Turkish Journal of Earth Sciences (Turkish J. Earth Sci.), Vol. 18, 2009, pp. 239–297. *Copyright ©TÜBİTAK*
doi:10.3906/yer-0710-2 First published online 15 December 2008

Benthic Faunal Assemblages of the Holocene Sediments from the Southwest Black Sea Shelf

DEMET ONGAN[1], OYA ALGAN[1], SEVİNÇ KAPAN-YEŞİLYURT[2], ATİKE NAZİK[3], MUSTAFA ERGİN[4] & CHRIST EASTOE[5]

[1] İstanbul University, Institute of Marine Sciences and Management, Vefa, TR–34470 İstanbul, Turkey
(E-mail: algan@istanbul.edu.tr)

[2] Çanakkale Onsekiz Mart University, Faculty of Engineering and Architecture,
Department of Geology Engineering, Terzioğlu Kampusu, TR–17020 Çanakkale, Turkey

[3] Çukurova University, Faculty of Enginnering and Architecture,
Department of Geological Engineering, Balcalı, TR–01330 Adana, Turkey

[4] Ankara University, Faculty of Engineering, Department of Geological Engineering, Tandoğan, TR–06100 Ankara, Turkey

[5] University of Arizona, Department of Geosciences, Isotope Geochemistry Laboratory, Tucson, AZ 85721, USA

received 07 August 2007; revised typescript received 31 December 2007; accepted 22 May 2008

Abstract: Benthic faunal content (benthic foraminifera, mollusca and ostracoda) of sediment cores from the SW Black Sea shelf were examined. Based on the vertical distribution of abundance and diversity of the benthic fauna, three benthic assemblages were distinguished. These assemblages are BF1, BF2 and BF3, and reflect the changes in bottom water from the termination of the Neoeuxinian period to present. BF1 displays high abundance and diversity in the surroundings of the Bosporus channel, diminishing in the shelf sediments further away from the channel. In the Mid-Shelf and Outer Shelf, it displays low abundance and low diversity. BF1 which started to be deposited at about 6 ky BP reflects the source effect of the saline Mediterranean lower layer, diminishing in strength toward more distal areas. In the Outer Shelf, changing foraminiferal faunal content may suggest that relatively low salinity conditions in the bottom water were established after ~4 ky BP. BF2 consists of a mixed fauna (brackish and euryhaline Mediterranean species), suggesting transitional conditions with intrusion of Mediterranean water earlier than ~8 ky BP. BF3 corresponds to the Neoeuxinian lake phase of the Black Sea.

Key Words: Black Sea, benthic fauna, Holocene, Mediterranean, shelf sediments

Karadeniz Güneybatı Şelfinin Holosen Sedimentlerindeki Bentik Fauna Toplulukları

Özet: Bu çalışmada Karadeniz GB şelf alanından alınan sediment karotlarının bentik fauna içerikleri (bentik foraiminifer, mollusc ve ostracod) incelenmiştir. Karotlar boyunca bentik faunanın bolluk ve tür çeşitliliğindeki değişimlerine bağlı olarak 3 farklı bentik topluluk ayırtlanmıştır. Bu topluluklar BF1, BF2 ve BF3 olup, Yeni Öksin dönemin bitişinden günümüze kadar dip suyundaki değişimleri yansıtmaktadır. Kanal-Çevresi'nden alınan karotlarda BF1 yüksek popülasyon ve tür çeşitliliği göstermekte, ancak şelf sedimentlerine doğru her ikisi de azalmaktadır. Orta-Şelf ve Dış-Şelf'te BF1 düşük popülasyon ve fakir bir tür çeşitliliğine sahiptir. Bu topluluk tuzlu Akdeniz alt suyunun Kanal çevresinde baskın olduğunu ve şelfe doğru uzaklaştıkça etkisinin azaldığını yansıtmaktadır ve yaklaşık 6 bin yıl önce çökelmeye başlamıştır. Dış-Şelf'te gözlenen foraminiferal faunadaki değişim, günümüzden yaklaşık 4 bin yıl önce dip suyunun nispeten düşük tuzluluğa doğru değişmesi ile alakalı olabilir. BF2 karışık bir fauna (acısı ve denizel Akdeniz türleri) içermekte ve Akdeniz suyunun yaklaşık 8 bin yıldan daha önceki girişi ile oluşan geçiş koşullarını yansıtmaktadır. BF3 ise Karadeniz'in Yeni Öksin'deki göl safhasına karşılık gelmektedir.

Anahtar Sözcükler: Karadeniz, bentik fauna, Holosen, Akdeniz, şelf sedimentleri

Introduction

The Black Sea is the largest anoxic basin in the world at present and is connected to the Mediterranean Sea by the narrow Bosporus and Dardanelles Straits, linked by the Marmara Sea (Figure 1). It has a permanent two-layered water system with a thin low-salinity surface layer of riverine origin, overlying a relatively high-salinity deep layer of Mediterranean origin. A sharp pycnocline defines the boundary to stable anoxic conditions below shelf depth. At present, there is water exchange with adjacent seas through the Bosporus; however the exchange was complicated in the past during global sea level variations between glacial and interglacial periods, as a result of the confined geographical situation of the passage-way. During the Last Glacial Maximum, when global sea level fell below the level of the sill located at the northern

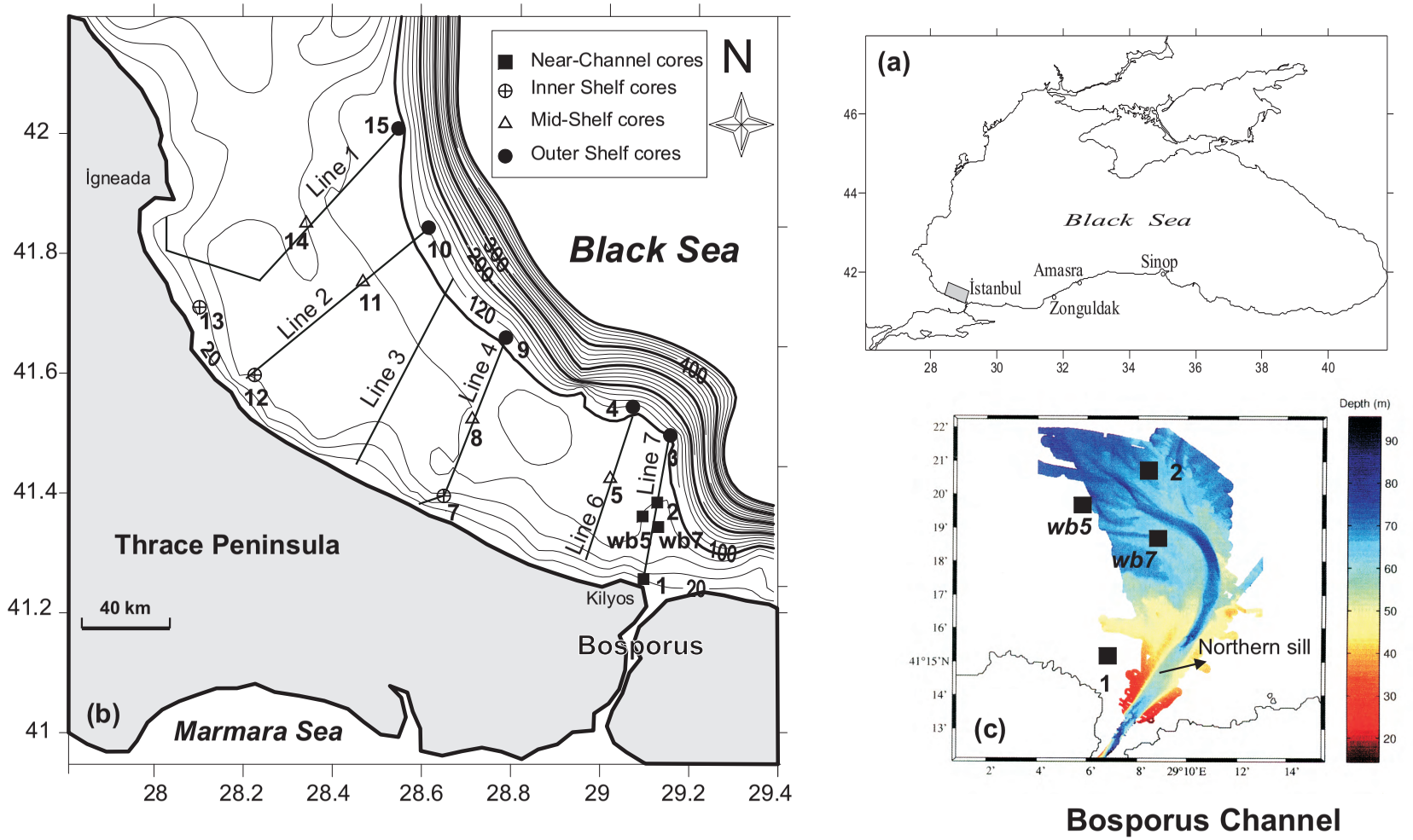

Figure 1. Study area and sampling locations. (a) The Black Sea, grey shaded box denotes the study area. (b) Bathymetric map with locations of the sediment cores. Lines 1 to 7 denote the seismic profiles from Algan *et al.* (2007). (c) Bathymetry of the northern exit of the Bosporus (from Di Irio & Yüce 1999).

approaches of the Bosporus, the Black Sea was isolated from the Mediterranean Sea and became a freshwater lake (Neoeuxinian phase, 22 to 9 ky BP, Fedorov 1971; Ross & Degens 1974; Nevesskaya 1965). During this period, the shelf areas of the Black Sea were exposed to subaerial erosion and excavated by rivers until about 11–9 ky BP (Degens & Ross 1974). Recent studies indicate that the Black Sea received a series of melt water pulses originating from the disintegration of the Scandinavian ice sheet between 18 and 15 ky BP (cal.) (Bahr *et al.* 2005). However the mode and timing of the rise of sea level after that time, in relation to its connection with the Mediterranean Sea through the Marmara Sea via the straits is under debate, and variably described as 'catastrophic' (Ryan *et al.* 1997, 2003; Ryan 2007), 'persistent outflow ' (Aksu *et al.* 2002a) or 'fluctuating' (Fedorov 1978; Chepalyga 1984; Yanko-Hombach 2007) views. An abrupt transgression that originated from Mediterranean waters at about 7.15 or 8.4 ky BP, submerging the low-lying shelf area of the Black Sea, was implied in the 'catastrophic' view by Ryan *et al.* (1997, 2003) and supported by others (Algan *et al.* 2002, 2007; Lericolais *et al.* 2007). A strong and 'persistent outflow' of the Black Sea at about 11–9 ky BP into the Marmara Sea argues against a low-level Black Sea at that time and is shown to be responsible for major deposition of 'organic-rich'-sapropelic sediments in the Marmara and Mediterranean seas (Çağatay *et al.* 2000; Aksu *et al.* 1999, 2002a, b; Hiscott *et al.* 2002). 'Fluctuating' or oscillating sea level within a range of 5 to 20 m between Late Pleistocene–Holocene transgressive and regressive cycles in the Black Sea (Fedorov 1978; Chepalyga 1984; see also references in Yanko-Hombach 2007) is in agreement with the 'persistent outflow' view, with respect to a high sea level of the Black Sea before it became connected to the Marmara Sea.

The study area includes the SW Black Sea shelf area and the northern exit of the Bosporus channel. Faunal composition of the bottom sediments is particularly important for understanding the changing bottom water conditions of the Black Sea in relation to the water exchange. Present-day bottom water conditions of the Black Sea support only about 20–25 % of the zoobenthos of the Mediterranean Sea (Mutlu *et al.* 1993). Quaternary stratigraphy of Black Sea sediments is based on mollusca (Arkhangel'sky & Strakhov 1938; Nevesskaya 1965; Fedorov 1978). Yanko (1990) established a biostratigraphical scheme of the Pleistocene and Holocene by investigating samples from sediment cores and ecological parameters of living benthic foraminifera from shelf and coastal environments of the Black Sea. However, her sampling of the SW shelf was confined to the outer shelf. Micro- (Meriç *et al.* 2001) and macro-palaeontological data from the SW shelf sediments are very few and/or limited to only characteristic bivalve forms (Algan *et al.* 2007). In this study the spatial and temporal distribution of foraminifera in Holocene sediments from the SW shelf, together with other faunal groups (mollusca and ostracoda) are examined. This study aims to determine their response to bottom water changes from lacustrine to marine conditions as well as to understand the changing environmental conditions after the first entrance of Mediterranean waters until the present day.

Study Area

The study area is the SW Black Sea shelf (Figure 1). The SW shelf area is the widest part of the Anatolian sector, with ~25 km width off the Thrace Peninsula. The shelf break occurs at about 110–120 m water depth, marking the outer edge of a flat gently north-dipping continental platform. At the northern exit of the Bosporus, the shelf is cut by an 80–90 m deep channel representing the northward extension of the strait (Figure 1c; Di Iorio & Yüce 1999). Beyond a sill located at a water depth of about 60 m the channel disappears on the outer shelf; however, in line with the channel's course, a deep canyon is located at the shelf break.

The present oceanography of the Black Sea is governed by water exchange through the Bosporus as a two layered flow. The Black Sea receives a large amount of fresh water input from rivers (~350 km^3/y) and precipitation (~300 km^3/y), well in excess of evaporation (350 km^3y), leading to a positive water balance maintaining a low-salinity surface layer (18–20 psu). These conditions lead to an outflow through the Bosporus which is higher than the average inflow of saline (38–39 psu) Mediterranean water that flows northward as an undercurrent into the Black Sea (Ünlüata *et al.* 1990) throughout the year (except when interrupted for short duration by strong winds) (Latif *et al.* 1991). The continuous Mediterranean inflow is greatly confined within the narrow Bosporus channel, which is initially

oriented in a northeast direction, then turning to the northwest (Figure 1c). Spreading of the salty Mediterranean water (36 psu) on the shelf occurs close to the shelf edge at ~100 m, where the water is diluted to 25 psu (Di Iorio & Yüce 1999).

On the SW shelf, an anticlockwise rotating '*Rim current*' flows eastward along the Anatolian coast, separating cyclonic gyres of the basin centre from anticyclonic coastal eddies (Oğuz *et al.* 1992; Sur *et al.* 1994). Annually 2.8 km^3 water and 150,000 tons of sediment are discharged onto the SW shelf from several small rivers draining the Thrace peninsula (Hay 1994; Aksu *et al.* 2002a).

Materials and Methods

A total of 14 sediment cores were collected with a gravity corer in August 1999 on board the *R. V. Arar* of İstanbul University, Institute of Marine Sciences and Management (IU-IMSM) from positions located along high frequency seismic profiles (Figure 1b). Cores WB5 and WB7 were recovered from the northern exit of the Bosporus in June 1996 on board the NATO Research Vessel *Alliance*. Core data are presented in Table 1.

The sediment cores were sampled at 5 to 10 cm intervals, depending on the lithological variations. Wet samples weighing about 20 g were soaked in 10% H_2O_2 for about 24 hours, and then washed on a 0.063 mm sieve. The residue was dried in air and later sieved on 2.0, 1.0, 0.5, 0.25, 0.125 and 0.063 mm sieves. After examining the residue from all the sieves, the great majority of benthic foraminifera were found on the 0.25 mm sieve. Benthic foraminifera within the < 0.25 mm size fraction were too small to identify different species. Hence only specimens from the > 0.25 mm size fraction were identified and counted. Ostracodes were also separated from the samples and identified. Mollusc species were handpicked from the bulk samples, identified and counted. Broken shell fragments were described as spp, and counted separately.

Age determination of selected mollusc samples was carried out by radiocarbon dating at the Isotope Geochemistry Laboratory of Arizona University and Geochrone Laboratory (USA) (Table 2). Articulated mollusc samples, unbroken and clean were selected for age determination, avoiding old and reworked material. A reworked *Dreissena* shell was also dated (17.970 yr BP, Table 2) in order to have an idea of the age of reworked material. In this study, reported dates are given as uncalibrated radiocarbon years BP (yr BP).

Stratigraphy from the Seismic Profiles

According to previously published seismic explorations in the study area, a widespread shelf-crossing erosional surface separating two units was observed (Aksu *et al.*

Table 1. Cores collected from the SW Black Sea shelf.

Core No	Location	Water Depth (m)	Core Length (cm)
1	41°16′20″N / 29° 06′20″E	51	57
2	41°23′10″N / 29°08′00″E	80	80
3	41°16′20″N / 29°06′20″E	102	214
4	41°32′10″N / 29°05′20″E	103	245
5	41°25′50″N / 29°01′05″E	84	65
7	41°24′15″N / 28°38′00″E	61	141
8	41°31′95″N / 28°43′00″E	81	247
9	41°40′00″N / 28°48′00″E	113	212
10	41°50′80″N / 28°37′00″E	124	63
11	41°45′20″N / 28°57′75″E	72	230
12	41°36′75″N / 28°13′30″E	63	246
13	41°43′20″N / 28°06′20″E	54	240
14	41°51′90″N / 28°20′00″E	64	240
15	42°00′40″N / 28°33′50″E	100	80
WB7	41°20′28″N / 29°80′41″E	74	95
WB5	41°22′18″N / 29°54′55″E	79	84

Table 2. Uncalibrated radiocarbon dates obtained from mollusc samples.

Core no	Interval in core (cm)	Conventional ^{14}C age (yr BP)	Material
5	55–60	7280 ± 165	*Mytilus* sp.
WB7	94–95	7550 + 215/-210	*Dreissena* sp.
7	130–141	7900 ± 270	*Dreissena* sp.
10	55–63	11.800 ± 430	*Dreissena* sp.
13	210–213	5930 ± 200	*Dreissena* sp.
3	100–110	2435 ± 130	*Mytilus* sp.
	100–110	17.970+545/-510	*Dreissena* sp.
	110–120	4330 + 125/-120	*Mytilus* sp.

2002a; Algan *et al.* 2007). It extends to the shelf edge at 120 m water depth which was the palaeoshore of the earlier Neoeuxinian Lake phase of the Black Sea. Unit 1 drapes the erosional surface and displays various depositional features (Figure 2a–c). It is represented by a thin drape in the westernmost part of the area, and is widespread across most of the inner and outer shelf with parallel internal configuration (Algan *et al.* 2007). In the eastern part of the study area, close to the Bosporus channel, Unit 1 consists of depositional bodies having wavy morphologies and/or irregular bedforms on Lines 6 and 7 (Figure 2c, d). These distinctive features are found at water depths of 80 to 100 m, grading shoreward to a thin drape, and were interpreted as shallow water depositional features (Algan *et al.* 2007) such as barrier islands/beaches and sediment ridges, sediment waves, and current-generated marine bars (Aksu *et al.* 2002a), formed during a relatively rapid but progressive sea-level rise. Aksu *et al.* (2002a) differentiated Unit 1 into four subunits, representing lowstand, transgressive and highstand system tracts. Unit 2 is represented by seaward-prograding clinoforms at the shelf edge and indicates various lowstands and subsequent sea level rises (Algan *et al.* 2007).

The majority of the sediment cores collected in this study represent the uppermost part of Unit 1. Cores 1, 7, 8, 9, 11, and 12 sample the thin drape of Unit 1, whereas cores 2, 3, 4, and 5 also contain the irregular bedforms in the easternmost section of the study area, below the thin drape. This is most conspicuous in the lower part of cores 2, 3 and 5, by the presence of coarse-grained and/or thick shelly sediments and the hardness of the substratum. Core 10 is retrieved from a water depth of 124 m at the shelf edge where Unit 1 becomes very thin or almost disappears, and could not penetrate farther than 62 cm due to the hardness of the bottom (Figure 2a). It includes the sediments just above the erosional surface that separates units 1 and 2. No seismic information for cores WB5 and WB07 from the Near-Channel area is available.

Results

In the presentation of results four physiographical areas are distinguished based on present-day environmental conditions; Near-Channel, Inner Shelf, Mid-Shelf and Outer Shelf (Figure 1b). Near-Channel cores represent also Inner and Mid-Shelf environments, with respect to their water depths.

I. Near-Channel Cores 1, 2, WB5 and WB7 were collected from the shelf adjacent to the Bosporus Channel, from water depths between 51 and 84 m.

II. Inner Shelf Cores 7, 12 and 13 represent the Inner Shelf area between İğneada and Bosporus, with water depths of 50 to 60 m.

III. Mid-Shelf Cores 5, 14, 11 and 8 were collected from water depths of 60 to 80 m between the Inner and Outer Shelf areas.

IV. Outer Shelf Cores 3, 4, 15, 9 and 10 were collected from 100 to 120 m water depth.

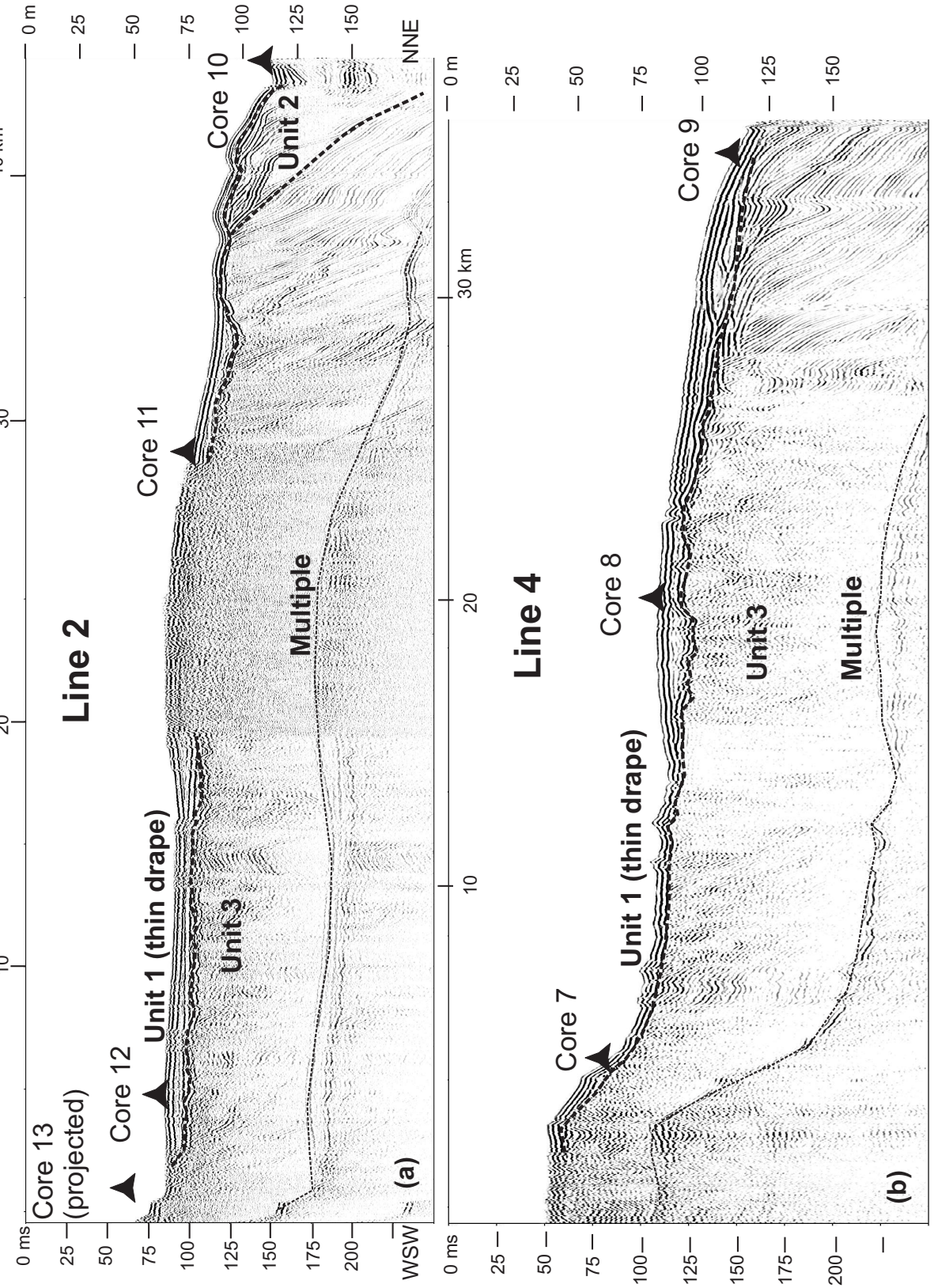

Figure 2. Seismic reflection profiles across the SW Black Sea shelf with position of the sediment cores (modified from Algan *et al.* 2007; see Figure 1b for locations).

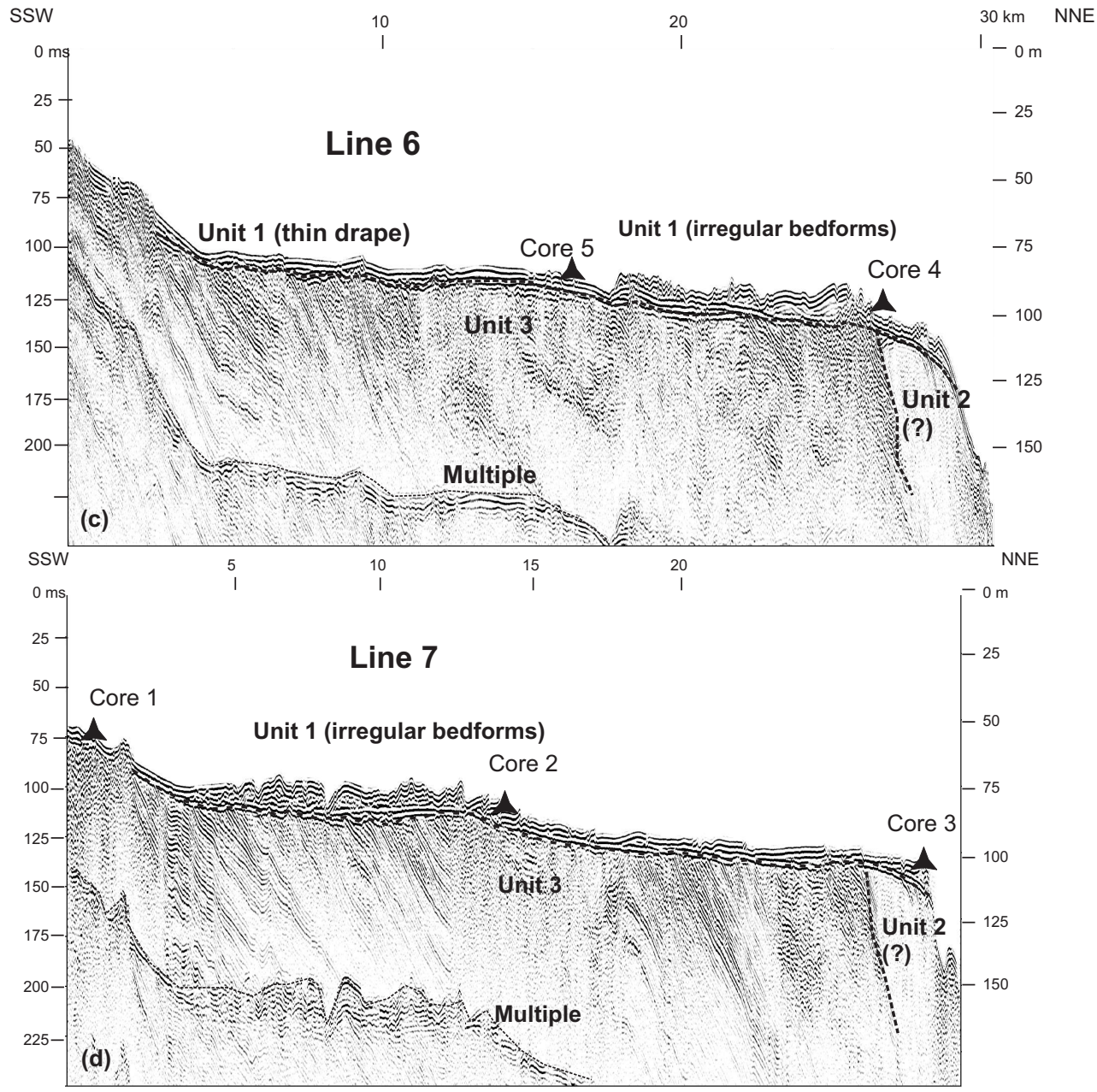

Figure 2. Continued.

Lithology and Chronology

The lithological characteristics of the sediment cores are schematically represented in Figure 3. In general, relatively coarse-grained sediments with abundant shells and shell fragments are prevalent in the Near-Channel and Outer Shelf areas, whereas fine-grained sediments are common on the Inner and Mid-Shelf. Different from all other cores, core WB7 from the Near-Channel area consists entirely of sand-sized material, including abundant shell fragments. Fine-grained sediments are composed of dark grey to greenish grey mud, with laminations and colour bands, particularly in Inner and Mid-Shelf cores. Shell layers and scattered shells often occur in the muddy sediments, except in cores 8, 11 and

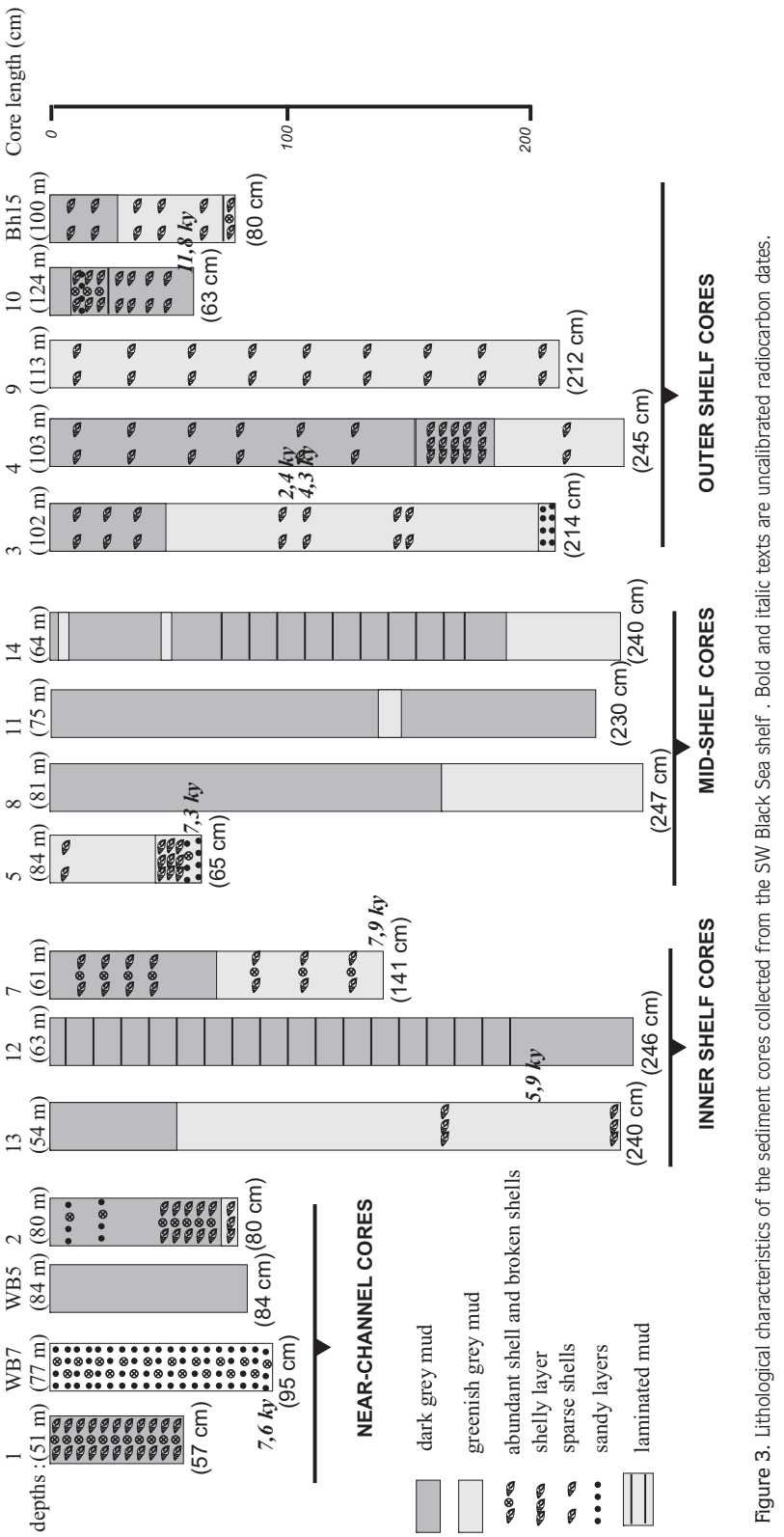

Figure 3. Lithological characteristics of the sediment cores collected from the SW Black Sea shelf . Bold and italic texts are uncalibrated radiocarbon dates.

14 from the Mid-Shelf. Sandy layers with abundant broken shells at the base of cores 3 and 5 are indicative of a shallow water depositional environment where irregular bedforms shown in seismic profiles were formed (Figure 2c, d). Core 10 also consists of broken shells with some fine sand material underlying a surficial dark grey mud layer, but this core was recovered from the shelf edge, where an erosional surface is almost exposed to the sea floor (Figure 2a). At the base this core, a *Dreissena* shell gave an age of 11.8 ky BP (Table 2), which is the oldest age obtained from the available cores in the study area. This age dates the sequence to the lacustrine-Neoeuxinic period of the Black Sea. Ages obtained from the base of Near-Channel (WB7), Inner Shelf (7), and Mid-Shelf (5) cores vary within a range of 7.3 and 7.9 ky BP. Core 13 from the Inner Shelf consists of almost homogeneous mud. Some shell fragments, predominantly *Mytilus,* occur close to its base (210–213 cm) and were dated to 5.9 ky BP. From shelly layers between 100–110 and 110–120 cm depth in core 3, two *Mytilus* shells gave ages of 2.4 and 4.3 ky BP, respectively. In this layer, one of the reworked thick-shelled *Dreissena* shells was dated to ~18 ky BP.

Faunal Characteristics and Vertical Distribution of Benthic Assemblages

Vertical distribution of dominant benthic foraminiferal and mollusc species in selected cores from the four physiographical areas are presented in Figures 4 to 11, while distribution of ostracod species are summarized in the text below and in Table 3. From these distribution patterns, three different benthic faunal assemblages were distinguished (Figure 12). Each assemblage differs from the others in terms of relative abundance, diversity and affinity of the faunal groups. Additionally, similarities in vertical distribution pattern of these parameters in cores are also considered. The full list of taxa for each assemblage is documented in Table 3. Faunal data are given in Supplements 1 and 2.

BF1: This benthic faunal assemblage is widespread in the area. It is dominated by *Ammonia*, and includes euryhaline mollusc and mesohaline ostracod groups. Total benthic foraminiferal abundance is very high (> 2000 specimens per 20 g, Supplement 1) throughout cores 1 and 2 from the Near-Channel area (Figure 4b), reaching maximum abundances at the top, whereas diversity is constant. Cores WB5 and WB7 have a lower foraminiferal abundance, but a high diversity (Figure 4a, Supplement 1). The foraminiferal fauna is dominated by *Ammonia compacta,* together with relatively abundant *Quinqueloculina seminula, Lobatula lobatula* and some *Elphidium* and *Pyrgo* species, and low quantities of *Textularia, Triloculina, Lobatula, Rosalina*, and *Cribroelphidium*. These are mainly Mediterranean immigrant species.

In general, abundance and diversity of BF1 in the Inner Shelf sediments is lower, compared to that of Near-Channel sediments. In core 12 from the Inner Shelf area, benthic foraminiferal abundance is low from the surface to 140 cm depth, ranging from 1 to 150 specimens per 20 g, and the assemblage consists of *A. compacta* and a few *A. tepida* (Figure 5a). Below this depth, benthic foraminifera increase to 500 specimens per 20 g and are dominated by *A. compacta*, however this increase is not consistent downward. The number of species (NS) does not indicate a significant change. In core 7, the BF1 assemblage is recognized by a sharp increase in foraminiferal abundance (~1900 specimens per 20 g) between 60 cm and 70 cm, decreasing toward the upper part (15 cm) of the core. A similar pattern can be noticed in NS (Figure 5b). *A. compacta* is the most common foraminifer in the BF1 assemblage of core 7, occurring together with other species as *Quinqueloculina seminula, Q.* cf. *anguina,* and *A. parasovica*.

In the Mid-Shelf area, the BF1 assemblage is represented by sporadic occurrences of three species of *Ammonia* in cores 8, 11 and 14 (Supplement 1, Figure 7a–c). In core 5 foraminiferal abundance as well as diversity are generally high, with dominance of *A. compacta*. *Quinqueloculina seminula* and *Elphidium macellum* are also abundant. Both foraminiferal abundance and NS decrease in the upper 15 cm of core 5.

In the Outer Shelf, this assemblage is characterized by low foraminiferal abundance, with the exception of core 3 (Figure 9a–c). Foraminiferal abundance does not exceed 50 specimens throughout core 9 and in the upper part of cores 4 and 15 (Supplement 1). The topmost 10 cm of core 10 contains only 2 specimens per 20 g of *E. punctatum* (Supplement 1). In core 3 foraminiferal abundance increases from 90 cm to 40 cm (Figure 9a). *A. parasovica* is dominant in the upper 90 cm, whereas *A. compacta* is abundant in the lower part. NS increases below this interval. On the contrary, in core 4 *A. parasovica* is abundant below 140 cm (Figure 9c). The

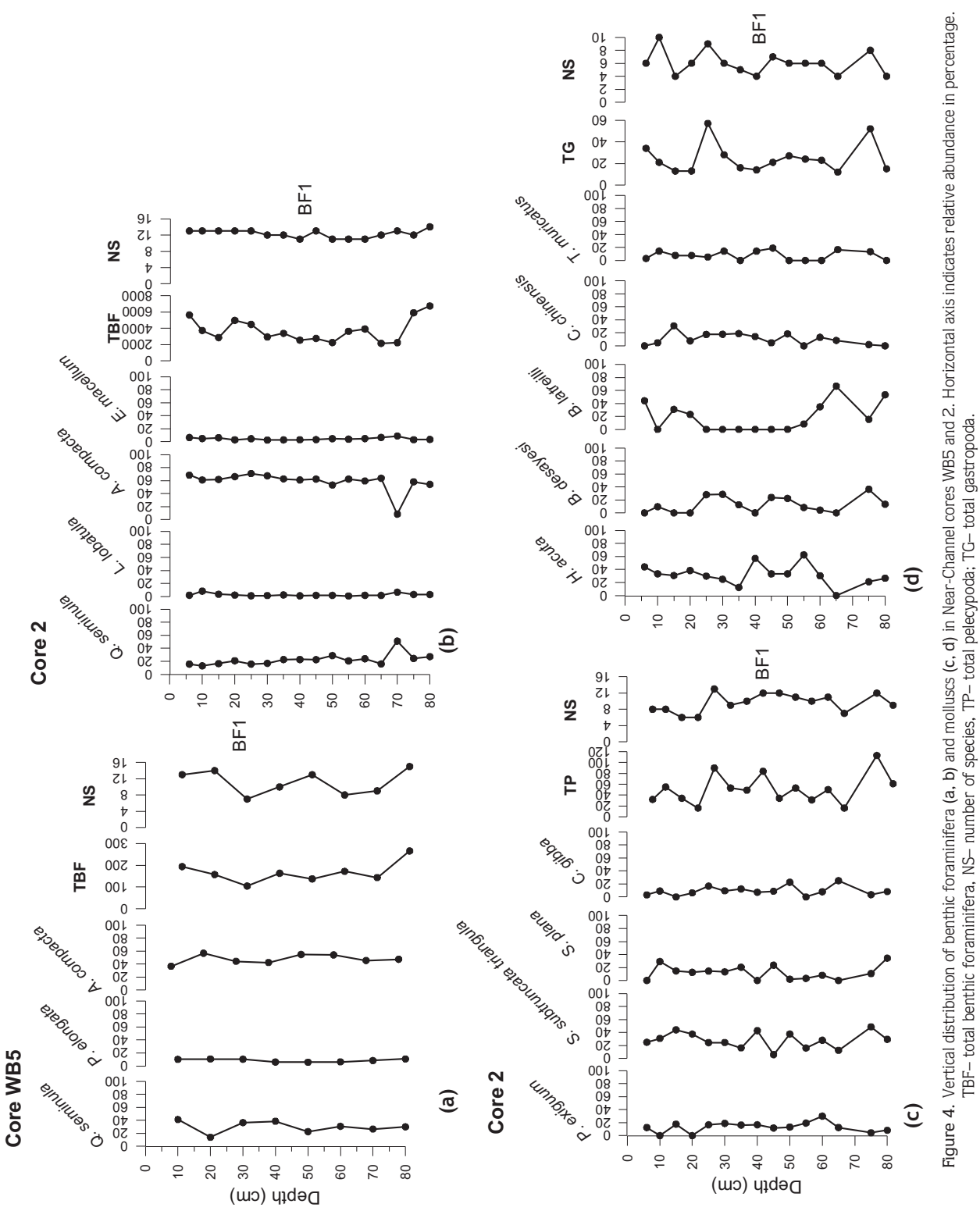

Figure 4. Vertical distribution of benthic foraminifera (a, b) and molluscs (c, d) in Near-Channel cores WB5 and 2. Horizontal axis indicates relative abundance in percentage. TBF– total benthic foraminifera, NS– number of species, TP– total pelecypoda; TG– total gastropoda.

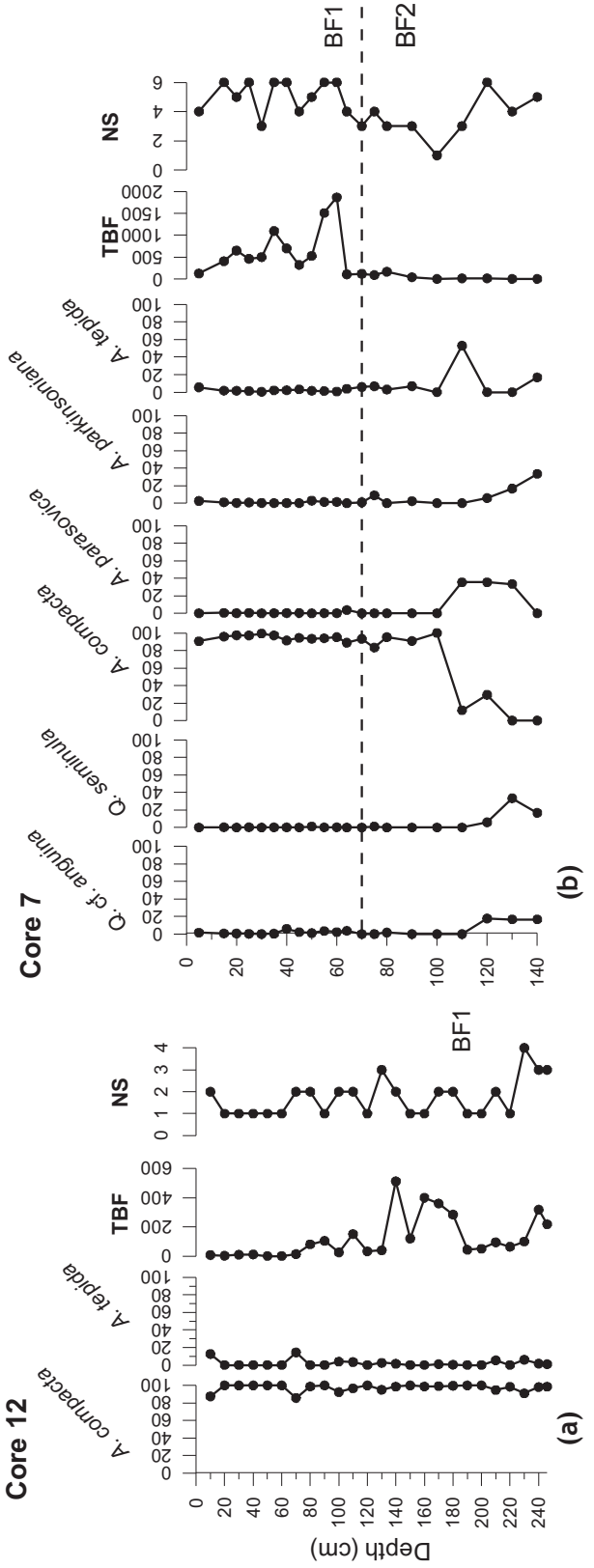

Figure 5. Vertical distribution of benthic foraminifera in Inner Shelf cores 12 and 7. Horizontal axis indicates relative abundance in percentage. TBF– total benthic foraminifera, NS– number of species.

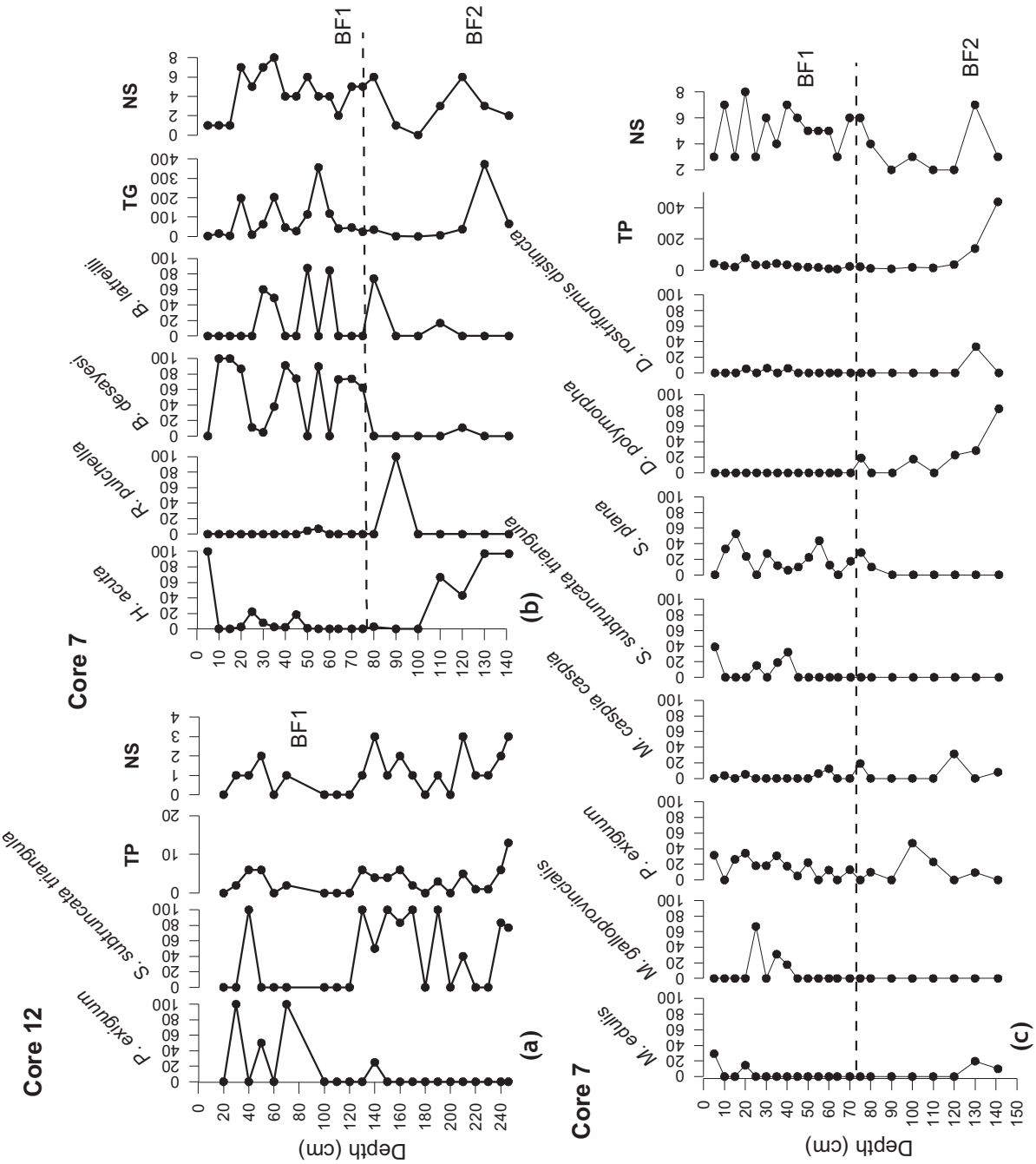

Figure 6. Vertical distribution of molluscs in Inner Shelf cores 12 and 7. Horizontal axis indicates relative abundance in percentage. NS– number of species, TP– total pelecypoda; TG– total gastropoda.

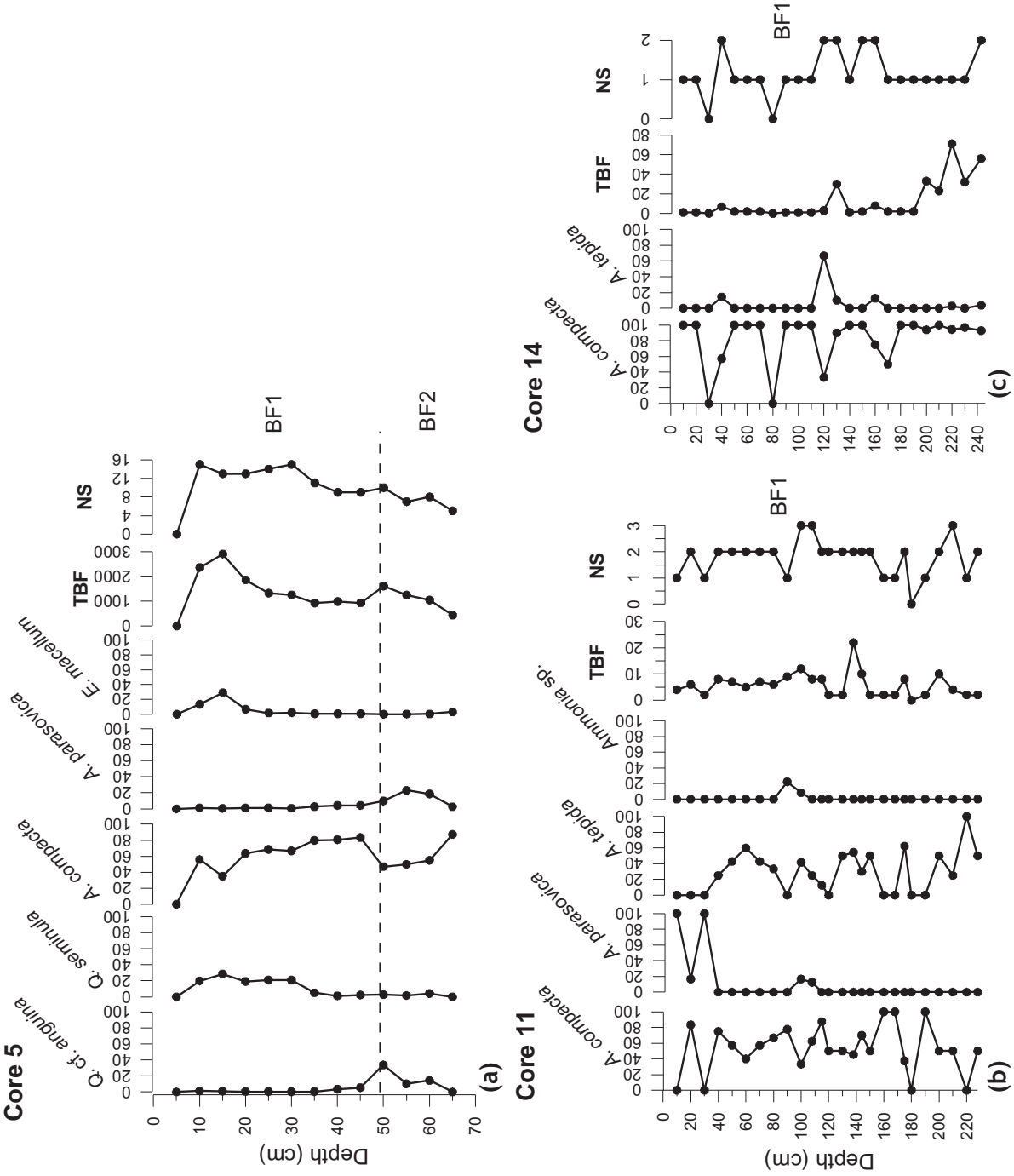

Figure 7. Vertical distribution of benthic foraminifera in Mid-Shelf cores 5, 11 and 14. Horizontal axis indicates relative abundance in percentage. TBF– total benthic foraminifera, NS– number of species.

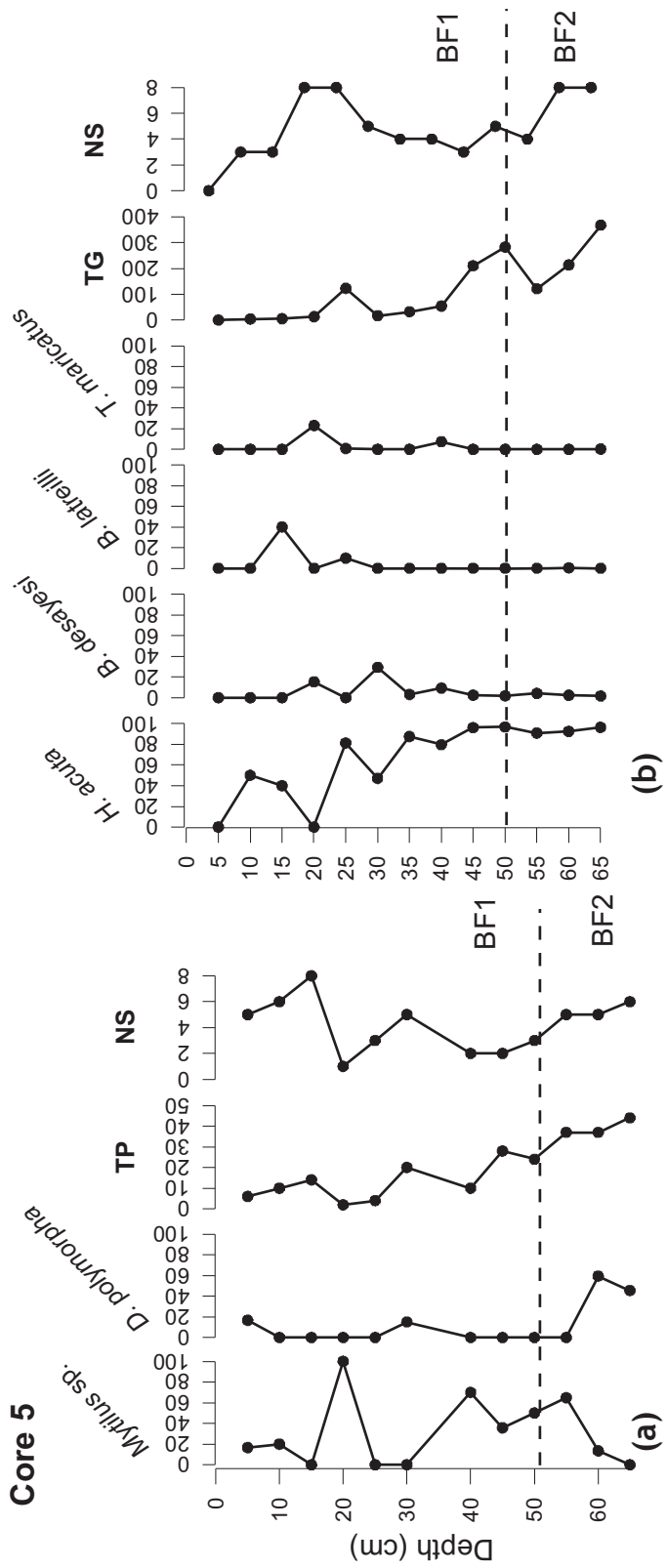

Figure 8. Vertical distribution of molluscs in Mid-Shelf core 5. Horizontal axis indicates relative abundance in percentage. NS– number of species, TP– total pelecypoda; TG– total gastropoda.

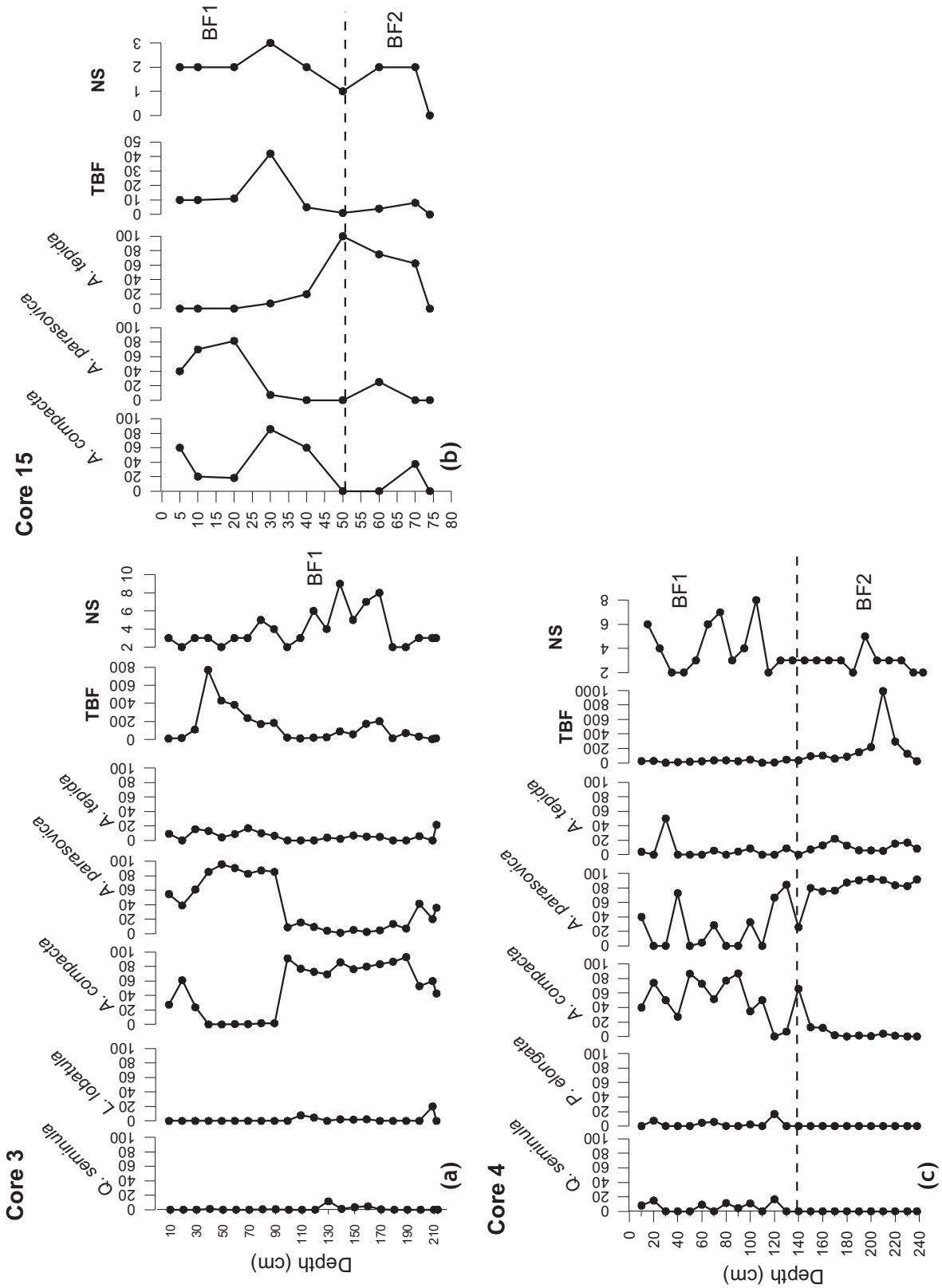

Figure 9. Vertical distribution of benthic foraminifera in Outer-Shelf cores 3, 15 and 4. Horizontal axis indicates relative abundance in percentage. TBF– total benthic foraminifera, NS– number of species.

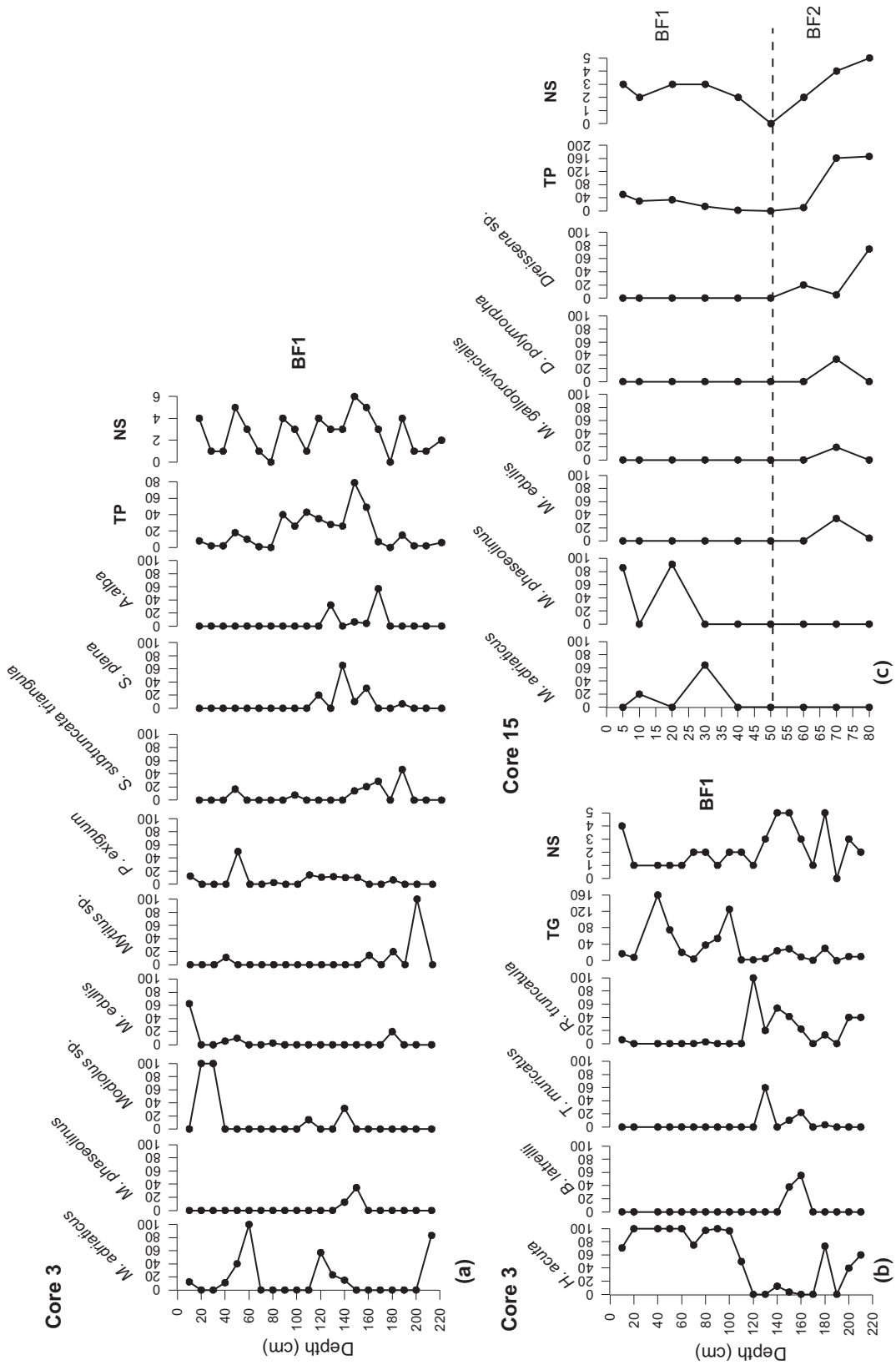

Figure 10. Vertical distribution of mollusks in Outer-Shelf cores 3 and 15. Horizontal axis indicates relative abundance in percentage. NS– number of species, TP– total pelecypoda; TG– total gastropoda.

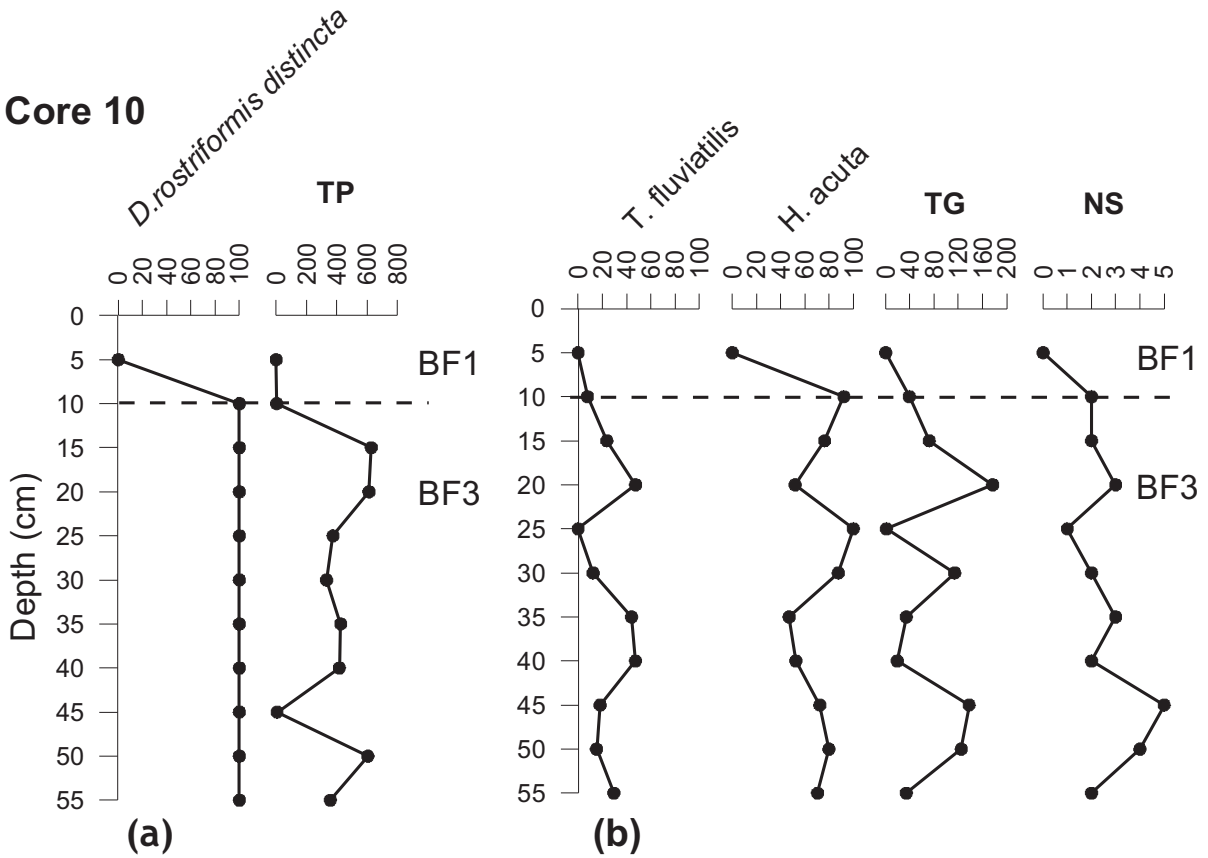

Figure 11. Vertical distribution of molluscs in core 10 from the Outer-Shelf. Horizontal axis indicates relative abundance in percentage. NS– number of species, TP– total pelecypoda; TG– total gastropoda.

abundances of *A. compacta* and *A. parasovica* display opposite trends in the upper 140 cm. NS is relatively high in this part of the core, with low numbers of *Pyrgo* and *Quinqueloculina* species. The opposite trends of *A. compacta* and *A. parasovica* can also be noticed in core 15 (Figure 9b).

The mollusc fauna is dominated by pelecypoda in core 2 from the Near-Channel (Figure 4c, d, Supplement 2) and represented by *Parvicardium exiguum, Spisula* (S) *subtruncata triangula,* and *Scrobicularia plana,* together with a few *Nucula nucleus, Mytilus* sp., *Chione* (*C.) gallina, Corbula gibba,* while relatively common gastropoda are *Hydrobia acuta*, *Bittium desayesi* and *Calyptraea chinensis*. In cores WB7 and 2 there are also *Dreissena polymorpha* (Supplement 2) with very thick-walled shells, strongly suggesting that they are reworked. Radiocarbon dating from such a *Dreissena* shell from core 3 confirms this view, yielding an age of ~ 18 ky BP (Table 2). Gastropod fauna occurs in low quantity or is absent in cores 1, WB5 and WB7, and is represented mainly by *B. desayesi, B. latreilli* and *H. acuta* (Supplement 2).

B. desayesi, B. latreilli, *P. exiguum* and *S. subtruncata* are common in core 13 (Supplement 2) and in the 15–70 cm interval of core 7 (Figure 6b, c) from the Inner Shelf. The sharp fluctuations in the vertical distribution of mollusc fauna correspond with the lithological changes between shelly layers and grey mud (Figure 3).

In general, molluscs occur only sporadically in Mid-Shelf cores (Supplement 2), however *H. acuta* and *Mytilus* sp. are relatively abundant in core 5 (Figure 8).

Modiolus species and *H. acuta* are common in cores from the Outer Shelf (Figure 10; Supplement 2). *H. acuta* is the most common gastropod in the upper 100 cm of core 3. The other mollusca are *Modiolus phaseolinus, P. exiguum, S. subtruncata triangula, S. plana, B. latreilli,*

Table 3. Species list of the benthic faunal assemblages found in sediments from the SW Black Sea shelf.

Benthic Assemblage	Foraminifera	Mollusca Ostracoda
BF1	*Ammoscalaria runiana, Spiroplectammina sagittula, S.* cf. *staiwanica, S. wrighti, Eggerelloides advenus, Textularia agglutinans, T. bocki, T. conica, T. pala, Adelosina cliarensis, A. mediterranensis, Lachlanella bicornis, Massilina gualtieriana, Quinqueloculina* cf. *anguina, Q. berthelotiana, Q. laevigata, Q. lamarckiana, Q. lata, Q. limbata, Q. seminula, Q.* cf. *ungeriana, Q* cf. *viennensis, Q. vulgaris, Pseudotriloculina rotunda, Miliolinella dilatata, M.* cf. *labiosa, M. subrotunda, Pyrgo elongata, P. anomala, P. inornata, P. williamsoni, Triloculina adriatica, T. tricarinata, Polymorphina* sp., *Valvulineria bradyana, Stomatorbina* sp., *Rosalina bradyi, R. floridensis, Lobatula lobatula, Planorbulina mediterranensis, Ammonia beccarii, A. compacta, A. parasovica, A. parkinsoniana, A. tepida, Cribroelphidium decipiens,C. subgranosum, Elphidium granosum, E. macellum, E. Punctatum*	*Nucula (N.) nucleus, Modiolus adriaticus, M. phaseolinus, Mytilaster lineatus, Mytilus edulis, M. galloprovincialis, Lucinella divaricata, Thyasira flexuosa, Mysella bidentata, Acanthocardia paucicostatum, Cardium papillosum, Cerastoderma edula, Parvicardium exiguum, Spisula subtruncata triangula, Scrobicularia plana, Abra alba, Chione (C.) gallina, Dosinia lupinus, Gafrarium (C.) minimum, Paphia rugata rugata, P. senescans, P. discrepans anapensis, Pitar rudis, Corbula gibba.* *Lepata caeca, Gibbula* sp., *Valvata* sp., *Hydrobia acuta, H. ventrosa, Nematurella* sp., *Tornus subcarinatus, Alvania lactea, A. reticulata, Onoba semicostata, Rissoa querinii, R. marginata, R. pulchealla, Melanopsis* sp., *Bittium desayesi, B. latrelli, B. reticulatum, Calyptraea chinensis, Naticarius punchtatus, Hexaplex trunculus, Trophon muricatus muricatus, Cylope brusinae, Nassarius reticulatus, Monophorus perversus, Retusa truncatula, Chrysallida fenestrata, C. interstincta, Eulimella phaula, Turbonilla lactea*	*Aurila convexa, Pseudocytherura calcarata, Bythocythere minima, Paradoxostoma triste,Neonesidea mediterranea, Callistocythere Montana, C. pallida, C. mediterreanae, Leptocythere lacertosa, L. porcellanea, Cyprideis torosa, Pontocythere elongata, Carinocythereis carinata, Costa edwardsii, C. tricosta, Hiltermannicythere emaciate, Urocythereis oblonga, Ptherigocythereis jonessi, Basslerites berchoni, Loxoconcha agilis, L. rhomboidea, L. tumida, Xestoleberis auranita, X. depressa, Sclerochilus contortus, Paracypris polita*
BF2	*Q.* cf. *anguina, Q. laevigata, Q.* cf. *lamarckiana, Q. seminula, P. elongata, P. anomola, P. williamsoni, L. lobatula, A. compacta, A. parasovica, A. parkinsoniana, A. tepida , E. macellum*	*M. phaseolinus, Modiolus* sp., *Mytilaster lineatus, M. edulis, M. galloprovincialis, Mytilus* sp., *Cardium* sp., *C. edule, P. exiguum, Monadacna caspia caspia, S. subtruncata triangula, S. plana, D. polymorpha, D. rostriformis distincta,* *Theodoxus fluviatilis, H. acuta, H. ulvae, H. ventrosa, Nematurella* sp., *O. semicostata, R. querinii, Bivonia triquetra, B. desayesi, B. latreilli, C. chinensis, T. muricatus, C. danovania, M. perversus, Eulima crosseana, R. truncatula, C. interstincta, E. phaula, E. ventricosa, T. lactea D. rostriformis distincta*	*C. pallida, L. Lacertosa, C. carinata, H. emaciate, Tyrrhenocythere amnicola, T. flipescui, L. agilis, L. tumida, X. auranita, X. depressa, Candona angulata*
BF3		*T. fluviatilis, H. acuta, R. querinii, E. crosseana, E. Phaula*	*Euxinocythere* sp., *Cythereissa* sp., *T. amnicola, T. flipescui, L. tumida, X. depressa, C. liventalina, C. srebarnensis, C. (metacandona)* sp., *Candona (typhlocypris)* sp., *C. angulata*

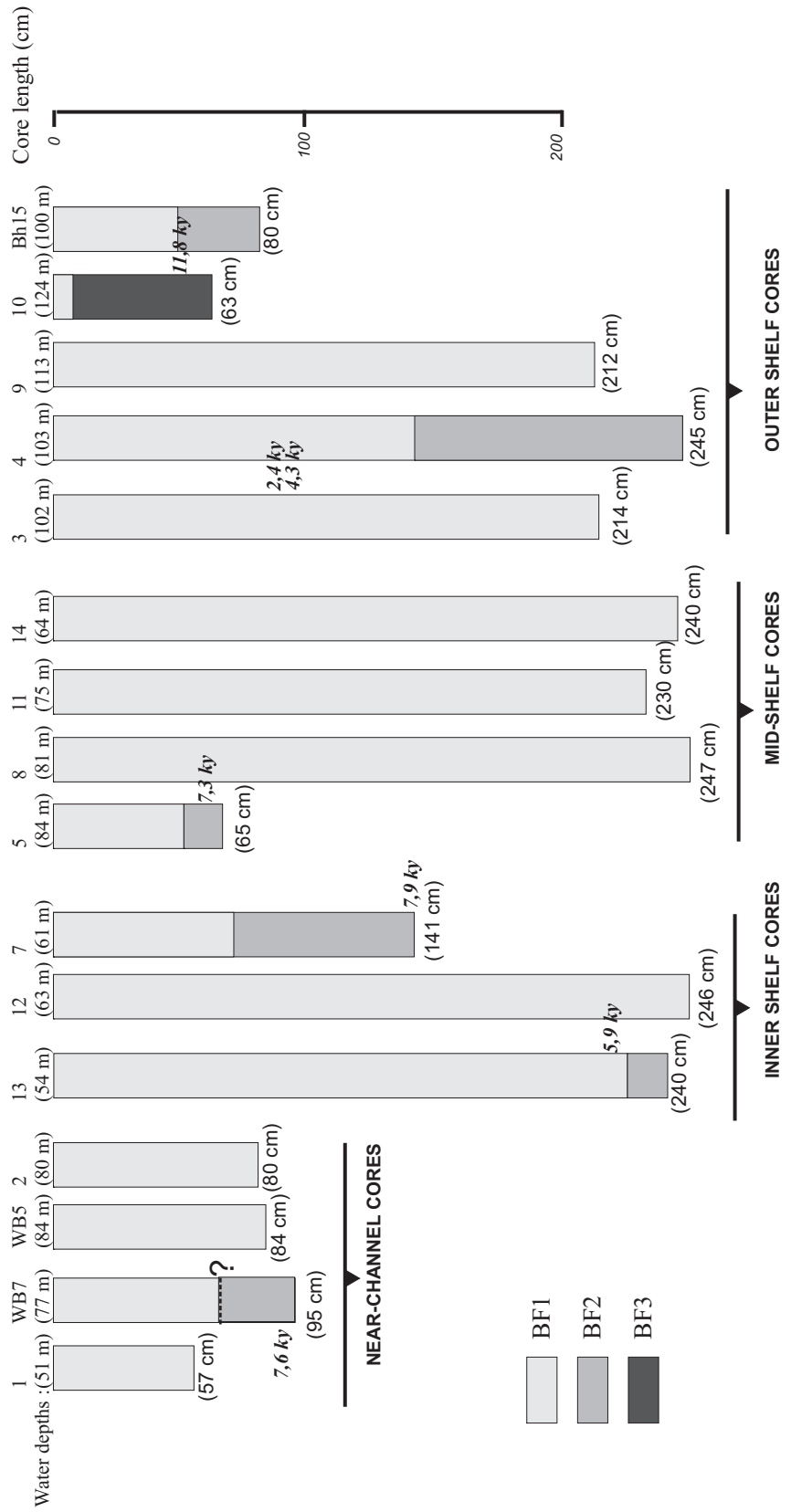

Figure 12. Benthic faunal assemblages defined in the sediments from the SW Black Sea shelf.

Trophon muricatus and *Retusa truncatula* in the shelly layers of core 3 (Figure 10a, b).

Ostracods are represented predominantly by mesohaline forms of Mediterranean-Atlantic origin, such as *Loxoconcha agilis*, *Carinocythereis carinata*, *Hiltermannicythere emaciata, Callistocythere pallida*, *C. carinata*, *Costa edwardsii, Ptherigocythereis jonesii* and *Paracypris polita* (Table 3).

BF2: This assemblage is characterized by a mixed fauna of low salinity (brackish) and high salinity (marine) environment, particularly for what concerns the mollusc and ostracod groups. *Dreissena polymorpha, D. rostriformis,* and *M. caspia caspia* are species of Caspian Sea origin (Chepalyga 2007), preferring 0.5–3.5 ‰ in the Black Sea (Liakhnovich *et al.* 1994) and tolerating a maximum of 6‰ salinity in the Baltic Sea (Jarvekulg 1979). *Dreissena rostriformis distincta* does not live presently in the Black Sea basin, except in the estuaries of the rivers Dniester, Dnieper and Don (Arkhangel'sky & Strakhov 1938).

On the inner shelf, mollusc fauna consists of fresh-brackish *D. polymorpha, D. rostriformis distincta* and *Monodacna caspia caspia,* and marine *M. edulis* and *P. exiguum,* below 70 cm of core 7 (Figure 6c) and below 220 cm of core 13 (Supplement 2). The Near-Channel core WB7 also contains this assemblage in its lower part (Supplement 2). However, the boundary of BF2 is indistinguishable due to presences of old *Dreissena* shells throughout the core (Figure 12). On the Mid-Shelf this assemblage is present only in core 5 (Figure 8a), while cores 8, 11 and 14 contain only few molluscs (Supplement 2). The lower part (50 to 65 cm) of core 5 contains *Mytilus* and *D. polymorpha.* In the Outer Shelf, the BF2 assemblage is present in cores 4 (Supplement 2) and 15 (Figure 10c).

A similar mixture can be observed amongst the ostracod group. Low salinity tolerant-brackish *Tyrrhenocythere amnicola* and *Candona angulata* (Carbonel 1983; Krstic 1977) and mesohaline, Mediterranean-Atlantic species *Callistocythere pallida, Carinocythereis carinata, Hiltermannicythere emaciata, Loxoconcha agilis* and *Xestoleberis depressa* (Nazik *et al.* 1999) occur together in this assemblage (Table 3).

The foraminiferal fauna of BF2 has a lower diversity than the overlying BF1 assemblage (Table 3). *A. parasovica* is the most dominant foraminifer in this assemblage, instead of *A. compacta* which dominates the upper assemblage in cores 7 (Figure 5b) and 4 (Figure 9c), and is relatively abundant in core 5 (Figure 7a).

BF3: Fauna consists of predominantly brackish mollusc species (Neoeuxinic fauna) and is found only in core 10 collected from the outer shelf (Figure 11). Only few foraminifera (Supplement 1) are found in this assemblage. Mollusc fauna consists of abundant *D. rostriformis distincta,* including many fragments, and the fresh-brackish water species *Theodoxus fluviatilis.* Prevailing ostracoda are Ponto-Caspian taxa such as *Euxinocythere* sp., *Candona* (*Caspiolla)* sp., *Candona* (*Metacandona*) sp., *Candona* (*Typhlocypris*) sp., *Candona angulata* and *Tyrrhenocythere* (Table 3). *Tyrrhenocythere* is a fresh-brackish genus and prefers shallow water depths (<30 m) with shelly substratum and presently lives in the Caspian Sea, Baltic Sea, and Lake Aral.

Discussion

Three different benthic assemblages (Figure 12) in the sediments from the SW Black Sea shelf reflect changing bottom water conditions. The topmost assemblage BF1 is characterized by high faunal abundance and diversity in the Near-Channel cores, diminishing toward the shelf further away from the channel. *Ammonia compacta, Quinqueloculina seminula, Elphidium macellum* and *Lobatula lobatula* are the most common species, whilst *Triloculina adriatica, Pyrgo anomala, Textularia aglutinans, T. bocki* sparsely occur in Near-Channel cores (Supplement 1). However, in the shelf sediments, foraminiferal fauna of this assemblage generally displays low diversity and low abundance and consists of *A. compacta, A. tepida* and *A. parasovica*. Cores 8, 11, 14 from the Mid-Shelf (Figure 7b, c; Supplement 1) and core 12 from the Inner Shelf (Figure 5a) and core 9 from the Outer Shelf (Supplement 1) contain only these species. *A. compacta* is a polyhaline species (≥ 18 ‰, Yanko 1990) and found in the north and northwest of the Black Sea in water depths ranging from 71 to 220 m, and is also abundant in the shelf areas of the Caspian Sea at 36–70 m depths. *A. tepida* and *A. parasovica* are euryhaline species (1–26 ‰, Yanko 1990). The present day benthic foraminiferal fauna of the Black Sea shelf is dominated by the *Ammonia* genus (Yanko 1990). Meriç *et al.* (2001) found a low-diverse recent benthic foraminiferal assemblage, investigating surface sediments of the shelf area between Kilyos and Amasra (Figure 1).

The diversity of the mollusc fauna in the Near-Channel and Inner Shelf cores is high (Figures 4c, d, and 6b, c), becoming lower in the Mid-Shelf and Outer Shelf cores (Figures 8 & 10). *S. subtrancata triangula, S. plana, P. exiguum, Corbula* (V.) *gibba, H. acuta,* and *B. desayesi* are abundant in the Near-Channel and Inner Shelf cores. *Modiolus phaseolinus* and *Retusa truncatula* become relatively abundant in the Outer Shelf cores. Albayrak (2003) studied the mollusc fauna of the recent sediments from the shelf area to the west and east of the Bosporus exit to a water depth of 65 m. The diversity of the mollusc fauna was highest in the 11–20 m depth zone, decreasing to 2–3 species in the 41–60 m depth zone which partly corresponds to the Inner Shelf area of this study. *S. subtruncata* was the most widespread species in this zone as observed in BF1 of Inner Shelf cores.

The Mediterranean lower water layer is the apparent source for species-rich and abundant euryhaline Mediterranean benthic fauna observed in the Near-Channel area. Sedimentological effects, such as winnowing out of fine-grained sediment in the Near-Channel area and concentration of coarse-grained sediments containing abundant foraminifera, can not explain this distribution pattern. Cores collected from the Near-Channel area are away from the main channel, where strong currents occur. Besides, they consist of different lithologies (Figure 3), but consistently have higher abundance of foraminifera as compared to other cores. At present, the saline Mediterranean lower layer enters the Black Sea following the Bosporus channel. Although the plume spreads laterally at the outer shelf, the main part of it is transported into the deep basin (Latif *et al.* 1991; Di Irio & Yüce 1999). Therefore, BF1 must be considered to reflect the source effect of the saline Mediterranean lower layer issuing forth from the Bosporus, reducing in strength at more distal areas. Radiocarbon dates obtained from the base of BF1 in core 13 suggest that it started at ~6 ky BP (Figure 12). In the Mid-Shelf, the low diversity of both the foraminiferal and mollusc fauna of BF1 are comparable to those found in recent sediments in the study area, suggesting that it represents conditions close to present-day relatively low salinity (Yanko 1990; Meriç *et al.* 2001; Albayrak 2003). Within the BF1 assemblage, a different fauna is observed in the upper 90 cm of core 3 and in core 15 from the Outer Shelf (Figure 9a, b), with dominance of *A. parasovica*, as in the BF2 assemblage. However, mixed mollusc and ostracod fauna are not present in core 3 and in the upper 50 cm of core 15 and hence they cannot be considered as BF2. *A. parasovica* is a euryhaline species and hence can tolerate a wide range of salinity conditions, compared to the polyhaline *A. compacta.* Therefore, this sharp change in the foraminiferal fauna might indicate a salinity change in the bottom water. Two radiocarbon ages obtained from *Mytilus* shells in core 3 range between ~2.4 and 4.3 ky BP (Table 2), indicating the approximate date of this change. The presence of reworked and old *Dreissena* shells (Table 2) between the dated layers suggests an erosional event, although the resolution of seismic profiles is not adequate to verify this (Figure 2d). The oldest date of the *Mytilus* shell can be considered to represent the date of this change.

Benthic assemblage BF2 which is a mixture of two different affinities indicates the beginning of the marine conditions in the brackish Neoeuxinic basin. Although *A. compacta* is the most common species in this assemblage, *A. parasovica* becomes dominant in the Outer Shelf (core 4, Figure 9c) and is relatively abundant in the Inner Shelf core 7 (Figure 5b) and Mid-shelf core 5 (Figure 7a). The ages obtained from the layer containing BF2 in cores WB7, 5 and 7 vary between 7.3 to 7.9 ky BP (Figure 12). Although no sediment cores reached the lower boundary of this benthic assemblage, it must date from earlier than 7.9 ky BP, because of the salinity threshold which is necessary for the adaptation of euryhaline taxa after the first incursion of Mediterranean water. This finding supports previously published datings of Mediterranean water intrusion into the Black Sea, varying from 8.2 ky to 9.5 ky BP (Ryan *et al.* 2003; Major *et al.* 2006; Ivanova *et al.* 2007; Yanko-Hombach 2007).

The BF3 assemblage clearly reflects the fresh-brackish condition of the Neoeuxinic basin, before the Mediterranean intrusion. The age determination from a *Dreissena* shell confirms that it corresponds to the Neoeuxinian period.

In the traditional Late Quaternary stratigraphical scheme of the Black Sea sediments established by former Soviet Union scientists, the Holocene is divided into four phases, consisting of regressions and transgressions within a range of about 1 to 20 m (Arkhangel'sky & Strakhov 1938; Nevesskaya 1965; Fedorov 1978; Balabanov *et al.* 1981), based on the faunal contents of the sediments from the NW, north and NE shelf areas of the Black Sea. However, Kaplin & Selivanov (2004) reconstructed fluctuations of relative sea level caused by variations in river discharge in response to climatic

changes on the Russian Plain during the middle and late Holocene. These fluctuations were on the order of several metres with four high sea level stands at about 7.5, 7–6, 5.5–4.5, and 2.2–1.7 ky BP. Nevertheless, we refrain from making a correlation, since the faunal assemblages identified in their study are not strongly comparable with those described in the present study, except their affinities. This might be due to regional variations in the benthic faunal content of shelf sediments of the Black Sea (Yanko 1990). More detailed investigation of the benthic fauna in the study area is necessary to integrate it into a wider context.

Based on the observation of lateral variations in the benthic faunal assemblage, *H. acuta* and *M. phaseolinus* seem to prefer the Outer Shelf where water depths are greater than 80 m, while *B. desayesi* and *S. subtruncata triangula* are characteristic species for the Inner and Mid-Shelf environments of the SW Black Sea.

The findings of this study may not directly serve to resolve the mode of the last connection with the Mediterranean Sea, because these data do not show at what depth the sea level in the Black Sea was when the Mediterranean water penetrated in the early Holocene. BF1 point to sea level changes at about 6 ky BP after its initial penetration earlier than 8 ky BP. At about 6 ky BP, the rate of global sea level rise was reduced (Fairbanks 1989; Bard *et al.* 1996) with the stabilization of the global eustasy (Pirazzoli 2005). The dominance of *A. parasovica* might be a sign for reduced salinity conditions at the Outer Shelf after ~4 ky BP.

Conclusions

Three benthic faunal assemblages were identified in sediment cores collected from the SW shelf area of the Black Sea, reflecting the transition from the termination of the Neoeuxinian Lake phase to recent conditions. BF1 displays high faunal abundance and diversity in the Near-Channel area, indicating the influence of saline Mediterranean lower layer. Decreasing abundance and diversity in the shelf sediments away from the Near-Channel, is a response to relatively low-saline conditions which are comparable to the present-day bottom conditions in the SW Black Sea shelf. BF1 started to be deposited at about 6 ky BP. On the Outer Shelf, changing foraminiferal faunal content might be a sign of relatively low salinity conditions in the bottom water, established after ~4 ky BP. The mixed occurrence of two different affinities in assemblage BF2 indicates a transitional condition, from fresh-brackish lake phase to marine conditions, which occurred before ~8 ky BP. The mixture of two affinities is more pronounced in the mollusc fauna which is characterized by the co-existence of marine pelecypoda *Mytilaster, Mytilus* and *Parvicardium* and brackish pelecypoda *M. caspia caspia, D. polymorpha* and *D. rostriformis distincta*. BF3 corresponds to the Neoeuxinian phase of the Black Sea.

Acknowledgements

The authors wish to thank the captains and the crew of *R/V Arar* (IU-IMSM) and R/V *Alliance (*NATO) for their help during sampling. The present work was supported by the Research Fund of İstanbul University, project number T-1151/18062001, for the PhD Thesis of the first author of the paper. The samples studied in this paper were collected within the scope of a research project supported by the Scientific and Technological Research Council of Turkey (TÜBİTAK), project number YDABCAG-198Y083. We are grateful to Prof.Dr. E. Meriç and Dr. E. Kırcı-Elmas for their useful suggestions during the preparation of this paper. Prof. Jerry Lloyd and Dr. Henko de Stigter are greatly appreciated for their reviews that helped to improve the earlier version of this manuscript.

References

Aksu, A.E., Hiscott, R.N. & Yaşar, D. 1999. Oscillating Quaternary water levels of the Marmara Sea and vigorous outflow into the Aegean Sea from the Marmara Sea-Black Sea drainage corridor. *Marine Geology* **153**, 275–302.

Aksu, A.E., Hiscott, R.N., Kaminski, M.A., Mudie, P.J., Gillespie, H., Abrajano, T. & Yaşar, D. 2002b. Last glacial-Holocene paleoceanography of the Black Sea and Marmara Sea: stable isotopic, foraminiferal and coccolith evidence. *Marine Geology* **190**, 119–149.

Aksu, A.E., Hiscott, R.N., Yaşar, D., İşler, F.İ. & Marsh, S. 2002a. Seismic stratigraphy of Late Quaternary deposits from the southwestern Black Sea shelf: evidence for non-catastrophic variations in sea-level during the last 10.000 yr. *Marine Geology* **190**, 61–94.

Albayrak, S. 2003. On the Mollusca fauna of the Black Sea near İstanbul. *Zoology in the Middle East* **30**, 69–75, Kasparek Verlag, Heidelberg.

ALGAN, O., ERGİN, M., KESKİN, Ş., GÖKAŞAN, E., ALPAR, B., ONGAN, D. & KIRCI-ELMAS, E. 2007. The sea level changes during the late Pleistocene–Holocene on the southern shelves of the Black Sea. *In:* YANKO-HOMBACH, V., GILBERT, A., PANIN, N. & DOLUKHANOV, P. (eds), *The Black Sea Flood Question: Changes in Coastline, Climate, and Human Settlement*. NATO Science Series IV – Earth and Environmental Sciences, Kluwer Academic Press, 603–631, Springer, Dordrecht, the Netherlands.

ALGAN, O., GÖKAŞAN, E., GAZİOĞLU, C., YÜCEL, Z., ALPAR, B., GÜNEYSU, C., KIRCI, E., DEMİREL, S., SARI, E. & ONGAN, D. 2002. A high-resolution seismic study in Sakarya Delta and Submarine Canyon, southern Black Sea shelf. *Continental Shelf Research* **22**, 1511–1527.

ARKHANGEL'SKY A.D. & STRAKHOV N.M. 1938. Geologicheskoe stroenie i istoriia razvitiia Chernogo moria (Geological structure and History of the Black Sea). Izdatel'stvo Akademiia Nauk SSSR, Moscow-Leningrad, 1–226 [In Russian].

BAHR, A., LAMY, F., ARZ, H., KUHLMANN, H. & WEFER, G. 2005. Late Glacial to Holocene climatic and sedimentation history in the NW Black Sea. *Marine Geology* **214**, 309–322.

BALABANOV, I.P., KVIRKVELIA, B.D. & OSTROVSKIY, A.B. 1981. *Recent History of the Development of Engineering-Geological Conditions and Long-time Forecast for the Coastal Zone of the Pitsunda Peninsula.* Metsiniereba, Tbilisi [In Russian].

BARD, E., HAMELIN, B., ARNOLD, M., MONTAGGIONI, L., CABIOCH, G., FAURE, G. & ROUGERIE, F. 1996. Deglacial sea-level record from Tahiti corals and the timing of global melt water discharge. *Nature* **382**, 241–244.

CARBONEL, G. 1983. Morphometrie et hypersalinite chez Cyprideis torosa (Jones) (Ostracoda-Actuel) dans les salines de Santa-pola (Alicante, Espagna). *Science Geological Bulletin* **36**, 211–219.

CHEPALYGA, A.L. 1984. Inland sea basins. *In:* VELICHLEO, A.A., WRIGHT, H.E. & BARNOSKY, C.W. (eds), *Late Quaternary Environments of the Soviet Union*. University of Minnesota Press, Mineapolis, 229–247.

CHEPALYGA, A.L. 2007. The late glacial great flood in the Ponto-caspian Basin. *In:* YANKO-HOMBACH, V., GILBERT, A., PANIN, N. & DOLUKHANOV, P. (eds), *The Black Sea Flood Question: Changes in Coastline, Climate, and Human Settlement*. NATO Science Series IV – Earth and Environmental Sciences, Kluwer Academic Press, 119–148, Springer, Dordrecht, the Netherlands.

ÇAĞATAY, M.N., GÖRÜR, N., ALGAN, O., EASTOE, C., TCHAPALYGA, A., ONGAN, D., KUHN, T. & KUŞCU, İ. 2000. Last glacial-Holocene palaeoceanography of the Sea of Marmara: timing of the last connections with the Mediterranean and the Black Sea. *Marine Geology* **167**, 191–206.

DEGENS, E.T. & ROSS, D.A. 1974. *The Black Sea – Geology, Chemistry and Biology*. AAPG Memoir **20**, p. 633.

DI IORIO, D. & YÜCE, H. 1999. Observations of Mediterranean flow into the Black Sea. *Journal of Geophysical Research* **104**, 3091–3108.

FAIRBANKS, R.G. 1989. A 17,000-year glacio-eustatic sea level record: influence of glacial melting rates on the Younger Dryas event and deep-ocean circulation. *Nature* **342**, 637–642.

FEDOROV, P.V. 1971. Postglacial transgression of the Black Sea. *International Geology Reviews* **14**, 160–164.

FEDOROV, P.V. 1978. *The Pleistocene of the Ponto-Caspian*. Nauka Press, Moscow [in Russian].

HAY, B.J. 1994. Sediment and water discharge rates of Turkish Black Sea Rivers before and after hydropower dam construction. *Environmental Geology* **23**, 276–283.

HISCOTT, R.N., AKSU, A.E., YAŞAR, D., KAMINSKI, M.A., MUDIE, P.J., KOSTYLEV, V.E., MACDONALD, J.C., İŞLER, F.İ. & LORD, A.R. 2002. Delta south of the Bosphorus Strait record persistent Black Sea outflow to the Marmara Sea since ~10 ka. *Marine Geology* **190**, 95–118.

IVANOVA, E.V., MURDMAA, I.O., CHEPALYGA, A.L., CRONIN, T.M., PASECHNIK, I.V., LEVCHENKO, O., HOWE, S.S., MANUSHKINA, A.V. & PLATONOVA, E.A. 2007. Holocene sea-level oscillations and environmental changes on the Eastern Black Sea shelf. *Palaeogeography, Palaeoclimatology, Palaeoecology* **246**, 228–259.

JARVEKULG, A. 1979. Ecology of bivalve molluscs in the eastern part of the Baltic Sea. *In:* LIKHAREV, I. (ed), *Molluscs, the Main Results in Their Investigations*. Nauka, Leningrad, 45–47 [In Russian].

KAPLIN, P.A. & SELIVANOV, A.O. 2004. Late glacial and Holocene sea level changes in semi-enclosed seas of North Eurasia: examples from the contrasting Black and White Seas. *Palaeogeography, Palaeoclimatology, Palaeoecology* **209**, 19–36.

KRSTIC, N. 1977. The ostracod genus Tyrrenocythere. *Sixth International Ostracode Symposium*, Saalfeden, 395–405.

LATİF, M.A., ÖZSOY, E., OĞUZ, T. & ÜNLÜATA, Ü. 1991. Observations of the Mediterranean inflow into the Black Sea. *Deep Sea Research* **38** (Suppl. 2), S711–S723.

LERICOLAIS, G., POPESCU, I., GUICHARD, F., POPESCU, S-M. & MANOLAKAKIS, L. 2007. Water-level fluctuations in the Black Sea since the Last Glacial maximum. *In:* YANKO-HOMBACH, V., GILBERT, A., PANIN, N. & DOLUKHANOV, P. (eds), *The Black Sea Flood Question: Changes in Coastline, Climate, and Human Settlement*. NATO Science Series IV - Earth and Environmental Sciences, Kluwer Academic Press, 437–453, Springer, Dordrecht, the Netherlands.

LIAKHNOVICH, V.N., KARATAEV, A.YU., LIAKHOV, S.M., *et al.* 1994. Habitat parameters. *In:* STAROBOGATOV, Y.I. (ed), *Sistematika, evolyutsiya prakticheskoe znachenie (Dreissena polymorpha (Pall.) (Bivalvia, Dreissenidae): (Freshwater Zebra mussel Dreissena polymorpha (Pall.) (Bivalvia, Dreissenidae) Taxonomy, ecology and practical use).* Nauka, Moskow, 109–119 [In Russian].

MAJOR, C.O., GOLDSTEIN, S.L., RYAN, W.B.F., LERICOLAIS, G., PIOTROWSKI, A.M. & HAJDAS, I. 2006. The co-evolution of Black Sea level and composition through the last deglaciation and its paleoclimatic significance. *Quaternary Science Reviews* **25**, 2031–2047.

MERİÇ, E., AVŞAR, N., ERYILMAZ, M. & YÜCESOY-ERYILMAZ, F. 2001. Güneybatı Karadeniz (Kilyos-İstanbul Boğazı Kuzeyi-Riva-Dolmalı-Kilimli ve Amasra) güncel bentik foraminifer topluluğu ve çökel dağılımı [Recent benthic foraminifera and sediment distribution of southwestern Black Sea (Kilyos-North of Bosphoru-Riva-Domalı-Kilimli-Amasra)]. *Yerbilimleri-Geosound* **39**, 155–183 [in Turkish with English abstract].

MUTLU, E.M., ÜNSAL, M. & BİNGEL, F. 1993. Faunal community of soft-bottom molluscs of the Turkish Black Sea. *Doğa, Turkish Journal of Zoology* **17**, 189–206 [in Turkish].

NAZİK, A., MERİÇ, E. & AVŞAR, N. 1999. Environmental interpretation of Quaternary sediments: Küçüksu Palace (Asian side of Bosphorus, Anadolu Hisarı-Turkey). *Yerbilimleri, Bulletin of Earth Sciences Application and Research Centre of Hacettepe University* **21**, 105–113 [in Turkish with English abstract].

NEVESSKAYA, L.A. 1965. Late Quaternary bivalve molluscs of the Black Sea, their systematics and ecology. *Trudy Paleontologicheskogo Instituta Akademii Nauk SSSR* 105, 1–390. Nauka, Moscow [in Russian].

OĞUZ, T., LA VIOLETTE, P.E. & ÜNLÜATA, Ü. 1992. The upper layer circulation of the Black Sea: Its variability as Inferred from Hydrographic and Satellite Observations. *Journal of Geophysical Research* **97/C8**, 12,569–12,584.

PIRAZZOLI, P.A. 2005. A review of possible eustatic, isostatic and tectonic contributions in eight late-Holocene relative sea-level histories from the Mediterranean area. *Quaternary Science Reviews* **24**, 1989–2001.

ROSS, D.A. & DEGENS, E.T. 1974. Recent sediments of the Black Sea. *In:* DEGENS, E.T. & ROSS, D.A. (eds), *The Black Sea – Geology, Chemistry, and Biology.* AAPG Memoir **20**, 183–189.

RYAN, W.B.F. 2007. Status of the Black Sea flood hypothesis. *In:* YANKO-HOMBACH, V. GILBERT, A., PANIN, N. & DOLUKHANOV, P. (eds), *The Black Sea Flood Question: Changes in Coastline, Climate, and Human Settlement*. NATO Science Series IV – Earth and Environmental Sciences, Kluwer Academic Press, 63–89, Springer, Dordrecht, the Netherlands.

RYAN, W.B.F., PITMANN III, W.C., MAJOR, C.O., SHIMKUS, K., MOSKALENKO, V., JONES, G.A., DIMITROV, P., GÖRÜR, N., SAKINÇ, M. & YÜCE, H. 1997. An abrupt drowning of the Black Sea shelf. *Marine Geology* **138**, 119–126.

RYAN, W.B.F., MAJOR, C.O., LERICOLAIS, G. & GOLDSTEIN, S.L. 2003. Catastrophic flooding of the Black Sea. *Annual Review of Earth and Planetary Sciences* **31**, 525–554.

SUR, H.İ., ÖZSOY, E. & ÜNLÜATA, Ü. 1994. Boundary current instabilities, upwelling, shelf mixing and eutrophication processes in the Black Sea. *Progress in Oceanography* **33**, 249–302.

ÜNLÜATA, Ü., OĞUZ, T., LATİF, M.A. & ÖZSOY, E. 1990. On the physical oceanography of the Turkish Straits. *In:* PRATT, L.J. (ed), *The Physical Oceanography of Sea Straits*, 25–60. Kluwer, Dordrecht.

YANKO, V. 1990. Stratigraphy and paleogeography of the marine Pleistocene and Holocene deposits of the southern seas of the USSR. *Memorie della Societa Geologica Italiana* **44**, 167–187.

YANKO-HOMBACH, V.V. 2007. Controversy over Noah's Flood in the Black Sea: geological and foraminiferal evidence from the shelf. *In:* YANKO-HOMBACH, V., GILBERT, A., PANIN, N. & DOLUKHANOV, P. (eds), *The Black Sea Flood Question: Changes in Coastline, Climate, and Human Settlement*. NATO Science Series IV - Earth and Environmental Sciences, Kluwer Academic Press, 149–205, Springer, Dordrecht, the Netherlands.

Appendix 1

Foraminiferal data of the studied cores from the SW Black Sea shelf (Data of cores 5, WB5 and WB7 are given as separate tables below, due to their higher diversity).

	Core number (depth-cm)	*Ammoscalaria runiana* (Heron-Allen & Earland)	*Textularia agglutinans* (d'Orbigny)	*Textularia bocki*Höglund	*Quinqueloculina* cf. *angulna* (Terquem)	*Quinqueloculina seminula* (Linné)	*Quinceloculina* sp.	*Pyrgo anomala anomala* (Schlumberger)	*Pyrgo elongata* (d'Orbigny)	*Pyrgo inornata* (d'Orbigny)	*Pyrgo williamsoni* (Silvestri)	*Pyrgo* sp.	*Triloculina adriatica* Le Calvez , J. & Y.	*Triloculina* sp.	*Polymorphina* sp.	*Lobatula Lobatula* (Walker and Jacob)	*Lobatula* sp.	*Ammonia compacta* Hofker	*Ammonia parasovica* Stschedrina & Mayer	*Ammonia parkinsoniana* (d'Orbigny)	*Ammonia tepida* Cushman	*Ammonia* sp.	*Cribroelphidium decipiens* (Costa)	*Elphidium granosum* (d'Orbigny)	*Elphidium macellum* (Fichtel & Moll)	*Elphidium punctatum* (Terquem)	*Elphidium* sp.	Total Benthic Foraminifera (TBF)I	Benthic Assemblages
1	20				1	72												1425	219	86	85	68	9	5	6		1	1977	
	30				6	65									1			1648	119	77	64	71			10			2061	
	40					16												1611	71	69	35	42			14		2	1860	BF1
	50					8												1626	58	45	20	35			12		4	1808	
	57					14										4		1428	46	81	14	28			10		3	1628	
2	6	2	4		24	892	61	8	16	11		9	3	3		104	15	3852	76		102	63			348		44	5637	BF1
	10		1	6	41	488	31	10	20	12		10	18	2		304	18	2264	62		164	57			176		34	3718	
	15		6	4	22	472	51	12	26	21		5	8	3		95	14	1764	56		54	51			168		27	2859	
	20		2		42	1036	62	19	18	11		8	12	5	1	102	16	3272	91		38	71			136		19	4961	
	25		1	2	28	708	29	16	27	8		6	17	4	1	44	12	3168	69		62	59			196		16	4473	
	30		2		21	496	35	9	32	12		6	21	2		38	8	1968	52		74	67			68		11	2922	
	35			3	12	768	42	7	19	16		4	7	2		78	11	2108	48		58	75			91		23	3372	
	40				18	578	71	3	8	7		8		3		24	7	1544	35		66	72			72		18	2534	
	45		2	2	16	624	37	12	22	9		7	6	4		42	9	1714	44		45	54			82		24	2755	
	50				19	646	22	13	23	11		5		3		35	12	1192	28		64	48			102		21	2244	
	55				50	750	26	18	21	15		9	22	5		25	6	2252	96		98	62			131		33	3619	
	60				92	938	28	16	41	15		2		3		64	13	2318	33		74	59			184		25	3905	
	65			3	24	344	19	11	16	10		1		5		32	5	1364	46		38	45			136		46	2145	

Core number (depth-cm)	*Ammoscalaria runiana* (Heron-Allen & Earland)	*Textulaira agglutinans* (d'Orbigny)	*Textularia bocki*Höglund	*Quinqueloculina* cf. *angulna* (Terquem)	*Quinqueloculina seminula* (Linné)	*Quinqueloculina* sp.	*Pyrgo anomala anomala* (Schlumberger)	*Pyrgo elongata* (d'Orbigny)	*Pyrgo inornata* (d'Orbigny)	*Pyrgo williamsoni* (Silvestri)	*Pyrgo* sp.	*Triloculina adriatica* Le Calvez , J. & Y.	*Triloculina* sp.	*Polymorphina* sp.	*Lobatula Lobatula* (Walker and Jacob)	*Lobatula* sp.	*Ammonia compacta* Hofker	*Ammonia parasovica* Stschedrina & Mayer	*Ammonia parkinsoniana* (d'Orbigny)	*Ammonia tepida* Cushman	*Ammonia* sp.	*Cribroelphidium decipiens* (Costa)	*Elphidium granosum* (d'Orbigny)	*Elphidium macellum* (Fichtel & Moll)	*Elphidium punctatum* (Terquem)	*Elphidium* sp.	Total Benthic Foraminifera (TBF)I	Benthic Assemblages
70		6	2	18	1136	57	24	48	16		6	8	4		144	25	184	92		162	49				190		51	2222	
75		1		22	1442	63	26	72	19		4	12	3		178	26	3428	172		158	63				172		43	5904	
80	1	4	2	26	1834	72	32	96	42		2	14	2		190	31	3648	228		165	75				224		51	6739	
3																													
10																	3	6		1	1							11	BF1
20																	11	7										18	
30																	26	67		17								110	
40					8													657		100	5							770	
50																		412		18								430	
60																	2	348		34								384	
70																	1	196		40								237	
80					1									1			3	150		17								172	
90					1												3	157		12	11							184	
100																	21	2										23	
110															1		10	2										13	
120							1								1		16	2					1					21	
130					3	3											18	1		1								26	
140				1	1		2	1							2		78	1		2	2							90	
150					2	4									1		45	3		4								59	
160					8		3								4		139	4		9	4				3			174	
170					1	8		3									169	9		10								200	
180																	13	2										15	
190																	67	5										72	
200																	18	14		2								34	

Core number (depth-cm)	*Ammoscalaria runiana* (Heron-Allen & Earland)	*Textularia agglutinans* (d'Orbigny)	*Textularia bocki*Höglund	*Quinqueloculina* cf. *angulna* (Terquem)	*Quinqueloculina seminula* (Linné)	*Quinceloculina* sp.	*Pyrgo anomala anomala* (Schlumberger)	*Pyrgo elongata* (d'Orbigny)	*Pyrgo inornata* (d'Orbigny)	*Pyrgo williamsoni* (Silvestri)	*Pyrgo* sp.	*Triloculina adriatica* Le Calvez , J. & Y.	*Triloculina* sp.	*Polymorphina* sp.	*Lobatula lobatula* (Walker and Jacob)	*Lobatula* sp.	*Ammonia compacta* Hofker	*Ammonia parasovica* Stschedrina & Mayer	*Ammonia parkinsoniana* (d'Orbigny)	*Ammonia tepida* Cushman	*Ammonia* sp.	*Cribroelphidium decipiens* (Costa)	*Elphidium granosum* (d'Orbigny)	*Elphidium macellum* (Fichtel & Moll)	*Elphidium punctatum* (Terquem)	*Elphidium* sp.	Total Benthic Foraminifera (TBF)I	Benthic Assemblages
210															1		3	1										5	
213																	6	5		3								14	
4																													
10					2									1			10	10		1					1			25	
20					4			2							1		20											27	
30																	1			1								2	
40																	3	8										11	
50						1				1							13											15	
60					2			1							1	1	16	1										22	
70						1	1	2									18	10		2					1			35	BF1
80					4	1									2		27				1							35	
90					1										1		20			1								23	
100					5		2	1							2		16	15		4					1			46	
110						1											1											2	
120					1			1										4										6	
130																	3	38		4								45	
140															2		23	9			1							35	BF2
150																	12	76		7								95	
160																	12	76		13								101	
170																	1	45		13								59	
180																		76		11								87	
190							1			1							2	133		9	1							147	
200							1										1	202		13	2							218	
210																	38	902		52								992	

Core number (depth-cm)	*Ammoscalaria runiana* (Heron-Allen & Earland)	*Textularia agglutinans* (d'Orbigny)	*Textularia bocki*Höglund	*Quinqueloculina* cf. *angulna* (Terquem)	*Quinqueloculina seminula* (Linné)	*Quinqueloculina* sp.	*Pyrgo anomala anomala* (Schlumberger)	*Pyrgo elongata* (d'Orbigny)	*Pyrgo inornata* (d'Orbigny)	*Pyrgo williamsoni* (Silvestri)	*Pyrgo* sp.	*Triloculina adriatica* Le Calvez , J. & Y.	*Triloculina* sp.	*Polymorphina* sp.	*Lobatula Lobatula* (Walker and Jacob)	*Lobatula* sp.	*Ammonia compacta* Hofker	*Ammonia parasovica* Stschedrina & Mayer	*Ammonia parkinsoniana* (d'Orbigny)	*Ammonia tepida* Cushman	*Ammonia* sp.	*Cribroelphidium decipiens* (Costa)	*Elphidium granosum* (d'Orbigny)	*Elphidium macellum* (Fichtel & Moll)	*Elphidium punctatum* (Terquem)	*Elphidium* sp.	Total Benthic Foraminifera (TBF)l	Benthic Assemblages
220																	3	247		45								295	
230																		104		21	1							126	
238																		22		2								24	
7																													
5				2													115		3	7								127	
10																	325	1	3	10								339	
15				3	1												389	2	4	7								406	
20				4													633	1	2	10								650	
25				1	1												450	2	3	6								463	
30																	499		1	2								502	
35				5	1												1068	1	1	22								1098	BF1
40				41	1												640	2	1	15								700	
45				7													305	1		10								323	
50				6	6												494		15	8								529	
55				52	1												1417	2	19	18								1509	
60				42	5												1777	3	26	13								1866	
64				4													96	4		4								108	
70																	112		1	7								120	BF2
75					1												75		8	6								90	
80				3													161			5								169	
90																	40		1	3								44	
100																	4											4	
110																	2	6		9								17	
120				3	1				1								5	6	1									17	

Core number (depth-cm)	130	140	**8**
Ammoscalaria runiana (Heron-Allen & Earland)			
Textularia agglutinans (d'Orbigny)			
Textularia bockHöglund			
Quinqueloculina cf. *angulna* (Terquem)	1	1	
Quinqueloculina seminula (Linné)	2	1	
Quinqueloculina sp.			
Pyrgo anomala anomala (Schlumberger)			
Pyrgo elongata (d'Orbigny)		1	
Pyrgo inornata (d'Orbigny)			
Pyrgo williamsoni (Silvestri)			
Pyrgo sp.			
Triloculina adriatica Le Calvez , J. & Y.			
Triloculina sp.			
Polymorphina sp.			
Lobatula Lobatula (Walker and Jacob)			
Lobatula sp.			
Ammonia compacta Hofker			3 4 1 2 2 2 6 1 5 5 6 4 1 5 3 2 1 1 1 6 15 19
Ammonia parasovica Stschedrina & Mayer	2		
Ammonia parkinsoniana (d'Orbigny)	1	2	
Ammonia tepida Cushman		1	1 4 1 1 1 1
Ammonia sp.			
Cribroelphidium decipiens (Costa)			
Elphidium granosum (d'Orbigny)			
Elphidium macellum (Fichtel & Moll)			
Elphidium punctatum (Terquem)			
Elphidium sp.			
Total Benthic Foraminifera (TBF)I	6	6	4 4 5 2 2 2 6 1 5 5 6 5 1 6 3 3 1 3 6 15 20
Benthic Assemblages			BFI

Core number (depth-cm)	220	230	240	9	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180	190
Ammoscalaria runiana (Heron-Allen & Earland)																							
Textulaira agglutinans (d'Orbigny)																							
*Textularia bocki*Höglund																							
Quinqueloculina cf. *angulna* (Terquem)																							
Quinqueloculina seminula (Linné)																							
Quinceloculina sp.																							
Pyrgo anomala anomala (Schlumberger)																							
Pyrgo elongata (d'Orbigny)																							
Pyrgo inornata (d'Orbigny)																							
Pyrgo williamsoni (Silvestri)																							
Pyrgo sp.																							
Triloculina adriatica Le Calvez , J. & Y.																							
Triloculina sp.																							
Polymorphina sp.																							
Lobatula Lobatula (Walker and Jacob)																							
Lobatula sp.																							
Ammonia compacta Hofker	3	5	3		7	3	10	12	1	1	1						20						
Ammonia parasovica Stschedrina & Mayer																							
Ammonia parkinsoniana (d'Orbigny)																							
Ammonia tepida Cushman	1				1						1						1						
Ammonia sp.																1							
Cribroelphidium decipiens (Costa)																							
Elphidium granosum (d'Orbigny)																							
Elphidium macellum (Fichtel & Moll)																							
Elphidium punctatum (Terquem)																							
Elphidium sp.																							
Total Benthic Foraminifera (TBF)l	4	5	3		8	3	10	12	1	1	2					1	21						
Benthic Assemblages					BF1																		

Core number (depth-cm)	*Ammoscalaria runiana* (Heron-Allen & Earland)	*Textulaira agglutinans* (d'Orbigny)	*Textularia bock*Höglund	*Quinqueloculina* cf. *anguina* (Terquem)	*Quinqueloculina seminula* (Linné)	*Quincueloculina* sp.	*Pyrgo anomala anomala* (Schlumberger)	*Pyrgo elongata* (d'Orbigny)	*Pyrgo inornata* (d'Orbigny)	*Pyrgo williamsoni* (Silvestri)	*Pyrgo* sp.	*Triloculina adriatica* Le Calvez , J. & Y.	*Triloculina* sp.	*Polymorphina* sp.	*Lobatula Lobatula* (Walker and Jacob)	*Lobatula* sp.	*Ammonia compacta* Hofker	*Ammonia parasovica* Stschedrina & Mayer	*Ammonia parkinsoniana* (d'Orbigny)	*Ammonia tepida* Cushman	*Ammonia* sp.	*Cribroelphidium decipiens* (Costa)	*Elphidium granosum* (d'Orbigny)	*Elphidium macellum* (Fichtel & Moll)	*Elphidium punctatum* (Terquem)	*Elphidium* sp.	Total Benthic Foraminifera (TBF)l	Benthic Assemblages
200																												
210																												
212																												
10																												
10																									2	3	5	BF1
15																		1									1	
20																												
25																	2										2	
30																	3							3		2	8	
35																									1	2	3	BF3
40																												
45																												
50																	1										1	
55																												
11																												
10																		4									4	BF1
20																	5	1									6	
30																		2									2	
40																	6			2							8	
50																	4			3							7	
60																	2			3							5	
70																	4			3							7	
80																	4			2							6	
90																	7				2						9	

Core number (depth-cm)	*Ammoscalaria runiana* (Heron-Allen & Earland)	*Textulaira agglutinans* (d'Orbigny)	*Textularia bockHöglund*	*Quinqueloculina* cf. *angulna* (Terquem)	*Quinqueloculina seminula* (Linné)	*Quinqueloculina* sp.	*Pyrgo anomala anomala* (Schlumberger)	*Pyrgo elongata* (d'Orbigny)	*Pyrgo inornata* (d'Orbigny)	*Pyrgo williamsoni* (Silvestri)	*Pyrgo* sp.	*Triloculina adriatica* Le Calvez , J. & Y.	*Triloculina* sp.	*Polymorphina* sp.	*Lobatula Lobatula* (Walker and Jacob)	*Lobatula* sp.	*Ammonia compacta* Hofker	*Ammonia parasovica* Stschedrina & Mayer	*Ammonia parkinsoniana* (d'Orbigny)	*Ammonia tepida* Cushman	*Ammonia* sp.	*Cribroelphidium decipiens* (Costa)	*Elphidium granosum* (d'Orbigny)	*Elphidium macellum* (Fichtel & Moll)	*Elphidium punctatum* (Terquem)	*Elphidium* sp.	Total Benthic Foraminifera (TBF)l	Benthic Assemblages
100																	4	2		5		1						12	
108																	5	1		2								8	
115																	7			1								8	
120					1												1											2	
130																	1			1								2	
138																	10			12								22	
144																	7			3								10	
150																	1			1								2	
160																	2											2	
168																	2											2	
175																	3			5								8	
180																													
190																	2											2	
200																	5			5								10	
210					1												2			1								4	
220																				2								2	
228																	1			1								2	
12																													
10																	7			1								8	BF1
20																	3											3	
30																	10											10	
40																	12											12	
50																	1											1	
60																	1											1	

Core number (depth-cm)	*Ammoscalaria runiana* (Heron-Allen & Earland)	*Textularia agglutinans* (d'Orbigny)	*Textularia bocki*Höglund	*Quinqueloculina* cf. *angulina* (Terquem)	*Quinqueloculina seminula* (Linné)	*Quinqueloculina* sp.	*Pyrgo anomala anomala* (Schlumberger)	*Pyrgo elongata* (d'Orbigny)	*Pyrgo inornata* (d'Orbigny)	*Pyrgo williamsoni* (Silvestri)	*Pyrgo* sp.	*Triloculina adriatica* Le Calvez , J. & Y.	*Triloculina* sp.	*Polymorphina* sp.	*Lobatula Lobatula* (Walker and Jacob)	*Lobatula* sp.	*Ammonia compacta* Hofker	*Ammonia parasovica* Stschedrina & Mayer	*Ammonia parkinsoniana* (d'Orbigny)	*Ammonia tepida* Cushman	*Ammonia* sp.	*Cribroelphidium decipiens* (Costa)	*Elphidium granosum* (d'Orbigny)	*Elphidium macellum* (Fichtel & Moll)	*Elphidium punctatum* (Terquem)	*Elphidium* sp.	Total Benthic Foraminifera (TBF)l	Benthic Assemblages
70																	12			2								14	
80																	80											80	
90																	105											105	
100																	24			1	1							26	
110																	146			5								151	
120																	33											33	
130																	38			1					1			40	
140																	505			7								512	
150																	121											121	
160																	395				5							400	
170																	357			3								360	
180																	284			1								285	
190																	44											44	
200																	51											51	
210																	90			5								95	
220																	64				1							65	
230																	91			6							1	98	
240				1													312			5								318	
246				1													216			2								219	
13																													
10					4												231	1		27	21							284	
20					2												156	1		17	15				4			195	
30					1												252	2		22	12							289	BF1
40																	1160	9		26	30							1225	

Core number (depth-cm)	*Ammoscalaria runiana* (Heron-Allen & Earland)	*Textulaira agglutinans* (d'Orbigny)	*Textularia bocki*Höglund	*Quinqueloculina* cf. *angulna* (Terquem)	*Quinqueloculina seminula* (Linné)	*Quinceloculina* sp.	*Pyrgo anomala anomala* (Schlumberger)	*Pyrgo elongata* (d'Orbigny)	*Pyrgo inornata* (d'Orbigny)	*Pyrgo williamsoni* (Silvestri)	*Pyrgo* sp.	*Triloculina adriatica* Le Calvez , J. & Y.	*Triloculina* sp.	*Polymorphina* sp.	*Lobatula Lobatula* (Walker and Jacob)	*Lobatula* sp.	*Ammonia compacta* Hofker	*Ammonia parasovica* Stschedrina & Mayer	*Ammonia parkinsoniana* (d'Orbigny)	*Ammonia tepida* Cushman	*Ammonia* sp.	*Cribroelphidium decipiens* (Costa)	*Elphidium granosum* (d'Orbigny)	*Elphidium macellum* (Fichtel & Moll)	*Elphidium punctatum* (Terquem)	*Elphidium* sp.	Total Benthic Foraminifera (TBF)l	Benthic Assemblages
50																	414	3		19	16				2			454	
60																	471	1		8	26				1			507	
70																	150			1	15							166	
80																	397	1		5	21				1			425	
90																	549	1		18	12							580	
100																	148	1		8	7				1			165	
110																	155			5	6				1			167	
120						4											74	1		13	9							101	
130																	155			4	14							173	
140																	460	1		4	18							483	
150																	141	2		1	11							155	
160																	128	1		2	13							144	
170																	115	2		2	8							127	
180																	96			1	10							107	
190																	176	2		1	7							186	
200											1						186			1	19							207	
210																	328	2			17							347	
220																	403	2		2	25							432	
230																	12	5		4	2							23	BF2
240																	6	4		1								11	
14																													
10																	1											1	
20																	1											1	
30																													

Core number (depth-cm)	*Ammoscalaria runiana* (Heron-Allen & Earland)	*Textularia agglutinans* (d'Orbigny)	*Textularia bocki*Höglund	*Quinqueloculina* cf. *angulina* (Terquem)	*Quinqueloculina seminula* (Linné)	*Quinqueloculina* sp.	*Pyrgo anomala anomala* (Schlumberger)	*Pyrgo elongata* (d'Orbigny)	*Pyrgo inornata* (d'Orbigny)	*Pyrgo williamsoni* (Silvestri)	*Pyrgo* sp.	*Triloculina adriatica* Le Calvez , J. & Y.	*Triloculina* sp.	*Polymorphina* sp.	*Lobatula Lobatula* (Walker and Jacob)	*Lobatula* sp.	*Ammonia compacta* Hofker	*Ammonia parasovica* Stschedrina & Mayer	*Ammonia parkinsoniana* (d'Orbigny)	*Ammonia tepida* Cushman	*Ammonia* sp.	*Cribroelphidium decipiens* (Costa)	*Elphidium granosum* (d'Orbigny)	*Elphidium macellum* (Fichtel & Moll)	*Elphidium punctatum* (Terquem)	*Elphidium* sp.	Total Benthic Foraminifera (TBF)l	Benthic Assemblages
40																	4			1	2							7	
50																	2											2	
60																	2											2	
70																	2											2	
80																													
90																	1											1	
100																	1											1	
110																	1											1	
120																	1			2								3	
130																	27			3								30	
140																	1											1	BF1
150																	2											2	
160																	6			1	1							8	
170																	1			1								2	
180																	2											2	
190																	2											2	
200																	31				2							33	
210																	23											23	
220																	67			2	2							71	
230																	31				1							32	
243																	52			2	2							56	
15																													
5																	6	4										10	
10																	2	7			1							10	

Core number (depth-cm)	20	30	40	50	60	70	74
Ammoscalaria runiana (Heron-Allen & Earland)							
Textulaira agglutinans (d'Orbigny)							
*Textularia bocki*Höglund							
Quinqueloculina cf. *anguina* (Terquem)							
Quinqueloculina seminula (Linné)							
Quinceloculina sp.							
Pyrgo anomala anomala (Schlumberger)							
Pyrgo elongata (d'Orbigny)							
Pyrgo inornata (d'Orbigny)							
Pyrgo williamsoni (Silvestri)							
Pyrgo sp.							
Triloculina adriatica Le Calvez , J. & Y.							
Triloculina sp.							
Polymorphina sp.							
Lobatula Lobatula (Walker and Jacob)							
Lobatula sp.							
Ammonia compacta Hofker	2	36	3			3	
Ammonia parasovica Stschedrina & Mayer	9	3			1		
Ammonia parkinsoniana (d'Orbigny)							
Ammonia tepida Cushman		3	1	1	3	5	
Ammonia sp.			1				
Cribroelphidium decipiens (Costa)							
Elphidium granosum (d'Orbigny)							
Elphidium macellum (Fichtel & Moll)							
Elphidium punctatum (Terquem)							
Elphidium sp.							
Total Benthic Foraminifera (TBF)l	11	42	5	1	4	8	
Benthic Assemblages	BF1				BF2		

Core 5 (depth - cm)	*Ammoscalaria runiana* (Heron-Allen & Earland)	*Textularia agglutinans* (d'Orbigny)	*Adolosina mediettterranensis* (Le Calvez, J. & Y.)	*Adelosina* sp.	*Massilina gualtieriana* (d'Orbigny)	*Quinqueloculina* cf. *angulina* (Terquem)	*Quinqueloculina laevigata* d'Orbigny	*Quinqueloculina* cf. *lamarckiana* (d'Orbigny)	*Quinqueloculina seminula* (Linné)	*Quinculeloculina* spp.	*Pseudotriloculina rotunda* (d'Orbigny)	*Pyrgo anomala* (Schlumberger)	*Pyrgo elongata*(d'Orbigny)	*Pyrgo inornata* (d'Orbigny)	*Pyrgo* sp.	*Triloculina adriatica* (Le Calvez, J. & Y.)	*Polymorphina* sp.	*Uvigerina mederranea* Hofker	*Valvulineria bradyana* (Fornasini)	*Lobatula Lobatula* (Walker & Jacob)	*Lobatula* spp.	*Planorbulina mediterranensis* d'Orbigny	*Ammonia compacta* Hofker	*Ammonia parasovica* Stshedrina & Mayer	*Ammonia tepida* Cushman	*Ammonia* spp.	*Elphidium macellum* (Fichtel & Moll)	*Elphidium* spp.	Total Benthic Foraminifera (TBF)	Benthic Assemblages
5																															
10	3					29	15		470	5	4	4	12	6	1	6							2	1317	28	39	21	315	14	2359		
15			1	1	3	31	2		832	42		1	3			3				26	3	8		1018	17	23	19	846	32	2903		
20				1		12	11		357	65		3	5	1		4				23	5	11		1179	20	11	24	124	12	1857		
25				1		8	4		277	25		4	6	2		3			3	10	2	6		905	15	6	21	22	7	1321	BF1b	
30		1				5	2		261	31	1	2	23	2		1	1			5		9		835	8	9	23	28	14	1252		
35						5	1		47	11		1	3	1						39	6	8		738	25	8	31	6	3	925		
40						35	2		12	50			1							8	2	5		792	42	5	25	7	2	983		
45						51	6		22	7								1		1		8		776	40	8	12	7	1	932		
50						543	1	3	44	11		1	3											757	159	55	32	2		1611		
55						128		4	21	56														621	286	104	21	3		1244	BF2	
60						150		4	44	9														572	194	53	12	4		1042		
65										17														375	11	9	5	13		430		

Core WBS (depth-cm)	*Eggerelloides advenus* (Cushman)	*Spiroplectammina sagittula* (d'Orbigny)	*Textularia agglutinans* d'Orbigny	*Textularia pala* Czjzek	*Textularia* sp.	*Adelosina elegans* (Williamson)	*Adelosina* spp.	*Quinqueloculina annesteneS* (Schkumberger)	*Quinqueloculina bertheloti**ana* d'Orbigny	*Quinqueloculina laevigata* d'Orbigny	*Quinqueloculina limbata* d'Orbigny	*Quinqueloculina seminula* (Linné)	*Quinqueloculina* cf. *angui**na* (Terquem)	*Miliolinella* cf. *labiosa* (d'Orbigny)	*Miliolinella subrotunda* (Montagu)	*Pygo elongata* (d'Orbigny)	*Pygo inornata* (d'Orbigny)	*Triloculina adriatica* Le Calvez, J. ve Y.	*Triloculina* sp.	*Stomatorbina* sp.	*Lobatula Lobatula* (Walker & Jacob)	*Rosalina floridensis* (Cushman)	*Rosalina* sp.	*Planorbulina mediterranensis* d'Orbigny	*Ammonia compacta* Hofker	*Ammonia parasovica* Stschedrina & Mayer	*Ammonia tepida* Cushman	*Elphidium macellum* (Fichtel & Moll)	*Elphidium* sp	Total Benthic Foraminifera (TBF)	Benthic Assemblages
10	1	1		2		1						80			1	20	1	2		2	7			71	4			194		
20			1				2	1	1			22			2	17		1	2		8		2	89		2		5	157		
30									1			38			5	11			1		2			46				1	104		
40	1									3		63			4	10		1	1		5			69			3	4	163	BF1	
50										3		31	1		4	8		1	2		7	1		75			2		137		
60												53			3	11			1					93	3		2	6	172		
70					1					6		38			3	12					10			65	3		4	2	143		
80	2								1		1	80			3	29			2		8			126	4		6	1	266		

Core WB7 (depth-cm)	*Spiroplectammina sagittula* (d'Orbigny)	*Spiroplectammina* cf. *taiwanica* Chang	*Spiroplectammina wrightii* (Silvestri)	*Textularia agglutinans* d'Orbigny	*Textularia bocki* Höglund	*Textularia calva* Lalicker	*Textularia conica* d'Orbigny	*Textularia* sp.	*Textularia* spp.	*Adelosina clarensis* (Heron-Allen & Earland)	*Adelosina* sp.	*Adelosina* spp.	*Spiroloculina depressa* d'Orbigny	*Lachlanella bicornis* (Walker & Jacob)	*Lachlanella* sp.	*Quinqueloculina* cf. *angulina* (Terquem)	*Quinqueloculina annectens* (Schkumberger)	*Quinqueloculina laevigata* d'Orbigny	*Quinqueloculina lamarckiana* d'Orbigny	*Quinqueloculina lata* (Terquem)	*Quinqueloculina limbata* d'Orbigny	*Quinqueloculina seminula* (Linné)	*Quinqueloculina* cf. *ungeriana* d'Orbigny	*Quinqueloculina* cf. *viennensis* Le Calvez, J. & Y.	*Quinqueloculina vulgaris* d'Orbigny	*Quinqueloculina* sp.	*Miliolinella dilatata* (d'Orbigny)	*Miliolinella cf. labiosa* (d'Orbigny)	*Miliolinella subrotunda* (Montagu)
10																													
20																													
30					1	1				1		2		1	1		2		3				8				5		1
40	1				1						1							1	3		6		23				3	1	
50					1											1			4				17						
60																			4				10				11		
70									2								2		10	5			19	2		1			1
80	1	2			1					1					1		1			1		1	5	1	3				
90		2		1			1				1			1		1						1	37	72	2	2			
10			2				1			1			1				2					1	5	20	1			1	4
0																													

Core WB7 (continued, depth-cm)	*Pyrgo elongata* (d'Orbigny)	*Pyrgo anomala* (Schlumberger)	*Pyrgo inornata* (d'Orbigny)	*Pyrgo* sp.	*Triloculina adriatica* Le Calvez, J.& Y.	*Triloculina* sp.	*Parrina bradyi* (Millett)	*Polymorphina* sp.	*Epnonides concameratus* (Williamson)	*Stomatorbina* sp.	*Rosalina bradyi* Cushman	*Rosalina floridensis* Cushman	*Rosalina* sp.	*Lobatula Lobatula* (Walker & Jacob)	*Lobatula* sp.	*Hanzawaia* sp.	*Ammonia beccarii* (Linné)	*Ammonia compacta* Hofker	*Ammonia parasovica* Stshedrina & Mayer	*Ammonia parkinsoniana* (d'Orbigny)	*Ammonia tepida* Cushman	*Elphidium macellum* (Fichtel & Moll)	Total Benthic Foraminifera (TBF)	Benthic Assemblages
10					2	1		1				1		4				36	5	1		4	55	
20														2				47	7			8	74	
30			2		2							2		3		1		135	6	1		20	214	BF1b
40		1										3	2	6				120	5			12	177	
50					2								1	1				35	1	1		6	64	
60	6		1		4			1						3				98	5	1		16	183	
70									1			1			1			14				2	27	
80		1	1		1						1		3	7	3		2	114	3			29	229	BF2
90	8	2	3		6	3		1				2	2	6	2			185	16		1	38	360	
100	1	2	2	1	5	0	1			3				10				235	18	3	2	26	343	

Appendix 2a

Pelecypoda data of the studied cores from the SW Black Sea shelf.

	Core numbers (depth-cm)	*Nucula (N.) nucleus* (Linne)	*Modiolus adriaticus* (Lamarck)	*Modiolus phaseolinus* (Philippi)	*Modiolus* sp.	*Myrtilaster* sp.	*Myrtilaster lineatus* (Gmelin)	*Mytilus edulis* (Linne)	*Mytilus galloprovincialis* (Lamark)	*Mytilus* sp.	*Lucinella divaricata* (Linne)	*Thyasira flexuosa* (Montagu)	*Acanthocardia paucicostata* (Sowerby)	*Cardium* sp.	*Cardium (p.) papillosum smile* Mil.	*Cerastoderma* sp.	*Cerastoderma edule* (Linne)	*Parvicardium exiguum* (Gmelin)	*Monocanta caspia caspia* (Eichwaldi)	*Spisula sp.*	*Spisula (S.) subtruncata triangula* (Renier)	*Scrobicularia* sp.	*Scrobicularia plana (da Costa)*	*Abra alba* (W. Wood)	*Dreissena polymorpha* (Palas)	*Dreissena rostriformis distincta* Andrussow	*Dreissena* sp.	*Chione (C.) gallina* (Linne)	*Dosinia lupinus* (Linne)	*Gafrarium (C.) minimum* (Montagu)	*Paphia* sp.	*Paphia rugata rugata* (B.D.D.)	*Paphia (P.) senescans* (Coccconi)	*Paphia (P.) discrepans* (Mil.)	*Paphia (P.) discrepans anapensis* Nevesskaja	*Pitar (P.) rudis* (Poli)	*Corbula (V.) gibba* (Olivi)	Total Pelecypoda (TP)	Benthic Assemblages
1	20																	2			2								2		1						7	
	30									3	1							4			5							2								1	26	
	40					2				2								4			4															14	BF1
	50										2				1		3	3				1						1	5							16	
	57																				3							2						1		6	
2																																							
	6	2								5								4			8			6			4							2	1	32	BF1
	10				3					4					1						17				4			4						2	5	55	
	15			4						2								6			15	5			2											34	
	20	2								1											6	2		4											1	16	
	25	3			1	1				3								15	1		22	13			9			3						1	15	90	
	30	5								4		1						10			13	7			7				1						5	53	
	35	3					2				1	1						8			8	10			8		1	1							6	49	
	40	2			1		1			2	1							14			36			4	9	5		3							6	84	
	45	1			1		2			2								4	2		2	8			6				1					2	3	34	
	50	1			1					1	1							7	1		20	1			6			2							12	53	
	55	3			1					1	1							6	2		5	1			10				1							31	
	60	2			1					3	1							15	1		14	4			4			1							4	50	
	65									3	1							2	2		2				2										4	16	
	75	2			2					3	1				10			5	6		55	12			11			2							4	11	
	80	1								6	1						1	5	3		18	21													5	3	
3																																							
	10		1					5										1												1						8	BF1

Core numbers (depth-cm)	*Nucula (N.) nucleus* (Linne)	*Modiolus adriaticus* (Lamarck)	*Modiolus phaseolinus* (Philippi)	*Modiolus* sp.	*Mytilaster* sp.	*Mytilaster lineatus* (Gmelin)	*Mytilus edulis* (Linne)	*Mytilus galloprovincialis* (Lamark)	*Mytilus* sp.	*Lucinella divaricata* (Linne)	*Thyasira flexuosa* (Montagu)	*Acanthocardia paucicostata* (Sowerby)	*Cardium* sp.	*Cardium (p.) papillosum smile* Mill.	*Cerastoderma* sp.	*Cerastoderma edule* (Linne)	*Parvicardium exiguum* (Gmelin)	*Monodacna caspia caspia* (Eichwaldi)	*Spisula sp.*	*Spisula (S.) subtruncata triangula* (Reniер)	*Scrobicularia* sp.	*Scrobicularia plana (da Costa)*	*Abra alba* (W. Wood)	*Dreissena polymorpha* (Palas)	*Dreissena rostriformis distincta* Andrussow	*Dreissena* sp.	*Chione (C.) gallina* (Linne)	*Dosinia lupinus* (Linne)	*Gafrarium (C.) minimum* (Montagu)	*Paphia* sp.	*Paphia rugata rugata* (B.D.D.)	*Paphia senescans* (Coccoini)	*Paphia (P.) discrepans* (Mil.)	*Paphia (P.) discrepans anapensis* Nevesklaja	*Pitar (P.) rudis* (Poli)	*Corbula (V.) gibba* (Olivi)	Total Pelecypoda (TP)	Benthic Assemblages
20				2																																2	
30				2																																2	
40		2					1		2									3			3														4	18	
50		4					1										5																			10	
60		1																																		1	
70																																					
80					1		1	1									1																			40	
90																			2		2				4	14	8									26	
100																										25	18									43	
110				5													5						7		7	11										35	
120		16															3							9												28	
130		6															3						17													26	
140		12	10	25													8				11		8	5												79	
150			17														5				10		15	2												49	
160									1												2			4												7	
170																																					
180							3		3								1				7		1												15	
190																											1		1							2	
200									2																											2	
213		5										1																								6	
4																																					
30																							1													1	
80			1																				1													2	
90			30																				1													31	BF1
100		2																																		2	
110									5																											5	
120									12																											12	

Core numbers (depth-cm)	*Nucula (N.) nucleus* (Linne)	*Modiolus adriaticus* (Lamarck)	*Modiolus phaseolinus* (Philippi)	*Modiolus* sp.	*Mytilaster* sp.	*Mytilaster lineatus* (Gmelin)	*Mytilus edulis* (Linne)	*Mytilus galloprovincialis* (Lamark)	*Mytilus* sp.	*Lucinella divaricata* (Linne)	*Thyasira flexuosa* (Montagu)	*Acanthocardia paucicostata* (Sowerby)	*Cardium* sp.	*Cardium (P.) papillosum smile* Mill.	*Cerastoderma* sp.	*Cerastoderma edule* (Linne)	*Parvicardium exiguum* (Gmelin)	*Monodacna caspia caspia* (Eichwaldi)	*Spisula sp.*	*Spisula (S.) subtruncata triangula* (Renier)	*Scrobicularia* sp.	*Scrobicularia plana (da Costa)*	*Abra alba* (W. Wood)	*Dreissena polymorpha* (Palas)	*Dreissena rostriformis distincta* Andrussow	*Dreissena* sp.	*Chione (C.) gallina* (Linne)	*Dosinia lupinus* (Linne)	*Gafrarium (C.) minimum* (Montagu)	*Paphia* sp.	*Paphia rugata rugata* (B.D.D.)	*Paphia (P.) senescans* (Cocconi)	*Paphia (P.) discrepans* Mill.)	*Paphia (P.) discrepans anapensis* Nevesskaja	*Pitar (P.) rudis* (Poli)	*Corbula (V.) gibba* (Olivi)	Total Pelecypoda (TP)	Benthic Assemblages
140									10																										12	
160			1						11								1																		13	
170					7				4																										13	
180									18								2									2	1								23	
190									4																			6							10	BF2
200									4																										4	
210									27																	2									29	
220									13								1										3							1	18	
230																																				
238																																				
5																																				
5									1								1			2	1				1										6	BF1
10			1						2								2			3	1						1								10	
15	2		1														3			3	2						1	1						1	14	
20									2																											2	
25																				2	1				1										4	
30			1														1			2					3	13									20	
40									7																			3							10	
45								10	10																	5	3								28	
50			4					7	12									13								1									24	
55						4			24								1										6							2	37	BF2
60									5								2		2		1			22	6	1									37	
65		1	1			1											2	3						20	16									44	
7																																				
5							12											13	16																41	BF1
10				3					5								2				9										2				26	
15				4														5			10														19	

Core numbers (depth-cm)	*Nucula (N.) nucleus* (Linne)	*Modiolus adriaticus* (Lamarck)	*Modiolus phaseolinus* (Philippi)	*Modiolus* sp.	*Mytilaster* sp.	*Mytilaster lineatus* (Gmelin)	*Mytilus edulis* (Linne)	*Mytilus galloprovincialis* (Lamark)	*Mytilus* sp.	*Lucinella divaricata* (Linne)	*Thyasira flexuosa* (Montagu)	*Acanthocardia paucicostata* (Sowerby)	*Cardium* sp.	*Cardium (p.) papillosum smile* Mil.	*Cerastoderma* sp.	*Cerastoderma edule* (Linne)	*Parvicardium exiguum* (Gmelin)	*Monodacna caspia caspia* (Eichwaldi)	*Spisula sp.*	*Spisula (S.) subtruncata triangula* (Reniер)	*Scrobicularia* sp.	*Scrobicularia plana (da Costa)*	*Abra alba* (W. Wood)	*Dreissena polymorpha* (Palas)	*Dreissena rostriformis distincta* Andrussow	*Dreissena* sp.	*Chione (C.) gallina* (Linne)	*Dosinia lupinus* (Linne)	*Gafrarium (C.) minimum* (Montagu)	*Paphia* sp.	*Paphia rugata rugata* (B.D.D.)	*Paphia (P.) senescans* (Cocconi)	*Paphia (P.) discrepans discrepans* (Mil.)	*Paphia (P.) discrepans anapensis* Nevesskaja	*Pitar (P.) rudis* (Poli)	*Corbula (V.) gibba* (Olivi)	Total Pelecypoda (TP)	Benthic Assemblages
20				2			11		7								26	18									1	2								1	68	
25								22									6		5																		33	
30			5						9								6			9													2				31	
35								13	3								13		8	5																	42	
40		1						6	5							1	6		11	2																	31	
45									9							1	1			2							1	2		4								20	
50									2								4			4								6									18	
55		2							5									1		7								1									16	
60									4								1	1		1									1								8	
64				1					2															2													5	
70					1				11								3			4				1				3									23	
75									5							1				6					4										1		21	
80				2					6								1			1																	10	
90									6				1																								7	
100									6								8								3												17	
110									10								3																			BF2	13	
120									16										11						8												35	
130						6	27									2	13								39	46											13	
141							43												35						359												43	
9																																					7	
10		1																																		BF1	1	
25							59													2																	61	
30																																						
40																																						
60																																						
70																																						

Core numbers (depth-cm)
Nucula (N.) nucleus (Linne)
Modiolus adriaticus (Lamarck)
Modiolus phaseolinus (Philippi)
Modiolus sp.
Mytilaster sp.
Mytilaster linearis (Gmelin)
Mytilus edulis (Linne)
Mytilus galloprovincialis (Lamark)
Mytilus sp.
Lucinella divaricata (Linne)
Thyasira flexuosa (Montagu)
Acanthocardia paucicostata (Sowerby)
Cardium sp.
Cardium (p.) papillosum smile Mll.
Cerastoderma sp.
Cerastoderma edule (Linne)
Parvicardium exiguum (Gmelin)
Monodacna caspia caspia (Eichwaldi)
Spisula sp.
Spisula (S.) subtruncata triangula (Henier)
Scrobicularia sp.
Scrobicularia plana (da Costa)
Abra alba (W. Wood)
Dreissena polymorpha (Palas)
Dreissena rostriformis distincta Andrussow
Dreissena sp.
Chione (C.) gallina (Linne)
Dosinia lupinus (Linne)
Gafrarium (C.) minimum (Montagu)
Paphia sp.
Paphia rugata rugata (B.D.D.)
Paphia (P.) senescans (Coccoini)
Paphia (P.) discrepans discrepans (Mll.)
Paphia (P.) discrepans anapensis Nevesskaja
Pitar (P.) rudis (Poli)
Corbula (V.) gibba (Olivi)
Total Pelecypoda (TP)
Benthic Assemblages
BF1
BF3
BF1

Core numbers (depth-cm)	30	40	50	60	70	100	115	120	130	138	150	160	168	180	220	228	230	12	20	30	40	50	60	70	100	110	120
																			BF1								
Nucula (N.) nucleus (Linne)	1																										
Modiolus adriaticus (Lamarck)																											
Modiolus phaseolinus (Philippi)																											
Modiolus sp.																											
Mytilaster sp.					1																						
Mytilaster lineatus (Gmelin)																											
Mytilus edulis (Linne)																											
Mytilus galloprovincialis (Lamark)																											
Mytilus sp.																											
Lucinella divaricata (Linne)																											
Thyasira flexuosa (Montagu)																											
Acanthocardia paucicostata (Sowerby)																											
Cardium sp.																											
Cardium (p.) papillosum smile Mil.																											
Cerastoderma sp.																											
Cerastoderma edule (Linne)																											
Parvicardium exiguum (Gmelin)	1			1			4		1	1										2		3		2			
Monodacna caspia caspia (Eichwaldi)																											
Spisula sp.																											
Spisula (S.) subtruncata triangula (Reniер)			1		2			1	5	2		2				3					6						
Scrobicularia sp.																											
Scrobicularia plana (da Costa)															2												
Abra alba (W. Wood)							2																				
Dreissena polymorpha (Palas)																											
Dreissena rostriformis distincta Andrussow						1																					
Dreissena sp.																											
Chione (C.) gallina (Linne)																											
Dosinia lupinus (Linne)																											
Gafrarium (C.) minimum (Montagu)																											
Paphia sp.																											
Paphia rugata rugata (B.D.D.)																											
Paphia (P.) senescans (Coccoini)																											
Paphia (P.) discrepans discrepans (Mil.)																											
Paphia (P.) discrepans anapensis Nevesskaja																											
Pitar (P.) rudis (Poli)																											
Corbula (V.) gibba (Olivi)																					3						
Total Pelecypoda (TP)	1		1	1	3	1	6	1	6	3		2			2	3				2	6	6		2		
Benthic Assemblages																											

Core numbers (depth-cm)	*Nucula (N.) nucleus* (Linne)	*Modiolus adriaticus* (Lamarck)	*Modiolus phaseolinus* (Philippi)	*Modiolus* sp.	*Myrtilaster* sp.	*Myrtilaster lineatus* (Gmelin)	*Mytilus edulis* (Linne)	*Mytilus galloprovincialis* (Lamarck)	*Mytilus* sp.	*Lucinella divaricata* (Linne)	*Thyasira flexuosa* (Montagu)	*Acanthocardia paucicostata* (Sowerby)	*Cardium* sp.	*Cardium (p.) papillosum smile* Mil.	*Cerastoderma* sp.	*Cerastoderma edule* (Linne)	*Parvicardium exiguum* (Gmelin)	*Monodacna caspia caspia* (Eichwaldi)	*Spisula sp.*	*Spisula (S.) subtruncata triangula* (Renier)	*Scrobicularia* sp.	*Scrobicularia plana (da Costa)*	*Abra alba* (W. Wood)	*Dreissena polymorpha* (Palas)	*Dreissena rostriformis distincta* Andrussow	*Dreissena* sp.	*Chione (C.) gallina* (Linne)	*Dosinia lupinus* (Linne)	*Gafrarium (C.) minimum* (Montagu)	*Paphia* sp.	*Paphia rugata* (B.D.D.)	*Paphia (P.) senescans* (Cocconi)	*Paphia (P.) discrepans* (Mil.)	*Paphia (P.) discrepans anapensis* Nevesskaja	*Pitar (P.) rudis* (Poli)	*Corbula (V.) gibba* (Olivi)	Total Pelecypoda (TP)	Benthic Assemblages
130																					6								6								6	
140																	1				2								1								4	
150																					4								4								4	
160					1																5								6								6	
170																					2								2								2	
180																																							
190																					3								3								3	
200																																							
210				1									2								2								5								5	
220					1																								1								1	
230																			1										1								1	
240					1																5								6								6	
246																			2		10								13	1							14	
13																																							
10																					1								1								1	
20																																							
30										1							1				3		1						6								6	
40																	1				2								3								3	
50									3												3								6								6	
90																	1				5								6								6	
110																																							BF1
140																	4				38		2					1	45									
150																					3								4									
180																					2							1	2									
210																	2												3									
220				2					1										5		1		2				1		12									
230									1							3	11	17			2			4					42									BF2

Core numbers (depth-cm)	*Nucula (N.) nucleus* (Linne)	*Modiolus adriaticus* (Lamarck)	*Modiolus phaseolinus* (Philippi)	*Modiolus* sp.	*Mytilaster* sp.	*Mytilaster lineatus* (Gmelin)	*Mytilus edulis* (Linne)	*Mytilus galloprovincialis* (Lamark)	*Mytilus* sp.	*Lucinella divaricata* (Linne)	*Thyasira flexuosa* (Montagu)	*Acanthocardia paucicostata* (Sowerby)	*Cardium* sp.	*Cardium (P.) papillosum smile* Mil.	*Cerastoderma* sp.	*Cerastoderma edule* (Linne)	*Parvicardium exiguum* (Gmelin)	*Monodacna caspia caspia* (Eichwaldi)	*Spisula sp.*	*Spisula (S.) subtruncata triangula* (Renier)	*Scrobicularia* sp.	*Scrobicularia plana (da Costa)*	*Abra alba* (W. Wood)	*Dreissena polymorpha* (Palas)	*Dreissena rostriformis distincta* Andrussow	*Dreissena* sp.	*Chione (C.) gallina* (Linne)	*Dosinia lupinus* (Linne)	*Gafrarium (C.) minimum* (Montagu)	*Paphia* sp.	*Paphia rugata rugata* (B.D.D.)	*Paphia (P.) senescans* (Coccoini)	*Paphia (P.) discrepans* (Mil.)	*Paphia (P.) discrepans anapensis* Nevesskaja	*Pitar (P.) rudis* (Poli)	*Corbula (V.) gibba* (Olivi)	Total Pelecypoda (TP)	Benthic Assemblages
14																																						
240									4								9																					14	
10																	1			1																2	
20																	2																			2	
30																				1			2													3	
50																				6																6	
60																	3			1			1												1	6	
70																																			2	2	
80																					3															3	
90																																					
100																																			2	2	
110																			1	1																BF1	
130																																			1	1	
150																			2																2	
160																																					
180																			2																2	
190																			5																5	
200																																					
210																																					
220																			1																1	
230																				7			1												8	
243																			1																1	
15																																					
5			43						1								6						6												50	BF1
10		6		23																			1												30	
20			31						1														2												34	
30		9							4																										14	

Core numbers (depth-cm)	*Nucula (N.) nucleus* (Linne)	*Modiolus adriaticus* (Lamarck)	*Modiolus phaseolinus* (Philippi)	*Modiolus* sp.	*Mytilaster* sp.	*Mytilaster linearis* (Grnelin)	*Mytilus edulis* (Linne)	*Mytilus galloprovincialis* (Lamark)	*Mytilus* sp.	*Lucinella divaricata* (Linne)	*Thyasira flexuosa* (Montagu)	*Acanthocardia paucicostata* (Sowerby)	*Cardium* sp.	*Cardium (p.) papillosum smile* Mil.	*Cerastoderma* sp.	*Cerastoderma edule* (Linne)	*Parvicardium exiguum* (Gmelin)	*Monodacna caspia caspia* (Eichwaldi)	*Spisula sp.*	*Spisula (S.) subtruncata triangula* (Renier)	*Scrobicularia* sp.	*Scrobicularia plana (da Costa)*	*Abra alba* (W. Wood)	*Dreissena polymorpha* (Palas)	*Dreissena rostriformis distincta* Andrussow	*Dreissena* sp.	*Chione (C.) gallina* (Linne)	*Dosinia lupinus* (Linne)	*Gafrarium (C.) minimum* (Montagu)	*Paphia* sp.	*Paphia rugata rugata* (B.D.D.)	*Paphia (P.) senescans* (Coccoini)	*Paphia (P.) discrepans* (Mil.)	*Paphia (P.) discrepans anapensis* Nevesskaja	*Pitar (P.) rudis* (Poli)	*Corbula (V.) gibba* (Olivi)	Total Pelecypoda (TP)	Benthic Assemblages
40	1			1					1																											2	
50																																						
60									8																											10	
70					1		55	31	1																55	11	8									16	BF2
80							7											1	3						28	12									1	16	
WB7																										4										4	
10				1		1													2		4		1	43										1	53	
20				1					2												2						33	2							40	
30				1					3												1						3	1							9	
40					1				1						1				6		6				38			4							57	BF1b
50				1															5				3		45	1	1	1							57	
60				2	1				5		5	5	5	5		5	5	5	6		9				53	3		6						2	13	
70				2					2																										2	2	BF2
80					1				5								1				2		2		44	3	10	4						5	77	
90									4												7				18										29	
103				1					6									1			10		3		16		3	6					1	47	

Appendix 2b

Gastropoda data of the studied cores from the SW Black Sea shelf.

1	Core numbers (depth-cm)	*Lepata caeca* (O.F. Müler)	*Gibbula* sp.	*Theodoxus (T.) fluviatilis* (Linne)	*Valvata* sp.	*Hybrobia (H.) acuta* (Draparnaud)	*Hydrobia ulvae* (Pennant)	*Hydrobia ventrosa* (Montagu)	*Hydrobia* sp.	*Nematurella* sp.	*Tornus subcarinatus* (Chaster)	*Alvania lactea* (Michaud)	*Alvania (A.) reticulata* (Montagu)	*Onoba semicostata* (Montagu)	*Rissoa queriniі* Recluz	*Rissoa marginata* Michaud	*Rissoa pulchealla* Philippi	*Rissoa splendida* Eichwaldi	*Rissoa* sp.	*Turritella communis* Risso	*Bivonia triquetra* (Bivona)	*Melanopsis* sp.	*Prenella conica* (Blainville)	*Bittium desayesi* Cerulli & Irelli	*Bittium latreillі* (Payraudeau)	*Bittium reticulatum* (da Costa)	*Bittium* sp.	*Calyptraea chinensis* (Linne)	*Natica/rius punchatus* (Chemnitz in karsten)	*Hexaplex trunculus* (Linne)	*Trophon muricatus* (Montagu)	*Trophon* sp.	*Cylope brusinae* (Andrumow)	*Cylope danovania* Risso	*Cylope* sp.	*Nassarius pygmaeus* (Lamarck)	*Nassarius reticulatus* (Linne)	*Monophorus perversus* (Linne)	*Eulima crosseana* Brusina	*Retusa truncatula* (Bruguiere)	*Chrysallida fenestrata* (Forbes in Jeffreys)	*Chrysallida (P.) interstincta* (Montagu)	*Eulimella phaula* (Dautzenberg & Fischer)	*Eulimella ventricosa* (Forbes)	*Turbonilla lactea* (Linne)	*Turbonilla scalaris* (Philippi)	Total Gastropoda (TG)	Benthic Assemblages
	20					10									2									100																					114	
	30																		6			1		150					1																	166	
	40	1																						200																					206	BF1
	50						1												3					35																					39	
	57					9								3					5					253																					277	
2	6					15																			15				1	1															34	
	10					7							1				1							2		4			1	3												1			20	
	15					4																							4	1															13	
	20					5						1														3			1	1															13	
	25					17													2					16			1		10	3	2						1					5			57	
	30					7																		8					5	4															28	
	35					2																		2					3															16	
	40					8													2										2	2															14	BF1
	45					7																		5					1	4															21	
	50					9													4					6					5							1								27	
	55					15						1												2		2																		24	
	60					7													1					1		8			3															23	
	65																									8			1	2															12	
	75					11													3					19	8				1	7												1			52	
	80					4													1					2	8																			15	

3	Core numbers (depth-cm)	*Lepata caeca* (O.F. Müler)	*Gibbula* sp.	*Theodoxus (T.) fluviatilis* (Linne)	*Valvata* sp.	*Hybrobia (H.) acuta* (Draparnaud)	*Hydrobia ulvae* (Pennant)	*Hydrobia ventrosa* (Montagu)	*Hydrobia* sp.	*Nematurella* sp.	*Tornus subcarinatus* (Chaster)	*Alvania lactea* (Michaud)	*Alvania (A.) reticulata* (Montagu)	*Onoba semicostata* (Montagu)	*Rissoa guerinii* Recluz	*Rissoa marginata* Michaud	*Rissoa pulchealla* Philippi	*Rissoa splendida* Eichwaldi	*Rissoa* sp.	*Turritella communis* Risso	*Bivonia triquetra* (Bivona)	*Melanopsis* sp.	*Pirenella conica* (Blainville)	*Bittium desayesi* Cerulli & Irelli	*Bittium latreillii* (Payraudeau)	*Bittium reticulatum* (da Costa)	*Bittium* sp.	*Calyptraea chinensis* (Linne)	*Natcarius punctatus* (Chemnitz in kaarsten)	*Hexaplex trunculus* (Linne)	*Trophon muricatus* (Montagu)	*Trophon* sp.	*Cyclope brusinae* (Andrumow)	*Cyclope danovania* Risso	*Cyclope* sp.	*Nassarius pygmaeus* (Lamarck)	*Nassarius reticulatus* (Linne)	*Monophorus perversus* (Linne)	*Eulima crosseana* Brusina	*Retusa truncatula* (Brugiuere)	*Chrysallida fenestrata* (Forbes in Jeffreys)	*Chrysallida (P.) interstincta* (Montagu)	*Eulimella phaula* (Dautzenberg & Fischer)	*Eulimella ventricosa* (Forbes)	*Turbonilla lactea* (Linne)	*Turbonille scalaris* (Philippi)	Total Gastropoda (TG)	Benthic Assemblages
	10					12			2																			1																	18	
	20					8																																							8	
	40					160																																							160	
	50					75																																							75	
	60					20																																							20	
	70					3	1																																					4	
	80					37																				1																	38	
	90					54																																							54	
	100					121																																							125	
	110					1														1																								2	
	120																																													2	BF1
	130																												1				3				2								5	
	140					3																			3				1		4								13					24	
	150					1																					11												2					29	
	160																										5												12					9	
	170				1																																		2					1	
	180					22																																	4					30	
	190																																						1						
	200					4																																	4					10	
	213					6																																	4					10	
4																																														
	30					1																			1																			2	BF1
	80																																													
	90																																													

Core numbers (depth-cm)	*Lepata caeca* (O.F. Müler)	*Gibbula* sp.	*Theodoxus (T.) fluviatilis* (Linne)	*Valvata* sp.	*Hybrobia (H.) acuta* (Draparnaud)	*Hydrobia ulvae* (Pennant)	*Hydrobia ventrosa* (Montagu)	*Hydrobia* sp.	*Nematurella* sp.	*Tornus subcarinatus* (Chaster)	*Alvania lactea* (Michaud)	*Alvania (A.) reticulata* (Montagu)	*Onoba semicostata* (Montagu)	*Rissoa querinii* Recluz	*Rissoa marginata* Michaud	*Rissoa pulchella* Philippi	*Rissoa splendida* Eichwaldi	*Rissoa* sp.	*Turritella communis* Risso	*Bivonia triquetra* (Bivona)	*Melanopsis* sp.	*Pirenella conica* (Blainville)	*Bittium desayesi* Cerulli & Irelli	*Bittium latrellii* (Payraudeau)	*Bittium reticulatum* (da Costa)	*Bittium* sp.	*Caliptraea chinensis* (Linne)	*Natica/ris punchtatus* (Chemnitz in karsten)	*Hexaplex trunculus* (Linne)	*Trophon muricatus* (Montagu)	*Trophon* sp.	*Cyliope brusinae* (Andrumow)	*Cyliope danovania* Risso	*Cyliope* sp.	*Nassarius pygmaeus* (Lamarck)	*Nassarius reticulatus* (Linne)	*Monophorus perversus* (Linne)	*Eulima crosseana* Brusina	*Retusa truncatula* (Brugiuere)	*Chrysallida fenestrata* (Fortes in Jeffrys)	*Chrysallida (P.) interstincta* (Montagu)	*Eulimella phaula* (Dautzenberg & Fischer)	*Eulimella ventricosa* (Fortes)	*Turbonilla lactea* (Linne)	*Turbonille scalaris* (Philippi)	Total Gastropoda (TG)	Benthic Assemblages
100																																																	
110	2				2																																													
120																																																	
140					2																																													
160					40				2																																								
170						4																																											
180					10																																												
190					50																																												
200					4																																												
210					55																																												
220.																																																
230.				1																																												
238					1																																												
5																																																
10					2																							1	1																		4	
15					2																					2																				5	
20					100				2							1							2	2	12					2	3	1	5			1			1	1						1	13	
25					8																			5							1													2	1	123	BF1
30					28																			1					2			1													17	
35					43																			5						4															32	
40					202																			5																					54	
45					273		1														5			5																				3	210	
50					110														2		5			5																				1	282	BF2
55					197																5			5																					121	
60			1																					5	1			1				5						1							213	

Core numbers (depth-cm)	*Lepata caeca* (O.F. Müller)	*Gibbula* sp.	*Theodoxus (T.) fluviatilis* (Linne)	*Valvata* sp.	*Hydrobia (H.) acuta* (Draparnaud)	*Hydrobia ulvae* (Pennant)	*Hydrobia ventrosa* (Montagu)	*Hydrobia* sp.	*Nematurella* sp.	*Tornus subcarinatus* (Chaster)	*Alvania lactea* (Michaud)	*Alvania (A.) reticulata* (Montagu)	*Onoba semicostata* (Montagu)	*Rissoa queriniі* Recluz	*Rissoa marginata* Michaud	*Rissoa pulchella* Philippi	*Rissoa splendida* Eichwaldi	*Rissoa* sp.	*Turritella communis* Risso	*Bivonia triquetra* (Bivona)	*Melanopsis* sp.	*Prunella conica* (Blainville)	*Bittium desayesi* Cerulli & Irelli	*Bittium latrellii* (Payraudeau)	*Bittium reticulatum* (da Costa)	*Bittium* sp.	*Calyptraea chinensis* (Linne)	*Natcarius punctatus* (Chemnitz in karsten)	*Hexaplex trunculus* (Linne)	*Trophon muricatus* (Montagu)	*Trophon* sp.	*Cylope brusinae* (Andrumow)	*Cylope danovania* Risso	*Cylope* sp.	*Nassarius pygmaeus* (Lamarck)	*Nassarius reticulatus* (Linne)	*Monophorus perversus* (Linne)	*Eulima crosseana* Brusina	*Retusa truncatula* (Brugulere)	*Chrysallida fenestrata* (Forbes in Jeffreys)	*Chrysallida (P.) interstincta* (Montagu)	*Eulimella phaula* (Dautzenberg & Fischer)	*Eulimella ventricosa* (Forbes)	*Turbonilla lactea* (Linne)	*Turbonilla scalaris* (Philippi)	Total Gastropoda (TG)	Benthic Assemblages
7					354				2															6				1			1								1							367	
5					2																																									2	
10																								15																						15	
15																								3																						3	
20					5													8						172				3			6						2							198	
25					2														8					1				3		2								1						9	
30					5													8						3	38			5		3														63	
35					5													8						77	100			4		1							3	5						203	BF1b
40					1																			42				2										1						46	
45					5																			20				1										1						27	
50					1									5											100					2					1				1	5				114	
55														25										320										7					4					356	
60															15										100									2					1					118	
64																			11					30																				41	
70																			7					34					1					2				2						46	
75																			2					15						2														3		24	
80																									26			5	1				1					1							35	
90																1																														1	
100																																																
110																									1														1						6	BF2
120																																										3					37	
130																									4																					373	
141																																														1		
10																																														2		65

Core numbers (depth-cm)	*Lepata caeca* (O.F. Müler)	*Gibbula* sp.	*Theodoxus (T.) fluviatilis* (Linne)	*Valvata* sp.	*Hydrobia (H.) acuta* (Draparnaud)	*Hydrobia ulvae* (Pennant)	*Hydrobia ventrosa* (Montagu)	*Hydrobia* sp.	*Nematurella* sp.	*Tornus subcarinatus* (Chaster)	*Alvania lactea* (Michaud)	*Alvania (A.) reticulata* (Montagu)	*Onoba semicostata* (Montagu)	*Rissoa queriniі* Recluz	*Rissoa marginata* Michaud	*Rissoa pulchealla* Philippi	*Rissoa splendida* Eichwaldi	*Rissoa* sp.	*Turritella communis* Risso	*Bivonia triquetra* (Bivona)	*Melanopsis* sp.	*Pirenella conica* (Blainville)	*Bittium desayesi* Cerulli & Irelli	*Bittium latreillі* (Payraudeau)	*Bittium reticulatum* (da Costa)	*Bittium* sp.	*Calyptraea chinensis* (Linne)	*Naticarius punctatus* (Chemnitz in karsten)	*Hexaplex trunculus* (Linne)	*Trophon muricatus* (Montagu)	*Trophon* sp.	*Clyope brusinae* (Andrumow)	*Clyope danovaria* Risso	*Clyope* sp.	*Nassarius pygmaeus* (Lamarck)	*Nassarius reticulatus* (Linne)	*Monophorus perversus* (Linne)	*Eulima crossеana* Brusina	*Retusa truncatula* (Bruguiere)	*Chrysallida fenestrata* (Forbes in Jeffreys)	*Chrysallida (P.) interstincta* (Montagu)	*Eulimella phaula* (Dautzenberg & Fischer)	*Eulimella ventricosa* (Forbes)	*Turbonilla lactea* (Linne)	*Turbonille scalaris* (Philippi)	Total Gastropoda (TG)	Benthic Assemblages
10			3		36																																								41	BF1
15			17		55																																								72	
20			84		92									1																															177	
25					1																																								1	
35			18		32									2																															56	
30			14		100																																								114	BF3
35			15		15									3																															34	
40			9		10																																								19	
45			25		100									4																															138	
50			19		100		2																																					125	
55			10		24																																								38	
12																																															
20																																													BF1	
30																																														
40																									2																			2	
50																																					1							1	
60																																													
70																								1																			1	
100																																													
110																																													
120																								1																			1	
130																																													
140																																													
150																																													
160																																													

Core numbers (depth-cm)	*Lepata caeca* (O.F. Müller)	*Gibbula* sp.	*Theodoxus (T.) fluviatilis* (Linne)	*Valvata* sp.	*Hydrobia (H.) acuta* (Draparnaud)	*Hydrobia ulvae* (Pennant)	*Hydrobia ventrosa* (Montagu)	*Hydrobia* sp.	*Nematurella* sp.	*Tornus subcarinatus* (Chaster)	*Alvania lactea* (Michaud)	*Alvania (A.) reticulata* (Montagu)	*Onoba semicostata* (Montagu)	*Rissoa guerinii* Recluz	*Rissoa marginata* Michaud	*Rissoa pulchealla* Philippi	*Rissoa splendida* Eichwaldi	*Rissoa* sp.	*Turritella communis* Risso	*Bivonia triquetra* (Bivona)	*Melanopsis* sp.	*Pirenella conica* (Blainville)	*Bittium desayesi* Cerulli & Irelli	*Bittium latreillii* (Payraudeau)	*Bittium reticulatum* (da Costa)	*Bittium* sp.	*Calyptraea chinensis* (Linne)	*Natica/us punctatus* (Chemnitz in karsten)	*Hexaplex trunculus* (Linne)	*Trophon muricatus* (Montagu)	*Trophon* sp.	*Cylope bruslnae* (Andrumow)	*Cylope danovania* Risso	*Cylope* sp.	*Nassarius pygmaeus* (Lamarck)	*Nassarius reticulatus* (Linne)	*Monophorus perversus* (Linne)	*Eulima crosseana* Brusina	*Retusa truncatula* (Brugulere)	*Chrysallida fenestrata* (Forbes in Jeffrys)	*Chrysallida (P.) interstincta* (Montagu)	*Eulimella phaula* (Dautzenberg & Fischer)	*Eulimella ventricosa* (Forbes)	*Turbonilla lactea* (Linne)	*Turbonille scalaris* (Philippi)	Total Gastropoda (TG)	Benthic Assemblages
170																							1																							1	
180																																															
190																																															
200																																															
210																								2																						2	
220																								2																							
230																																															
240																																															
246					2									2			3	1						97							1														107	
13																																															
10																											1																			1	
20																								1																						1	
30					11																																								12	
40																															1														1	
50																																															
90																																															
110																								1																						1	BF1
140																	18							118							1							1	5					143	
150																	1								4																				5	
180																								1	3				1																6	
210																									7			9	1																151	
220					128									4																														2			
230					328																																							5	333	BF2
240					208																				1																					209	
15																																															

Core numbers (depth-cm)	5	10	20	30	40	50	60	70	80	WB7	10	20	30	40	50	60	70	80	90	103
Lepata caeca (O.F. Müller)																				
Gibbula sp.												1								
Theodoxus (T.) fluviatilis (Linne)												1	2	1					2	
Valvata sp.																				
Hybrobia (H.) acuta (Draparnaud)							5					4	16	11	1	15	2	5		19
Hydrobia ulvae (Pennant)																			2	
Hydrobia ventrosa (Montagu)														1	1					
Hydrobia sp.											2									
Nematurella sp.																				
Tornus subcarinatus (Chaster)													1							
Alvania lactea (Michaud)																				
Alvania (A.) reticulata (Montagu)																				
Onoba semicostata (Montagu)													1			3				
Rissoa guerinii Recluz											1									1
Rissoa marginata Michaud																				
Rissoa pulchella Philippi																3				
Rissoa splendida Eichwaldi																				
Rissoa sp.												2	2			1				
Turritella communis Risso																	1			
Bivonia triquetra (Bivona)																				
Melanopsis sp.																2				
Pirenella conica (Blainville)																				
Bittium desayesi Cerulli & Irelli		1							30			2	18	3		2				46
Bittium latrellii (Payraudeau)																				
Bittium reticulatum (da Costa)																				
Bittium sp.															1					
Calyptraea chinensis (Linne)																1				
Natica risellus punctatus (Chemnitz in Karsten)																		1		
Hexaplex trunculus (Linne)												1	2							
Trophon muricatus (Montagu)	4		3									2								
Trophon sp.														1						
Cyclope brusinae (Andrurmow)															1					
Cyclope canovania Risso																				
Cyclope sp.																				
Nassarius pygmaeus (Lamarck)																				
Nassarius reticulatus (Linne)															1					
Monophorus perversus (Linne)																				
Eulima crosseana Brusina																				
Retusa truncatula (Bruguiere)		1			1											1				
Chrysallida fenestrata (Forbes in Jeffreys)																				
Chrysallida (P.) interstincta (Montagu)																				1
Eulimella phaula (Bautzenberg & Fischer)									15							1		4		
Eulimella ventricosa (Forbes)									12											
Turbonilla lactea (Linne)																				
Turbonille scalaris (Philippi)																				
Total Gastropoda (TG)	4	2	3	1			5		57		3	10	43	16	5	29	2	6	10	67
Benthic Assemblages			BF1				BF2						BF1					BF2		