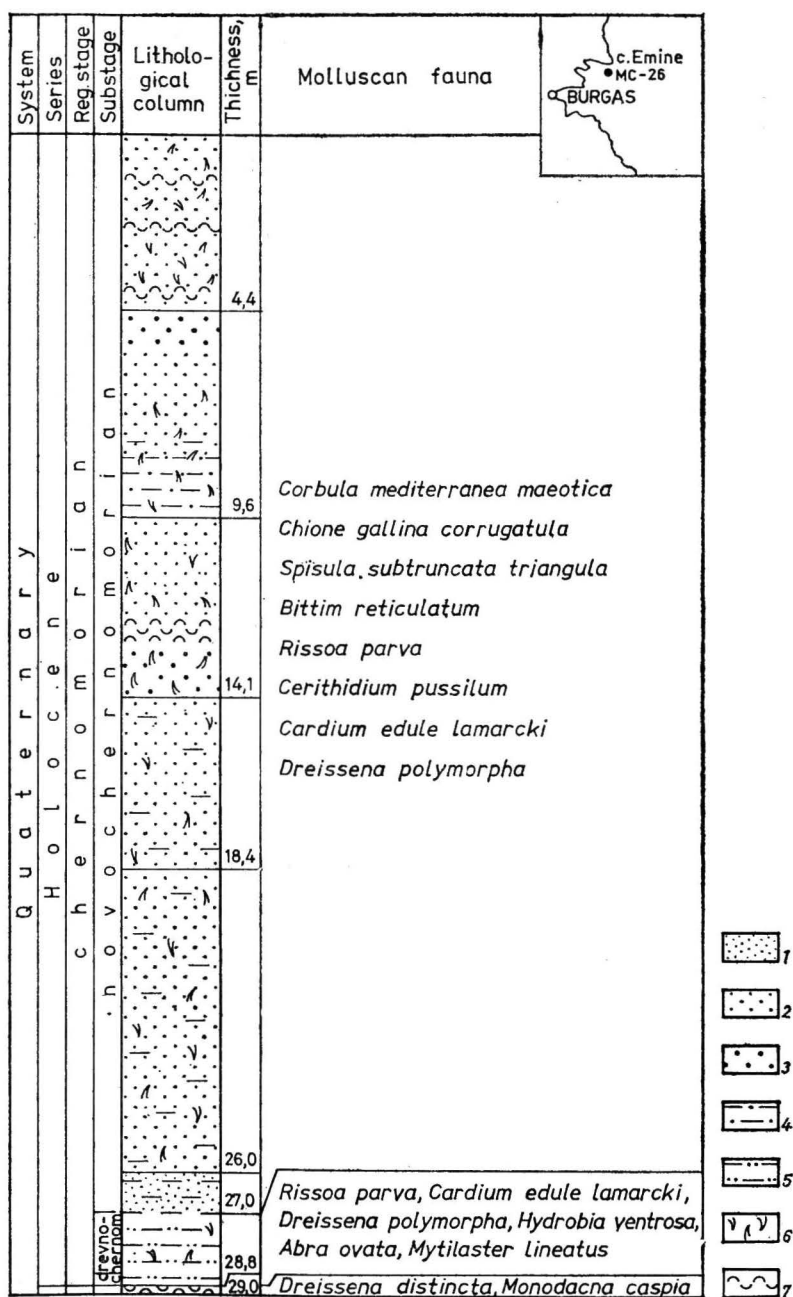


Fig. 1. Section of MC-26 Borehole

1 — fine-grained sand; 2 — medium-grained sand; 3 — coarse-grained sand; 4 — clayey sand to aleurite; 5 — aleurite mud; 6 — carbonate biotritus; 7 — shell accumulation

ventrosa (M t g.) and by the molluscan species mentioned above, overlies without a wash-out the sediments of the Upper Novoeuxinian Regional Substage also rich in molluscan fauna.

The MC-26 Borehole MC-26 (Fig. 1) reaches a depth of 18,00 m below the sea floor and is located in the Southeastern part of the Cocketrise bank in the Nessebar Bay. That bank is the largest sandy accumulation in the Southbulgarian shelf.

Description of Borehole MC-26 section

Holocene Series

Chernomorian Regional Stage (0,00-28,80 m)

Upper (Novochernomorian) Substage (0,00-27,00 m)

0,00-4,40 m — Packet of fine-grained yellowish-grey sand, without any clay cement, abundant in biotritus reaching 50% of the total composition. Lithified accumulations are registered at 0,96-1,33 cm; 2,27-2,61 cm and at 3,80-4,00 cm.

4,40-9,60 m — Packet of similar sand; in the upper part of the interval become more coarse-grained but downwards grow up to be more clayey and dark.

9,60-14,10 m — Packet of medium-grained clayey sand. In the upper part of the interval it is whitish-brown but downwards becomes lighter where a sharp prevalence of the carbonate biotritus over the terrigenous component is observed. A fractured indeterminate mammal bone has been found in the middle part of the interval.

14,10-18,40 m — Packet of medium-grained whitish-grey sand, well washed and sorted without any clayey cement. A predominance of the terrigenous component (quartz) over the carbonate biotritus is marked.

18,40-26,00 m — Packet of middle-grained polymictic dark-grey sand, comparatively well washed with some clayey cement. A certain enrichment in mafic minerals is noted.

From 16 samples of these 5 packets were found specimens of the following characteristic molluscan species: *Corbula mediterranea maeotica* (Mil.), *Chione gallina corrugatula* (Sie m.), *Spisula subtruncata triangula* (Ren.), *Bittium reticulatum* (Costa), *Cerithidium pusillum* (Jeffr.), *Rissoa parva* (Costa), *Dreissena polymorpha* (Pall.) et al.

Lower (Drevnochernomorian) Substage (27,00-28,80 m)

26,00-28,80 m — Packet of light-blue (clayey) mud; strongly sandy in the upper part of the interval becoming aleurolitic downwards.

The molluscan fauna found in this packet is represented by the following species: *Rissoa parva* (Costa), *Cardium edule lamarcki* Reeve, *Dreissena polymorpha* (Pall.), *Hydrobia ventrosa* (M t g.), *Abra ovata* (Phil.), *Mytilaster lineatus* (G m. in l.) et al.

Pleistocene Series

Upper Pleistocene Subseries

Novoeuxinian Regional Stage (28,80-29,00 m)

Upper Substage (28,80-29,00 m)

28,80-29,00 m — Shell accumulation of whole and broken molluscan shells with a little clayey cement.

The molluscan species are represented by: *Dreissena rostriformis distincta* Andrus., *Dreissena polymorpha* (Pall.), *Monodacna caspia caspia* (Eichw.), *Micromelania caspia lincta* Mil. et al.

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