



HOLOCENE ASSEMBLAGES OF MOLLUSCS IN THE NEAR-SHORE ZONE OF SOUTHERN BALTIC

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ABSTRACT: Silts from the Polish Baltic Coast were analysed with respect to their mollusc assemblages and radiocarbon-dated. Four faunae were distinguished: fauna with *Vertigo genesii* Gredl. (Young Dryas or beginning of Preboreal Phase); fauna with *Bithynia tentaculata* (L.) (Boreal Phase); fauna with *Valvata piscinalis* (O. F. Müll.) (Boreal Phase); fauna with *Cardium glaucum* Brug. (Atlantic Phase).

KEY WORDS: molluscs, Holocene, Baltic

INTRODUCTION

Mollusc-bearing deposits containing both fresh-water and brackish-marine species have been reported from a few localities in the Polish Coastal Zone of the Southern Baltic. They indicate palaeogeographical and palaeohydrological conditions that have been controlling the evolution of the sea during the last twelve thousand years. The initial stage, corresponding with the Glacial Baltic Ice Sea, is followed by a succession of phases falling on the Holocene, defined by molluscan taxa: *Yoldia*-*Ancylus*-*Littorina*-*Limnea* [*Lymnaea*]-*Mya*. During the climatic optimum the marine transgression reached the present Polish coastal line and even extended it, inundating depressions previously filled with peat or/and lacustrine organic-calcareous deposits, rich in shells of freshwater snails and bivalves. Sequences of mollusc assemblages, diatoms and ostracods related to fluctuations of the sea level have been found in profiles of boreholes situated in the landward part of the coast

(BRODNIOWICZ & ROSA 1967, WOJCIECHOWSKI 1995). The occurrence of the fauna has been also mentioned from the seaward part of the coast (KRZYMIŃSKA 1990).

Holocene deposits forming the bed of the near-shore littoral zone are still being eroded and removed by waves, mainly during the winter storms. Many fragments of silts of different size, up to 30 cm in diameter, are found on beaches along the middle part of the Polish Coast. They are accompanied by pebbles of crystalline and sedimentary rocks washed out of the removed till. Silts are grey or dark grey. Many contain intercalations of peat, plant debris and fragments of wood, as well as numerous shells of molluscs and ostracods. The fauna of freshwater and brackish-marine snails and bivalves collected from fragments of silt, clay and gyttja on beaches near Łeba was described by SOSZKA (1969). According to his interpretation it provides evidence of a Holocene lake temporarily flooded by a marine transgression.

MOLLUSC ASSEMBLAGES

Numerous fragments of mollusc-bearing silts have been collected by the author on beaches between Ustka and Łeba, mainly along the Łeba Barrier

(Fig. 1), as well as in Mielno. All of them were washed so as to sort out mollusc shells and shell fragments that could be determined. Four mollusc assemblages

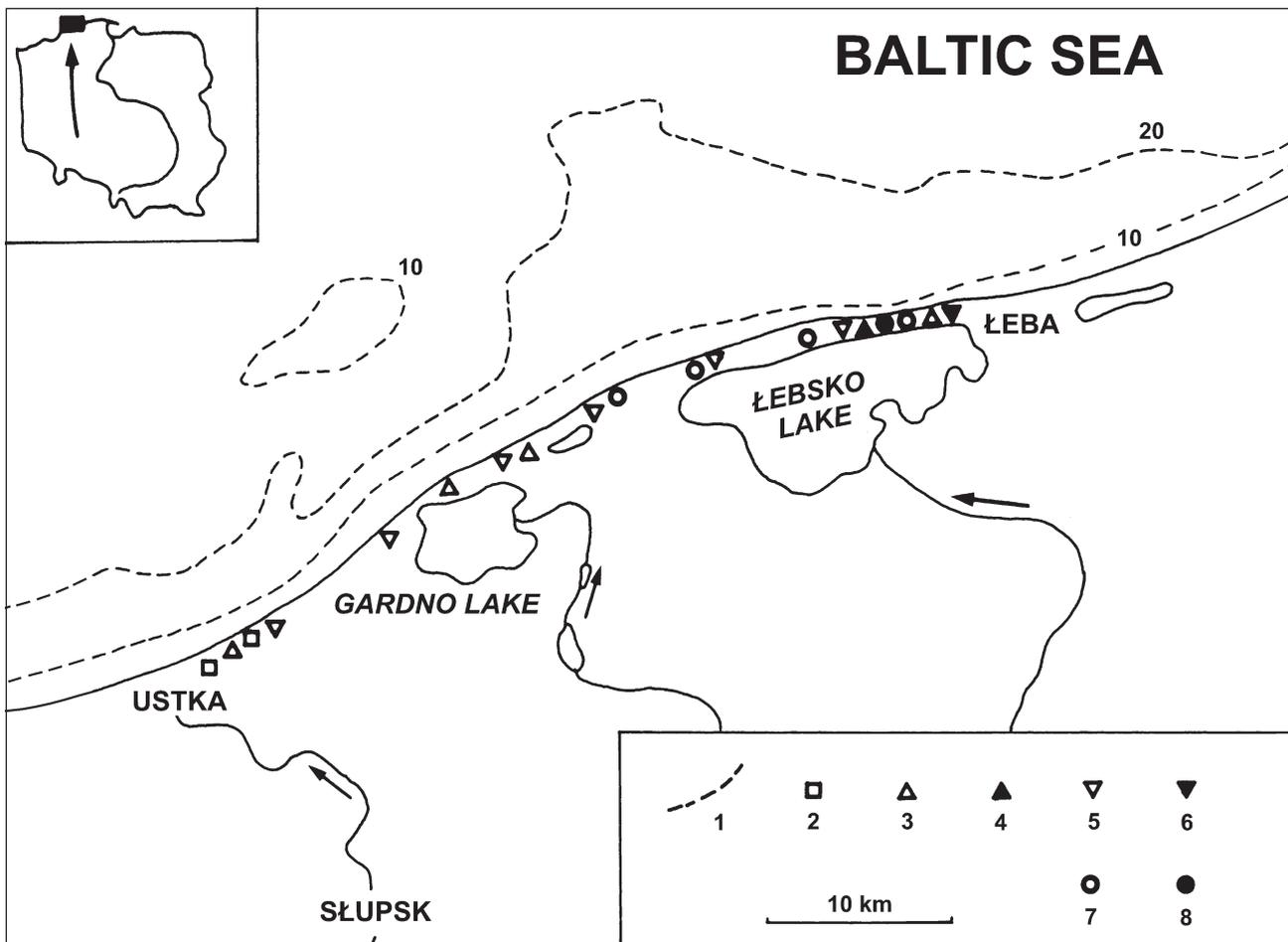


Fig.1. Distribution of samples collected in the coastal zone between Łeba and Ustka. 1 – isobates (10 m, 20 m), 2 – assemblages with *Vertigo genesii*, 3 – assemblages with *Bithynia tentaculata*, 4 – radiocarbon-dated assemblage with *Bithynia tentaculata*, 5 – assemblages with *Valvata piscinalis*, 6 – radiocarbon-dated assemblage with *Valvata piscinalis*, 7 – assemblages with *Cardium glaucum*, 8 – radiocarbon-dated assemblage with *Cardium glaucum*

were distinguished in the analysed material. Three of them, derived from fragments of silts containing wood and plant remains, were dated with the radiocarbon method in the ^{14}C Laboratory of the Silesian Technical University in Gliwice (grant 6 PO4E 026 10, State Committee for Scientific Research). The remaining one contains species typical of sediments deposited at the Pleistocene/Holocene boundary. The mentioned mollusc assemblages are related to particular phases of the Baltic Sea evolution.

I. The fauna with *Vertigo genesii* (Gredler) occurs in fragments of grey and yellow-grey silts collected on beaches near Ustka and Orzechowo. *V. genesii* dominates and is accompanied by *Columella columella* (Martens), *Vallonia pulchella* (O. F. Müller), *Euconulus fulvus* (O. F. Müller), *Lymnaea peregra* (O. F. Müller), *L. truncatula* (O. F. Müller), *Sphaerium corneum* (Linnaeus), *Pisidium obtusale lapponicum* Clessin and slug shells. Similar mollusc assemblages were reported from Late Vistulian deposits in several localities in the Podhale Basin, Carpathian Foothills and Małopolska

Upland (ALEXANDROWICZ & CHMIELOWIEC 1992, ALEXANDROWICZ & ALEXANDROWICZ 1995, ALEXANDROWICZ 1997) as well as from an outcrop near Ustka (ALEXANDROWICZ et al. 1989, BRODNIOWICZ 1979). It is a fauna typical of swamps, marshes and small water bodies, associated with cold climate and woodless environment of the tundra or park-tundra type. The described assemblage indicates the age of grey silts, deposited during the Young Days or at the beginning of the Preboreal Phase of the Holocene.

II. The fauna with *Bithynia tentaculata* (Linnaeus) was found in many fragments of grey and dark grey silts with plant debris on beaches near Łeba and Orzechowo, as well as in a few fragments collected on the Gardno Barrier. Numerous opercula of *Bithynia* occur in all the samples. The following species of aquatic molluscs are the components of the assemblage: *Bithynia tentaculata*, *Valvata piscinalis* (O. F. Müller), *Lymnaea peregra*, *L. occulta* (Jackiewicz), *L. truncatula*, *Armiger crista* (Linnaeus), *Gyraulus laevis* (Alder), *Sphaerium corneum* (Linnaeus), *Pisidium nitidum*

Jenyns, *P. milium* Held, *P. obtusale* (Lamarck). Subfossil assemblages of aquatic molluscs dominated by *B. tentaculata* (shells and opercula) are known from post-glacial lacustrine sediments. They occur in several localities in Eoholocene lacustrine chalk and have been reported both from Northern and Southern Poland (ALEXANDROWICZ 1988, 1989, ALEXANDROWICZ & NOWACZYK 1982, ALEXANDROWICZ & TCHÓRZEWSKA 1981, DEMBIŃSKA 1924, KOWALKOWSKI & BERGER 1966). One fragment of silt, abounding in opercula of *Bithynia*, found on the beach near Łeba (in Rąbka) was radiocarbon-dated to 8,820±120 years BP (Gd-7946) which corresponds with the Boreal Phase of the Holocene. Pebbles of gyttja and clays with opercula of *Bithynia* were reported from the Łeba Barrier by SOSZKA (1969).

III. The fauna with *Valvata piscinalis* occurs in several fragments of grey and yellow-grey silts on beaches between Łeba, Rogi and Ustka and sporadically in Mielno. It is composed of numerous shells of *Valvata piscinalis*, accompanied by *V. piscinalis antiqua* Sowerby, *V. cristata* O. F. Müller, *Bithynia tentaculata* (shells and opercula), *Lymnaea peregra*, *L. occulta*, *Ar-*

miger crista, *Gyraulus laevis*, *Sphaerium corneum*, *Pisidium nitidum*, *P. milium*, *P. henslowanum*. According to the results of radiocarbon dating of a silt containing this assemblage (8,620±110 years BP) it represents the Boreal Phase of the Holocene. Pebbles of silts with *Valvata piscinalis antiqua* were also found by SOSZKA (1969) on beaches near Łeba.

IV. The fauna with *Cardium glaucum* Bruguière was found in numerous fragments of grey and dark grey calcareous silts collected on beaches between Łeba, Rąbka and Rogi. The silts abound in specimens of *Cardium* which form intercalations enriched in shell detritus. Shells and shell fragments of *Macoma baltica* (Linnaeus), *Mytilus edulis* Linnaeus, *Hydrobia ulvae* (Pennant) and *H. ventrosa* (Montagu) are accessory components of this assemblage. A fragment of silt with plant debris and pieces of wood, containing the mentioned type of fauna, collected near Łeba-Rąbka, was dated to 6,920±140 years BP (Gd-11314). This indicates the Atlantic Phase of the Holocene (the postglacial climatic optimum). Numerous fragments of mollusc-bearing deposits rich in shells of *Cardium* were also mentioned by SOSZKA (1969) from the Łeba Barrier.

INTERPRETATION

The described assemblages of molluscs can be related to particular stages of the Baltic Sea development, distinguished and described by several authors (JANKE & KLIEWE 1982, ROSA 1987, TOMCZAK 1995). These stages have never been properly defined as geochronological units, but they are currently used in stratigraphical and palaeogeographical interpretations (HYVÄRINEN 1988). Changes of the water level and the range of the main water basin (the ancient Baltic) along the Polish Coastal Zone are illustrated in the "Geological Atlas of the Southern Baltic" (MOJSKI 1995).

The fauna with *Vertigo genesii* corresponds either with the Baltic Ice lake or with the Yoldia Sea. Deposits containing this assemblage were accumulated in swamps and marshes spreading over the southern border of the ancient water basin. Assemblages with *Valvata piscinalis* and with *Bithynia tentaculata* dated to the Boreal Phase of the Holocene (8,940–8,510 years BP) can be compared with the fauna of the so called "Ancylus Lake" falling to the same time span. Sediments containing the mentioned assemblages had been deposited before the marine transgression in the near-shore zone of this large lake or, more probably, in water bodies existing in their landward zone. Eoholocene mollusc-bearing deposits with *Bithynia* and *Valvata* have been reported from several localities situated close to the coast, as sediments accumulated in melt-lakes or in river valleys (ALEXANDROWICZ

1988, 1989, 1995, ALEXANDROWICZ et al. 1989). *Ancylus fluviatilis* O. F. Müller, pointed out as the standard taxon of the mentioned phase (the Ancylus Lake Phase), is a typical moving-water snail connected only with sediments of the littoral zone or found in supralittoral shell accumulations (thanatocenoses). Although it is repeatedly used in several publications, it should be replaced by another fresh-water index species, noted in numerous profiles and in different sediments – for example by *Bithynia tentaculata*. In the Polish part of the Southern Baltic no specimens of *Ancylus fluviatilis* have been found till now in deposits of Boreal age.

The assemblage with *Cardium glaucum* dated to 6,920 years BP indicates the marine transgression spreading gradually during the climatic optimum of the Holocene and reaching finally the coastal zone of the Southern Baltic (BERGLUND 1971, JANKE & KLIEWE 1982, MOJSKI 1995, ROSA 1987, TOMCZAK 1995). The index species *Littorina litorea* (Linnaeus), characterising the so called "Littorina Sea", was noted mainly along the eastern and northern coastal zone of the Baltic (HYVÄRINEN 1988). In its southern part it was found only occasionally, in Poland only as a single apex described from a bore hole in Czolpino (BROD-NIEWICZ & ROSA 1967). On the other hand, in marine deposits shells of *Cardium glaucum* occur as the main component of the fauna described from several localities. It seems that the latter taxon should be used as

an index species defining both the marine transgression and the deposits accumulated during the Mesozoic and Neoholocene.

The so called "Limnea Sea", corresponding with the Subboreal Phase and a part of Subatlantic Phase, was distinguished based on the occurrence of a freshwater snail *Lymnaea ovata* Draparnaud *f. baltica* (Linnaeus) or *L. peregra* O. F. Müller *f. baltica* (Linnaeus). Specimens of this species have been noted in littoral shell accumulations (HYVÄRINEN et al. 1988, KESSEL

1965). It is associated with water of low salinity and is not convenient as an index species of brackish-marine mollusc assemblages, composed mainly of *Cardium glaucum*, *Macoma baltica*, *Mytilus edulis* and *Hydrobia ventrosa*. Additionally, the currently used term "Limnea" needs correction, since the valid generic name is *Lymnaea*. The Mya Phase distinguished by HESSLAND (1945) and discussed by KESSEL (1965) as the youngest one seems to be correctly defined.

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received: August 14th, 1998

accepted: September 18th, 1998