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Updated Check-List of the Recent Foraminifera from the Bulgarian Black Sea Coast

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Abstract: A brief historical review of the investigations on the recent foraminifera from the Bulgarian Black Sea Coast was made. Up to now, a total of 107 species and subspecies, belonging to 56 genera and 32 families of 10 orders, were established in the Bulgarian Black Sea shore. As a result of a taxonomic revision of the reported foraminifera a separate list of their synonyms is given. The habitat distribution of the recent foraminifera in the Bulgarian Black Sea shore is also presented. The widely distributed families, represented by many species are: Hauerinidae (20 spp.), Elphidiidae (15), Rotaliidae (9) and Ellipsolagenidae (8). The most common genera, presented by many species and subspecies are: *Quinqueloculina* (11), *Ammonia* (9), *Elphidium* (6), *Cribroelphidium* (5) and *Fissurina* (5). More common and taxonomically interesting Black Sea foraminifera are illustrated by LM and SEM photographs.

Key words: Black Sea, Foraminifera, Check-list, Habitat distribution.

Introduction

The investigations on the diversity, biotopic distribution, biology and ecology of the recent foraminifera from the Bulgarian Black Sea Coast and the related brackish water sources (shoreline lakes, lagoons, river mouths) are still sporadic and incomplete. CHICHKOFF (1912) published the first notes on the 4 foraminiferal species from the genera *Rotalia, Quinqueloculina* and *Polystomella,* one of which was identified at a genus level. MOROV and NECHAEV (1929) reported the finding of foraminifera from the genus *Globigerina* in front of the Bulgarian Coastline. Probably these shells were brought accidentally to the Black Sea from the Mediterranean or Aegean seas, because it is known that the species of this genus inhabit seas and oceans with normal salinity (32-38 ‰).

Later the Romanian protozoologist LEPSI (1931) established 2 new benthic foraminiferal species from the genera *Ammodiscus* and *Peneroplis,* found in close proximity of the Romanian Coastline.

VALKANOV (1936) announced that he had often found shells of recent foraminifera in different brackish water sources (coastline lakes and river estuaries), but his materials were not identified. CASPERS (1931) also announced the findings of 3 unknown until then Black Sea foraminifera from the genera *Elphidium* and *Rotalia*. The first more detailed attempt for summarizing the data about the faunal diversity of the Bulgarian Black Sea Coast, including its recent foraminiferal fauna, was made by VALKANOV

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(1957). In his "Katalog Unseres Schwarzmeerfauna", besides the foraminifera reported by the previous authors, he reported 9 new recent foraminifera from the genera *Ammobaculites, Massilina, Nonion, Quinqueloculina* and *Verneulina.*

A few years later VALKANOVA (1964) found a monothalamous foraminiferal species in front of the Bulgarian Black Sea Coastline, which was morphologically close to *Bathysiphon flexilis* Huglung, 1947. As a result of morphological study of the shell structure and cytoplasm body VALKANOVA (1964) concluded that the found foraminifera differs from *Bathysiphon flexilis* and she described it as a new genus - *Rhabdogromia* n. gen. LOEBLICH and TAPPAN (1992) considered *R. flexilis* as a synonym of *Micatuba flexilis* (Höglung).

Data on the diversity of the foraminifera in the northwestern region of the Black Sea, including Bulgarian littoral, were given by TUFESCU (1973). He reported a total of 52 species of foraminifera from the northwestern Black Sea Coastline, 14 of which were found in front of the Bulgarian Coastline. Five of them were marked as doubtful species.

Since 1970 Golemansky has performed research on the rhizopodal fauna of subsurface waters of the sandy supra- and medium littoral of the Black Sea Coastline. As a result he established some unknown until then monothalamous foraminifera from the genera *Lagenidiopsis* and *Lagynis* (GOLEMANSKY, 1974, 1980, 1999).

The results of Valkanova's investigations on the polythalamous foramninifera in front of the Bulgarian Black Sea shores were summarized in a separate article (VALKANOVA, 1981). She presented data about the morphometry and the biotopic distribution of 43 recent foraminifera, 39 of which were reported for the first time by VALKANOVA (1981).

Some Russian researchers of the foraminiferal fauna of the Black Sea also gave information about the distribution of foraminifera in the Bulgarian Black Sea littoral. YANKO and TROITSKAJA (1987) reported a total of 70 species of foraminifera, inhabiting the northwestern region of the Black Sea. Thirty-six of them were from the Bulgarian littoral. Some years later YANKO (1989, 1990) gave more detailed information on the diversity, stratigraphy and ecology of the foraminifera of the Black Sea basin. For the Black Sea she reported a total of 104 recent foraminifera, 62 of which were found in the Bulgarian Black Sea shelf.

In the last few years a systematic research on the recent foraminifera of the Southern Bulgarian Black Sea Coastline has been carried out by TEMELKOV (1999A, 1999B, 2000, 2002). He established 27 species and 1 new subspecies.

The aims of our study are: (1) to summarize all available data on the foraminifera from the Bulgarian Black Sea Coastline, (2) to update their systematic position in a proposed check-list, and (3) to illustrate the more common foraminifera from the Bulgarian Black Sea Coast in order to facilitate their investigation and identification.

Results

Until now a total of 107 foraminiferal taxa were found from the Bulgarian Black Sea Coast. They belong to 10 orders, 32 families and 56 genera according to the classifications of LOEBLICH and TAPPAN (1992) and SEN GUPTA (1999). Ten of the found foraminifera are not identified at species level.

The opinion of Cimerman and Langer regarding the independence of the genera *Cribroelphidium* and *Porosononion* is accepted (CIMERMAN and LANGER, 1991). The genus *Canalifera* KRASHENINNIKOV, 1953, used by YANKO (1989) and YANKO and TROITSKAJA

(1987) was not accepted, because, as LOEBLICH and TAPPAN (1992) indicate, according to the ICZN this name is not available (no description). The established species of this genus were accepted as synonyms of the genus *Elphidium*.

A total updated check-list of the foraminifera found so far from the Bulgarian Black Sea Coast is presented in Table 1. Some foraminifera were reported in the cited literature with synonymous names. The list of synonyms and their valid names are presented in Table 2. More common and taxonomically interesting foraminifera are illustrated in Figs 1-51.

Discussion

In a review of the Mediterranean Foraminifera CIMERMAN and LANGER (1991) reported a total of 324 Foraminifera, dwelling different Mediterranean habitats. They belong to 143 genera from 66 families. But according to more recent information (GROSS, 2001) the number of the Mediterranean foraminifera is twice higher - 618 species. Three hundred eighty-six of them inhabit the Mediterranean only, and 232 are common for the Mediterranean and the Atlantic. Our data show that the foraminiferal fauna in front of the Bulgarian Black Sea Coastline is characterized by a comparatively poor species diversity. This fact is a consequence of the different ecological conditions of the both connected seas, such as their different salinity, annual temperatures, H_2S presence, etc.

There are some differences in the species composition and in the dominant structure of the foraminiferal communities in both seas. CIMERMAN and LANGER (1991) found out that the representatives of the family Hauerinidae (91 species, 21 genera) had a manifested predominance in the Mediterranean. The species of the families Elphidiidae (23, 3) and Spiroloculidae (21, 3) are also dominants, but to a lower extent. Altogether, the species of these three families constitute more than 40% of all observed foraminifera in the Mediterranean. Another characteristic feature of the foraminiferal communities in this sea is the presence of a great number of families (24) represented by one species only (Rzehakinidae, Cyclamminidae, Nouriidae, Patellinidae, Soritidae, Epistominidae, Globorotaliidae, etc.).

The foraminiferal fauna of the Bulgarian Black Sea Coastline has not well expressed predominating families. As well as in the Mediterranean, the foraminifera from the families Hauerinidae (20 species, 9 genera) and Elphidiidae (15, 4) predominate in the foraminiferal taxocenoses, but some common families in the Mediterranean are missing in the Black Sea. For example, many species of the family Spiroloculinidae (21) are dominating in the Mediterranean, whereas they are completely missing in the fauna of the Bulgarian Black Sea Coastline.

The considerable differences between the foraminiferal faunae of these two regions are more clearly expressed when they are compared on a genus or species level. Our study shows that only 15 species of all the 107 established in front of the Bulgarian Black Sea Coastline are represented in the Mediterranean foraminiferal fauna, too. On the other hand, about 95% (309 species, 132 genera) of the Mediterranean foraminifera have not been observed in front of the Bulgarian Black Sea Coastline.

An essential difference between the foraminiferal faunae of these two regions is the fact that the dominant genera in their foraminiferal communities differ considerably. Thus, in the Mediterranean the species of the genera *Quinqueloculina* (18), *Elphidium* (17), *Adelosina* (11), *Miliolinella* (9), *Spiroloculina* (9), *Brizalina* (8), *Cycloforina* (8), and

Table 1. Updated check-list of the foraminifera from the Bulgarian Black Sea Coast.

Class **FORAMINIFERA** D'ORBIGNY, 1826	**Sites**		**Authors***
	In the sea	On seashore, in pools marshes and river mouths	
(1)	(2)	(3)	(4)
Order **ALLOGROMIIDA** FURSSENKO, 1958			
Family **Lagynidae** SCHULTZE, 1854			
Lagynis pontica GOLEMANSKY, 1999	-	+	**16**
Lagenidiopsis elegans (GRÜBER, 1884) GOLEMANSKY, 1976	-	+	**9, 12**
L. valkanovi GOLEMANSKY, 1974	-	+	**8, 9, 12**
Family **Allogromiidae** RHUMBLER, 1904			
Allogromia sp.	-	+	**17, 20**
Micatuba flexilis (HÖGLUND, 1947)	+	+	**6, 9, 14, 12**
Order **ASTRORHIZIDA** LANKESTER, 1885			
Family **Psammosphaeridae** HAECKEL, 1894			
Psammosphaera sp.	+	-	**20**
Family **Saccamminidae** BRADY, 1884			
Lagenammina atlantica (CUSHMAN, 1944)	+	-	**13**
Order **LITUOLIDA** DE BLAINVILLE, 1827			
Family **Ammodiscidae** REUSS, 1862			
Ammodiscus gullmarensis HÖGLUND, 1948	+	-	**10, 12, 14**
A .incertus D'ORBIGNY, 1839	+	-	**3, 5, 7**
Glomospira glomerata HÖGLUND, 1947	+	-	**10, 12, 14**
Family **Rzehakinidae** CUSHMAN, 1933			
Miliammina fusca (BRADY, 1870)	+	-	**1, 5, 10, 12, 14**
M. groenlandica CUSHMAN, 1933	-	+	**10, 12, 14**
Triloculareña circulare HERON-ALLEN et EARLAND, 1930	+	-	**10, 12, 14**
Family **Discamminidae** MIKHALEVICH, 1980			
Discammina imperspica JANKO, 1974	+	-	**10, 11, 12, 13, 14, 15**
Family **Lituotubidae** LOEBLICH and TAPPAN, 1984			
Lituotuba lituiformis BRADY, 1879	-	+	**10, 12, 14**
Family **Lituolidae** DE BLAINVILLE, 1827			
Lituola nautiloides LAMARCK, 1804	+	-	**10, 12, 14**
Ammobaculites ponticus MIKHALEVICH, 1968	+	-	**5, 7, 10, 11, 12, 13, 14**
Ammobaculites sp.	-	+	**17, 20**
Family **Ammobaculinidae** SAIDOVA, 1981			
Bulbobaculites maync LOEBLICH and TAPPAN, 1954	+	-	**10, 12, 14**

Table 1. Continued.

(1)	(2)	(3)	(4)
Family **Pseudobolivinidae** WIESNER, 1931			
Pseudobolivina antarctica (WIESNER, 1931)	+	+	**10, 12, 14**
Order **TROCHAMMINIDA** SAIDOVA, 1981			
Family **Trochamminidae** SCHWAGER,1877			
Jadammina macrescens dacica TUFESCU, 1969	-	+	**17, 20**
Rotaliammina ochracea (WILLIAMSON, 1858)	+	+	**10, 12, 13, 14**
Trochammina inflata (MONTAGU, 1808)	-	+	**7, 13, 17, 20**
T. intermedia RHUMBLER, 1938	-	+	**10, 12, 14**
Order **TEXTULARIIDA** LANKESTER, 1885			
Family **Eggerellidae** Cushman, 1937			
Eggereloides scabrus (WILLIAMSON, 1858)	+	+	**5,7,12,13,14,15,16,20**
Family **Textulariidae** EHRENBERG, 1838			
Textularia deltoidea REUSS, 1862	-	+	**10, 12, 14**
Order **MILIOLIDA** DELAGE et HEROUARD, 1896			
Family **Cornuspiridae** SCHULTZE, 1854			
Cornuspira minuscula (MAYER, 1972)	+	-	**13**
Cornuspira planorbis SCHULTZE, 1854	+	-	**10, 12, 13, 14**
Cornuspira sp. 1	-	+	**Ours data**
Cornuspira sp. 2	-	+	**Ours data**
Family **Hauerinidae** SCHWAGER, 1876			
Ammomassilina alveoliniformis MILLETT, 1898	-	+	**10, 12, 14**
Dentostomina bermudiana CARMAN, 1933	-	+	**10, 12, 14**
Hauerina bradyi CUSHMAN, 1917	+	-	**10, 12, 14**
Lachlanella planciana (D'ORBIGNY, 1839)	+	-	**20**
Massilina secans (D'ORBIGNY, 1826)	+	-	**5, 10, 13, 14, 20**
Miliolinella dilatata (D'ORBIGNY, 1839)	+	-	**10, 11, 12, 13, 14**
M. subrotunda (MONTAGU, 1803)	+	+	**10, 12, 13, 14, 20**
Quinqueloculina arenacea RHUMBLER, 1911	-	+	**5**
Q. bicornis (WALKER et JACOB, 1798)	+	-	**13**
Q. consobrina (D'ORBIGNY, 1846)	+	-	**13**
Q. curvula YANKO, 1989	+	-	**13**
Q. inflata (D'ORBIGNY, 1826)	+	-	**13**
Q. laevigata D'ORBIGNY, 1839	+	-	**13, 20**
Q. lata TERQUEM, 1876	+	-	**13, 20**
Q. milletti (WIESNER, 1912)	+	-	**13**
Q. oblonga (MONTAGU, 1803)	+	-	**7, 13**
Q. seminula (LINNÉ, 1758)	+	-	**5, 10, 11, 12, 13, 14, 20**
Q. vulgaris D'ORBIGNY, 1826	+	-	**11, 13, 15**
Sigmella distorta (PHLEGER et PARKER, 1951)	+	-	**11, 13**
Siphonaperta macbeathi VELLA, 1957	-	+	**10, 12, 14**
Family **Peneroplidae** SCHULTZE, 1854			
Peneroplis sp.	+	-	**3, 5**

Table 1. Continued.

(1)	(2)	(3)	(4)
Order **LAGENIDA** LANKESTER, 1885			
Family **Lagenidae** REUSS, 1862			
Lagena felsina (FORNASINI, 1891)	-	+	**Ours data**
L. laevis (MONTAGU, 1803)	+	-	**11, 13**
L. semistriata (WILLIAMSON, 1858)	+	-	**7**
Family **Ellipsolagenidae** A. SILVESTRI, 1923			
Fissurina fabaria TROITSKAJA, 1987	+	-	**11, 13**
F. fragilis TROITSKAJA, 1987	+	-	**7, 10, 11, 12, 13, 14**
F. lucida (WILLIAMSON, 1858)	+	-	**11, 13, 15**
F. porrecta TROITSKAJA, 1987	+	-	**10, 11, 12, 13, 14**
F. solida SEGUENZA, 1862	+	-	**11, 13**
Parafissurina aventricosa MCCULLOCH, 1968	+	-	**10, 11, 12, 13, 14**
P. dzemetinica YANKO, 1979	+	-	**10, 11, 12, 13, 14, 15**
P. ex gr. *lateralis* (CUSHMAN, 1913)	+	-	**10, 11, 12, 13, 14, 15**
Family **Glandulinidae** REUSS, 1860			
Entolingulina deplanata YANKO, 1979	+	-	**11, 13**
Esosyrinx jatzkoi YANKO1974	+	-	**11, 13**
Laryngosigma williamsoni (TERQUEM, 1878)	+	-	**11, 13**
Order **GLOBIGERINIDA** DELAGE and HEROUARD, 1896			
Family **Globigerinidae** CARPENTER, PARKER and JONES, 1862			
Globigerina bulloides (D'ORBIGNY, 1826)	+	-	**3, 5**
Globigerina sp.	+	-	**2**
Order **BULIMINIDA** FURSSENKO, 1958			
Family **Bolivinidae** GLAESSNER, 1937			
Bolivina doniezi CUSHMAN and WICKENDEN, 1929	+	-	**13**
Family **Stilostomellidae** FINLAY, 1947			
Orthomorphina calomorpha (REUSS, 1866)	+	-	**11, 13**
O. drammenensis (FEYLING-HANSSEN, 1964)	+	-	**11, 13**
Order **ROTALIIDA** LANKESTER, 1885			
Family **Discorbidae** EHRENBERG, 1838			
Discorbis sp.	-	+	**10, 12, 14**
Family **Rosalinidae** REISS, 1963			
Neoconorbina sp.	+	-	**11**
Rosalina catesbyana D'ORBIGNY, 1839	+	-	**13**
Family **Heronalleniidae** LOEBLICH and TAPPAN, 1986			
Heronallenia chasteri (HERON-ALLEN et EARLAND, 1913)	+	-	**11, 13**
Family **Cibicididae** CUSHMAN, 1927			
Cibicides dispars (D'ORBIGNY, 1839)	+	-	**13**

Table 1. Continued.

(1)	(2)	(3)	(4)
C. lobatulus (WALKER and JACOB, 1798)	+	-	**7, 13**
Family **Planorbulinidae** SCHWAGER, 1877			
Planorbulina mediterranensis D'ORBIGNY, 1826	+	-	**11, 13**
Family **Nonionidae** SCHULTZE, 1854			
Astrononion stelligerum (D'ORBIGNY, 1839)	+	-	**5**
Haynesina anglica MURRAY, 1965	+	-	**11, 13, 15, 20**
Nonion matagordanus KORNFELD, 1931	+	-	**5,7,10,11,12,13,14,15,20**
N. pauciloculum CUSHMAN, 1944	+	-	**13, 20**
Family **Trichohyalidae** SAIDOVA, 1981			
Aubignyna perlucida (HERON-ALLEN et EARLAND, 1913)	+	+	**10, 11, 12, 13, 14, 15, 20**
A. suchumiensis JANKO, 1989	+	-	**13, 15**
Family **Rotaliidae** EHRENBERG, 1839			
Ammonia ammoniformis (D'ORBIGNY, 1826)	+	-	**10,11,12,13,14,15,18,20**
A. calcar (D'ORBIGNY, 1826)	+	-	**10, 12, 14**
A. caucasica YANKO, 1989	+	-	**13, 15**
A. compacta (HOFKER, 1969)	+	-	**4,5,7,10,11,13,14,15,18,20**
A. novoeuxinica YANKO, 1979	+	-	**11, 13**
A. orbicularis (D'ORBIGNY, 1826)	+	-	**4, 5**
A. parkinsoniana (D'ORBIGNY, 1839)	+	-	**20**
A. tepida (CUSHMAN, 1926)	+	-	**7,10,11,12,13,14,15,18,20**
A. veneta (SCHULTZE, 1854)	+	-	**1, 5**
Family **Elphidiidae** GALLOWAY, 1933			
Cribroelphidium bartletti (CUSHMAN, 1933)	+	-	**10, 12, 14**
C. parkerae YANKO, 1974	+	-	**11, 13, 15, 20**
C. percursum YANKO, 1974	+	-	**11, 13**
C. poeyanum (D'ORBIGNY, 1839)	+	-	**5,7,10,11,12,13,14,15,18,20**
C. translucens (NATLAND, 1938)	+	-	**13, 20**
Elphidium macellum (FICHTEL and MOLL, 1798)	+	-	**4, 5, 7, 10, 12, 13, 14, 18, 20**
E. ponticum (DOLGOPOLSKAJA et PAULI, 1931)	+	-	**10, 11, 12, 13, 14, 15, 20**
E. cf. *sculpturatum* CUSHMAN, 1936	+	-	**20**
E. strigilata D'ORBIGNY, 1839	+	-	**1, 5**
E. ex.gr. verriculata (BRADY, 1870)	+	-	**13**
Elphidium sp.	+	-	**1, 5, 18, 20**
Parrellina thalman LOEBLICH and TAPPAN, 1957	+	-	**10, 12, 14**
Porosononion martcobi (BOGDANOWICH, 1947)	+	-	**10, 11, 12, 13, 14, 18, 20**
P. subgranosus mediterranicus YANKO, 1989	+	-	**7, 11, 13**
P. subgranosus bulgaricus TEMELKOV, 2000	+	-	**19**

* 1 - CHICHKOFF, 1912; 2 - MOROV and NECHAEV, 1929; 3 - LEPSI, 1931; 4 - CASPERS, 1951; 5 - VALKANOV, 1957; 6 - VALKANOVA, 1964; 7 - TUFESCU, 1973; 8 - GOLEMANSKY, 1974; 9 - GOLEMANSKY, 1980; 10 - VALKANOVA, 1981; 11 - YANKO and TROITSKAJA, 1987; 12 - MARINOV and GOLEMANSKY, 1989; 13 - YANKO, 1989; 14 - MARINOV, 1990; 15 - YANKO, 1990; 16 - GOLEMANSKY, 1999; 17 - TEMELKOV, 1999A; 18 - TEMELKOV, 1999B; 19 - TEMELKOV, 2000; 20 - TEMELKOV, 2002.

Table 2. List of the synonymous names of foraminifera, cited in the literature about the Bulgarian Black Sea Coast.

Synonyms	Authors	Valid names
(1)	(2)	(3)
Ammobaculites agglutinans (D'ORBIGNY, 1846)	VALKANOV, 1957, p.11; TUFESCU, 1973, p. 26	***Ammobaculites ponticus*** MIKHALEVICH, 1968
Ammodiscus intermedius HÖGLUND, 1947	VALKANOVA, 1981, p. 9, T. 3, fig. 4; MARINOV and GOLEMANSKY, 1989, p. 8	***Cornuspira planorbis*** SCHULTZE, 1854
Ammonia beccarii (LINNÉ, 1758)	TUFESCU, 1973, p. 26, T. II, fig. 7	***Ammonia compacta*** (HOFKER, 1969)
Bolivia punctata D'ORBIGNY, 1839	VALKANOVA, 1981, p. 4, T. 1, fig. 1; MARINOV and GOLEMANSKY, 1989, p. 8	***Pseudobolivina antarctica*** (WIESNER, 1931)
Canalifera nigarensis (CUSHMAN, 1939)	YANKO, 1989, p. 163;	***Elphidium macellum*** (FICHTEL and MOLL, 1798)
Canalifera parkerae (YANKO, 1974)	YANKO and TROITSKAJA, 1987, p. 69; YANKO, 1989, p. 161	***Cribroelphidium parkerae*** (YANKO, 1974)
Canalifera ex. gr. *verriculata* (BRADY, 1870)	YANKO, 1989, p. 164	***Elphidium* ex. gr. *verriculata*** (BRADY, 1870)
Cribroelphidium depressulum (WALKER et JACOB, 1798)	VALKANOVA, 1981, p. 6, T. 5, fig. 2; MARINOV and GOLEMANSKY, 1989, p. 9	***Nonion matagordanus*** (KORNFELD, 1931)
Cribroelphidium martcobi (BOGDANOWICH, 1947)	VALKANOVA, 1981, p. 6; MARINOV and GOLEMANSKY, 1989, p. 9; TEMELKOV, 1999B, p. 19	***Porosononion martcobi*** (BOGDANOWICH, 1947)
Discammina fallax LACROIX, 1932	VALKANOVA, 1981, p. 4, T. 4, fig. 11; MARINOV and GOLEMANSKY, 1989, p. 9	***Discammina imperspica*** YANKO, 1974
Discorbis vilardeboana (D'ORBIGNY, 1839)	VALKANOVA, 1981, p. 9, T. 6, fig. 7; MARINOV and GOLEMANSKY, 1989, p. 9 YANKO, 1989, p. 162	***Ammonia tepida*** (CUSHMAN, 1926)
Eggerella scabra (WILLIAMSON, 1858)	VALKANOVA, 1981, p. 9, T. 4, fig. 7; YANKO and TROITSKAJA, 1987, p. 69; MARINOV and GOLEMANSKY, 1989, p. 9; YANKO, 1989, p. 161; YANKO, 1990, p. 174	***Eggereloides scabrus*** (WILLIAMSON, 1858)
Elphidium crispum (LINNÉ, 1758)	CASPERS, 1951, p. 51; VALKANOV, 1957, p. 11	***Elphidium macellum*** (FICHTELL and MOLL, 1798)

Table 2. Continued.

(1)	(2)	(3)
Elphidium incertum (WILLIAMSON, 1858)	VALKANOVA, 1981, p. 6, T. 6, fig. 6; MARINOV and GOLEMANSKY, 1989, p. 9	***Cribroelphidium parkerae*** YANKO, 1974
Elphidium poeyanum (D'ORBIGNY, 1839)	VALKANOV, 1957, p. 11; VALKANOVA, 1981, p. 6, T. 3, fig. 1; MARINOV and GOLEMANSKY, 1989, p. 9	***Cribroelphidium poeyanum*** (D'ORBIGNY, 1839)
Lagena aequilabialis BUCHNER, 1940	VALKANOVA, 1981, p. 4, T. 4, fig. 1; MARINOV and GOLEMANSKY, 1989, p. 9	***Parafissurina dzementica*** YANKO, 1979
Lagena apiculata (REUSS, 1850)	VALKANOVA, 1981, p. 4, T. 4, fig. 2; MARINOV and GOLEMANSKY, 1989, p. 9	***Fissurina porrecta*** TROITSKAJA, 1987
Lagena laevigata (REUSS, 1849)	TUFESCU, 1973, p. 27; VALKANOVA, 1981, p. 4, T. 4, fig. 3; MARINOV and GOLEMANSKY, 1989, p. 9	***Fissurina fragilis*** TROITSKAJA, 1987
Lagena laevis f. semistriata (WILLIAMSON, 1858)	TUFESCU, 1973, p. 26	***Lagena semistriata*** (WILLIANSON, 1858)
Lagena pseudiglobosa BUCHNER, 1940	VALKANOVA, 1981, p. 4, T. 4, fig. 4; MARINOV and GOLEMANSKY, 1989, p. 9	***Parafissurina*** ex. gr. ***latteralis*** (CUSHMAN, 1913)
Lagena simplex BUCHNER, 1940	VALKANOVA, 1981, p. 4, T. 4, fig. 5; MARINOV and GOLEMANSKY, 1989, p. 9	***Parafissurina aventricosa*** MCCULLOCH, 1968
Miliammina rugosa MIKHALEVICH, 1968	VALKANOVA, 1981, p. 6, T. 4, fig. 6; MARINOV and GOLEMANSKY, 1989, p. 9	***Miliammina fusca*** (BRADY, 1870)
Nonion depressula v. matagordana KORNFELD, 1931	TEMELKOV, 2002, p. 98, figs. 44-45	***Nonion matagordanus*** (KORNFELD, 1931)
Nonion depressulum (WALKER et JACOB, 1798)	VALKANOV, 1957, p.11; TUFESCU, 1973, p. 26, T. 1, fig. 3	***Nonion matagordanus*** (KORNFELD, 1931)
Nonion stelligerum (D'ORBIGNY, 1839)	VALKANOV, 1957, p. 11; VALKANOVA, 1981, p. 11, T. 5, fig. 3	***Astrononion stelligerum*** (D'ORBIGNY, 1839)
Pateoris dilatatus (D'ORBIGNY, 1839)	YANKO and TROITSKAJA, 1987, p. 69; YANKO, 1989, p. 164	***Miliolinella dilatata*** (D'ORBIGNY, 1839)
Polystomella strigilata (D'ORBIGNY, 1839)	CHICHKOFF, 1912, p. 31; VALKANOV, 1957, p. 11	***Elphidium strigilata*** (D'ORBIGNY, 1839)

Table 2. Continued.

(1)	(2)	(3)
Polystomella sp.	CHICHKOFF, 1912, p. 31; VALKANOV, 1957, p. 11	***Elphidium* sp.**
Porosononion martcobi ponticus YANKO, 1989	YANKO, 1989, p. 161	***Porosononion martcobi*** (BOGDANOWICH, 1947)
Porosononion subgranosus (EGGER, 1857)	YANKO and TROITSKAJA, 1987, p. 53, T. 19, figs. 1-3	***Porosononion subgranosus mediterranicus*** YANKO, 1989
Protelphidium tuberculatum (D'ORBIGNY, 1839)	TUFESCU, 1973, p. 27, T. 1, fig. 1	***Porosononion subgranosus mediterranicus*** YANKO, 1989
Proteonella atlantica (CUSHMAN, 1944)	YANKO, 1989, p. 162	***Lagenammina atlantica*** (CUSHMAN, 1944)
Quinqueloculina fusca BRADY, 1870	CHICHKOFF, 1912, p. 31; VALKANOV, 1957, p. 11	***Miliammina fusca*** (BRADY, 1870)
Quenqueloculina pseudoseminula MIKHALEVICH, 1968	VALKANOVA, 1981, p. 6, T. 2, fig. 2; MARINOV and GOLEMANSKY, 1989, p. 9	***Quenqueloculina seminula*** (LINNÉ, 1758)
Quenqueloculina seminulum (LINNÉ, 1758)	VALKANOV, 1957, p. 11; YANKO and TROITSKAJA, 1987, p. 69; YANKO, 1989, p. 163	***Quenqueloculina seminula*** (LINNÉ, 1758)
Rhabdogromia flexilis (HÖGLUND, 1947)	VALKANOVA, 1964, p. 58, figs. 1-5; MARINOV, 1979, p. 85; GOLEMANSKY, 1980, p. 118; MARINOV and GOLEMANSKY, 1989, p. 8	***Micatuba flexilis*** (HÖGLUND, 1947)
Rotalia beccarii (LINNÉ, 1758)	CASPERS, 1951, p. 51; VALKANOV, 1957, p. 11; VALKANOVA, 1981, p. 9, T. 6, fig. 5	***Ammonia compacta*** (HOFKER, 1969)
Rotalia calcar (D'ORBIGNY, 1826)	VALKANOVA, 1981, p. 9, T. 4, fig. 12; MARINOV and GOLEMANSKY, 1989, p. 9	***Ammonia calcar*** (D'ORBIGNY, 1826)
Rotalia orbicularis (D'ORBIGNY, 1826)	CASPERS, 1951, p. 51; VALKANOV, 1957, p. 11	***Ammonia orbicularis*** (D'ORBIGNY, 1826)
Rotalia perlucida (HERON-ALLEN et EARLAND, 1913)	VALKANOVA, 1981, p. 9, T. 3, fig. 3; MARINOV and GOLEMANSKY, 1989, p. 9	***Aubignyna perlucida*** (HERON-ALLEN et EARLAND, 1913)
Rotalia soldanii (D'ORBIGNY, 1826)	VALKANOVA, 1981, p. 9, T. 5, fig. 8; MARINOV and GOLEMANSKY, 1989, p. 9	***Ammonia ammoniformis*** (D'ORBIGNY, 1826)
Rotalia veneta (SCHULTZE, 1854)	CHICHKOFF, 1912, p. 31; VALKANOV, 1957, p. 11	***Ammonia veneta*** (SCHULTZE, 1854)
Sigmolina ex.gr. distorta (PHLEGER et PARKER, 1951)	YANKO and TROITSKAJA, 1987, p. 70, T. 3, figs. 7-9	***Sigmella distorta*** (PHLEGER et PARKER, 1951)

Table 2. Continued.

(1)	(2)	(3)
Triloculina oblonga D'ORBIGNY, 1826	TUFESCU, 1973, p. 26, T. 2, fig. 8	***Quinqueloculina oblonga*** (MONTAGU, 1803)
Trochammina labiosa HÖGLUND, 1947	VALKANOVA, 1981, p. 9, T. 5, fig. 7; MARINOV and GOLEMANSKY, 1989, p. 9	***Rotaliammina ochracea*** (WILLIAMSON, 1858)
Verneulina scabra (WILLIAMSON, 1858)	VALKANOV, 1957, p. 11; TUFESCU, 1973, p. 26, T. 2, fig. 3	***Eggereloides scabrus*** (WILLIAMSON, 1858)
Wiesnerella auriculata EGGER, 1857	VALKANOVA, 1981, p. 9, T. 6, fig. 3; MARINOV and GOLEMANSKY, 1989, p. 9	***Miliolinella dilatata*** (D'ORBIGNY, 1839)

Pyrgo (8) predominate, whereas in front of the Bulgarian Black Sea Coastline the species of the genera *Quinqueloculina* (11), *Ammonia* (9), *Elphidium* (6), *Cribroelphidium* (5) and *Fissurina* (5) are predominating. It is noteworthy that five of the 8 dominant genera in the Mediterranean (*Adelosina, Spiroloculina, Brizalina, Cycloforina* and *Pyrgo*) have not been represented in the foraminiferal fauna of the Bulgarian Black Sea Coastline at all.

The study of YANKO (1989) on the quaternary foraminifera of the southern seas of the USSR - Pontian-Caspian region, shows that more of the above conclusion, made on the basis of the foraminiferal fauna from the Bulgarian Black Sea Coastline, are valid for the Black Sea as a whole. Yanko established a total of 132 species and subspecies recent foraminifera in all seas of the Ponto-Caspian region. Of them 104 species were found in the Black Sea, 21 in the Sea of Azov and 18 in the Caspian Sea. She has also indicated that the recent foraminiferal fauna of the Black Sea is considerably poorer than the Mediterranean, and that it is thoroughly composed by the Mediterranean emigrants. Moreover, Yanko established that quantitatively predominated the species of the genera *Ammonia*, *Elphidium* and *Porosononion*, which constitute about 90-95% of all found foraminifera in the Black Sea. As regards the diversity she found that the genera *Quinqueloculina* (17), *Elphidium* (13), *Ammonia* (10), *Fissurina* (9), *Porosononion* (8) and *Cribroelphidium* (5) are represented by most species. In her study Yanko did not find representatives of the genera *Adelosina, Cycloforina* and *Spiroloculina* either, which are widely distributed in the Mediterranean foraminiferal fauna.

Generally, the differences between the foraminiferal faunae of the Mediterranean and the Black seas could be explained firstly by the great differences of the salinity of these two seas, and secondly by the presence of H_2S in the Black Sea below 150-200 m depth. The last fact is the main limiting factor for the distribution of many deep-water dwelling foraminifera in the Black Sea.

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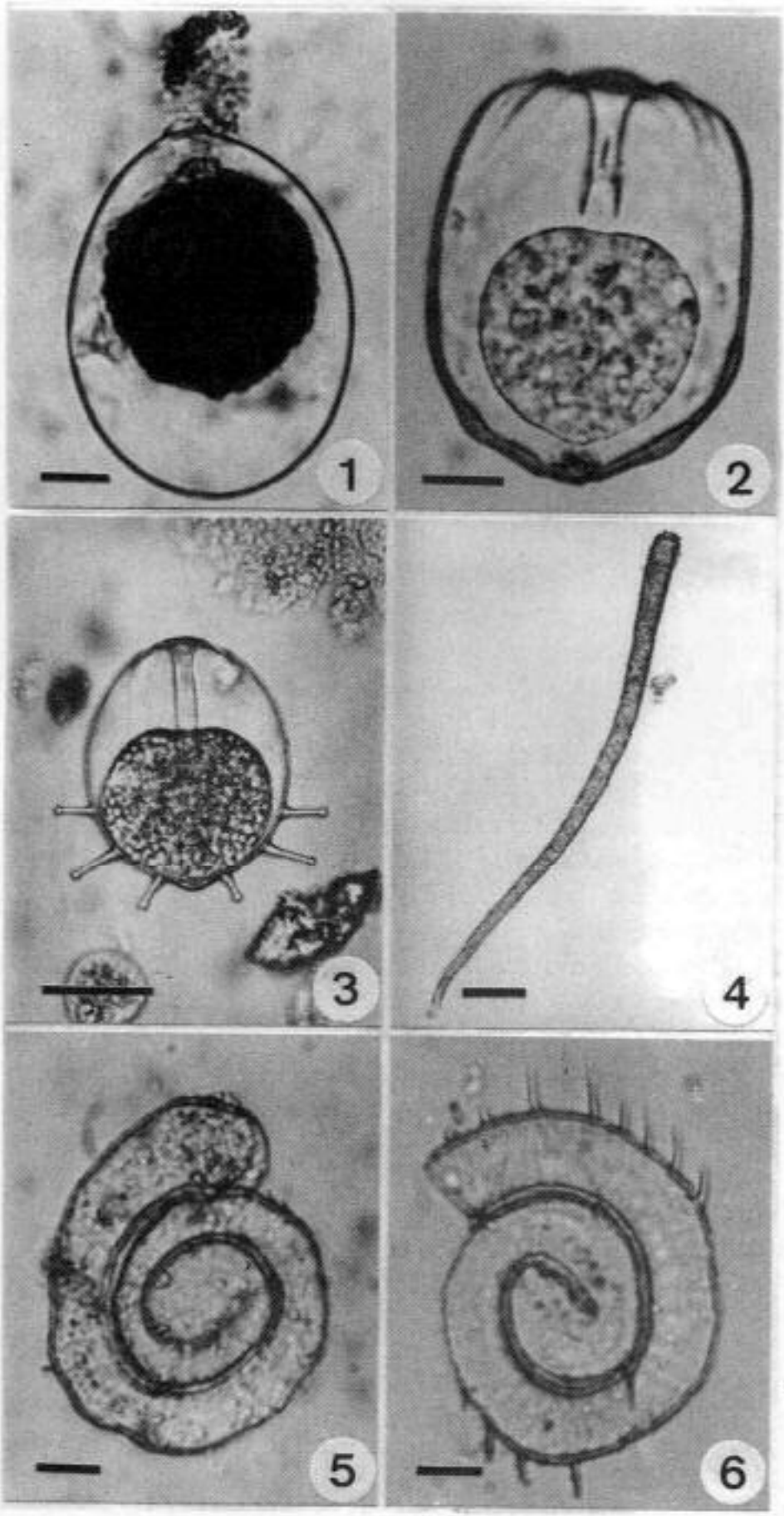
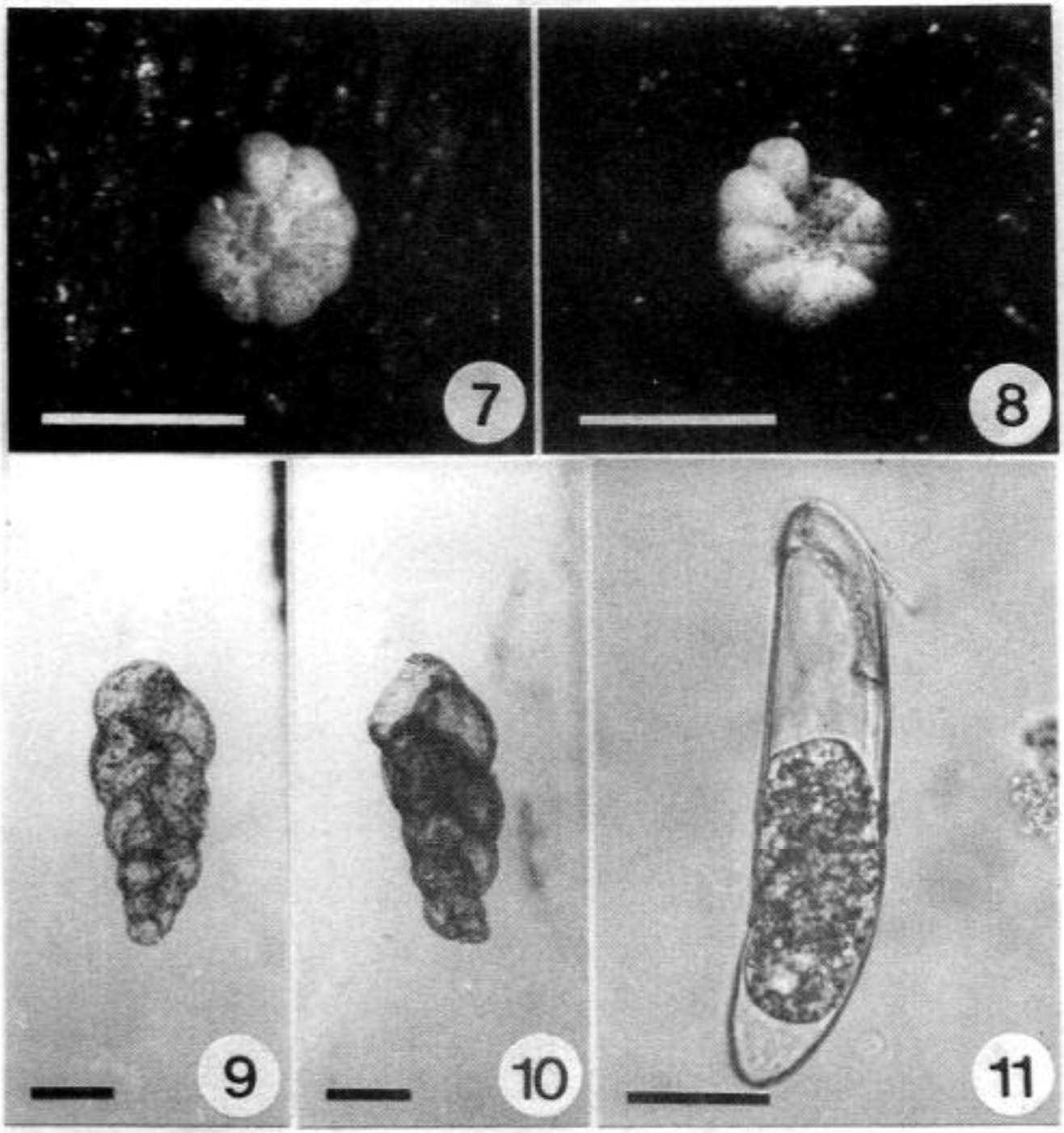
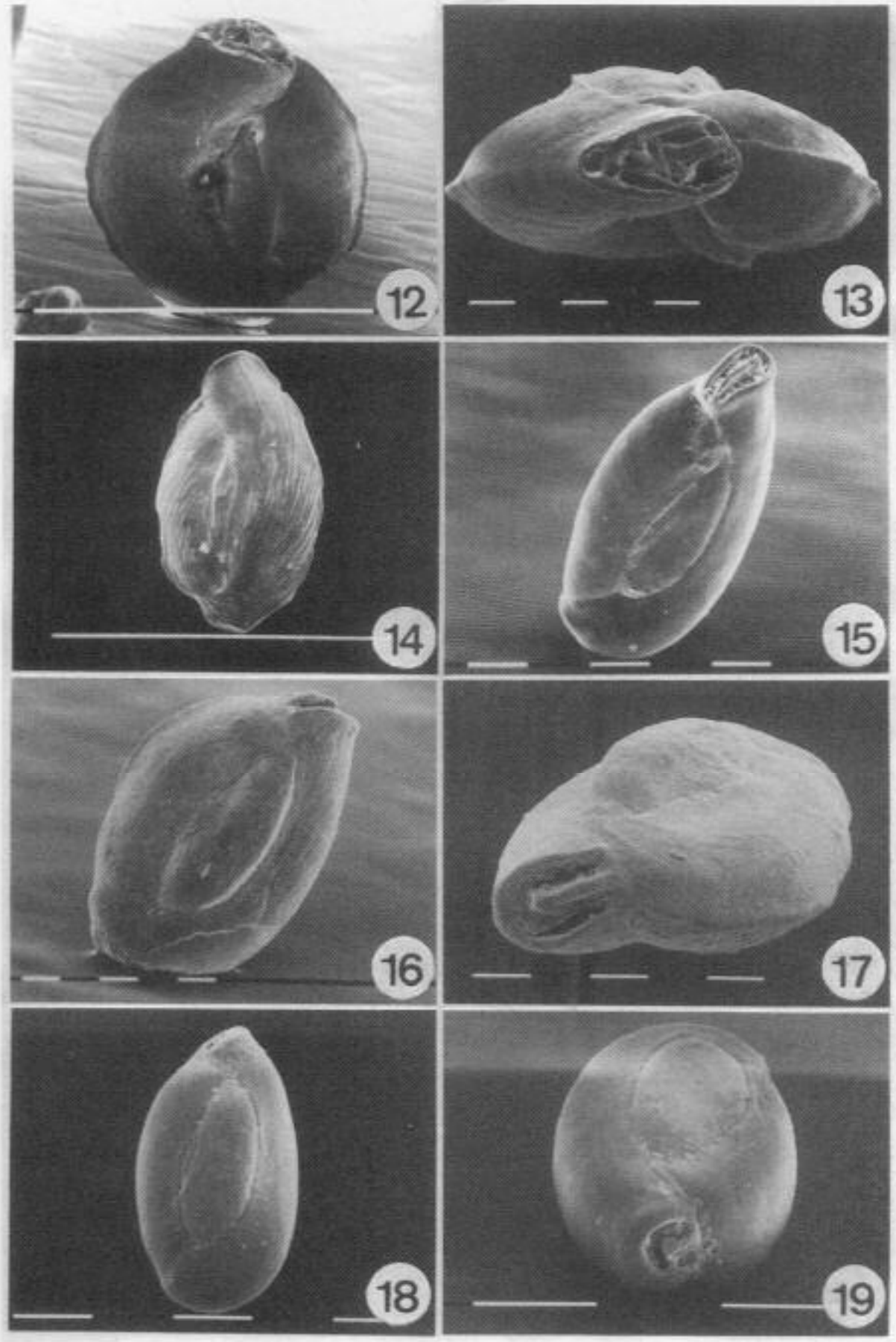


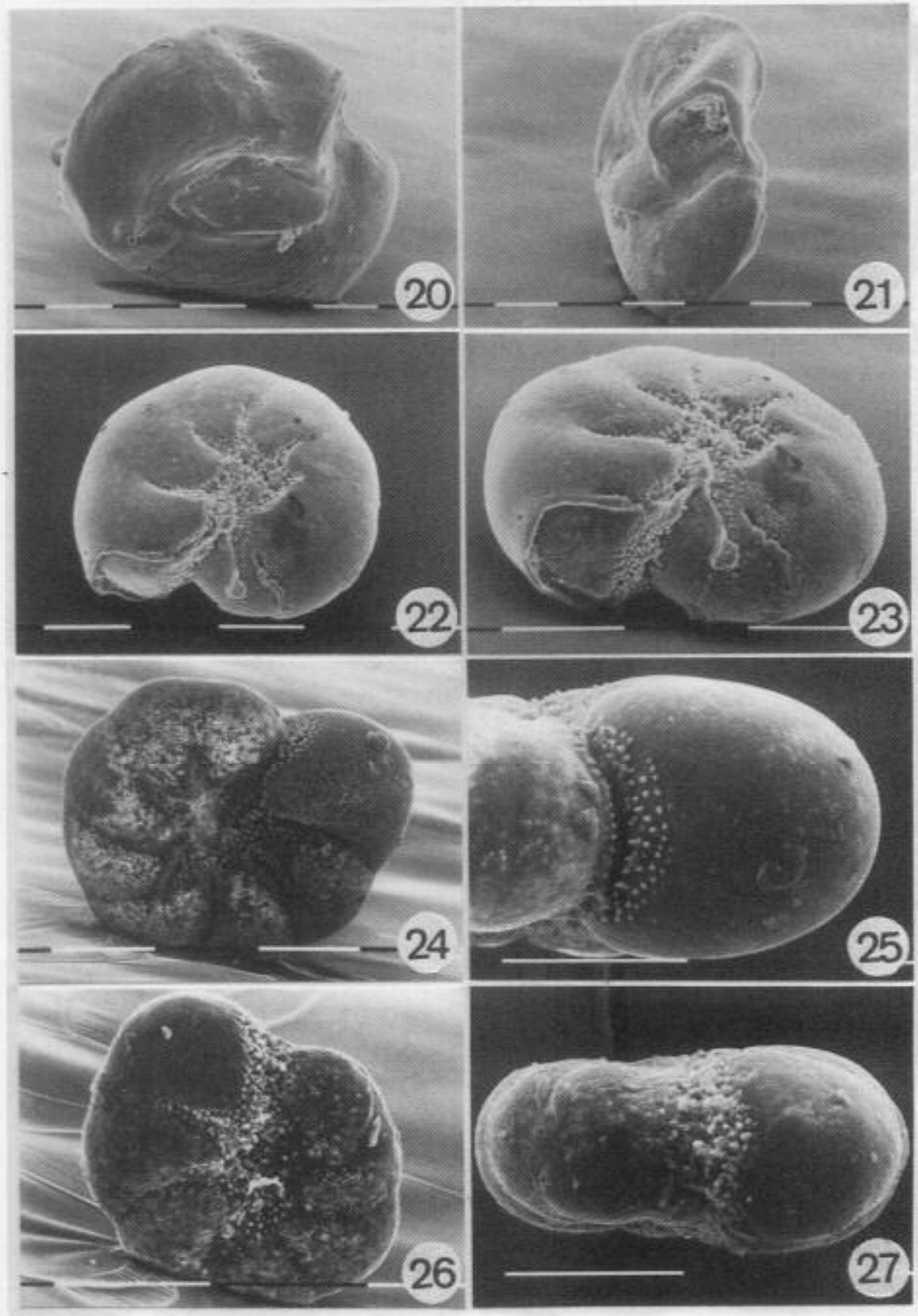
Figs 1-6. LM photographs of Black Sea foraminifera. 1 – *Lagynis pontica*, lateral view; 2 – *Lagenidiopsis elegans*, lateral view; 3 – *Lagenidiopsis valkanovi*, lateral view, 4 – *Micatuba flexilis*, lateral view; 5 – *Cornuspira* sp. 1, lateral view; 6 – *Cornuspira* sp. 2, lateral view. Scale bars - 25 μm (in Figs 1-3), 200 μm (in Fig. 4), 50 μm (in Figs 5-6).



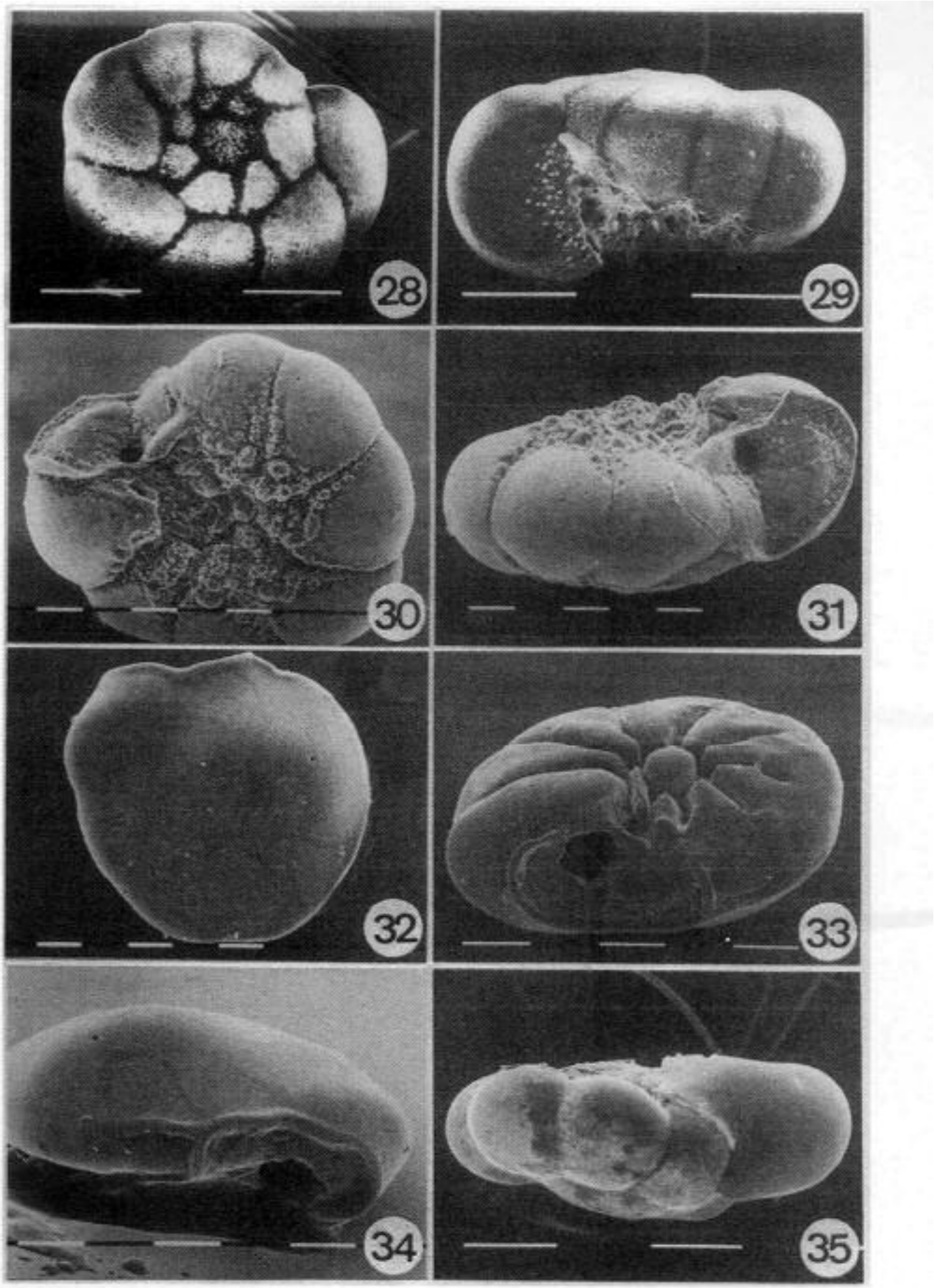
Figs 7-11. LM photographs of Black Sea foraminifera. 7-8 – *Jadammina macrescens dacica*. 7 - spiral view, 8 – umbilical view; 9-10 – *Eggereloides scabrus*, lateral views. 9 – microspherical form, 10 – macrospherical form; 11 – *Lagena felsina*, lateral view. Scale bars - 250 μm (in Figs 7-11).



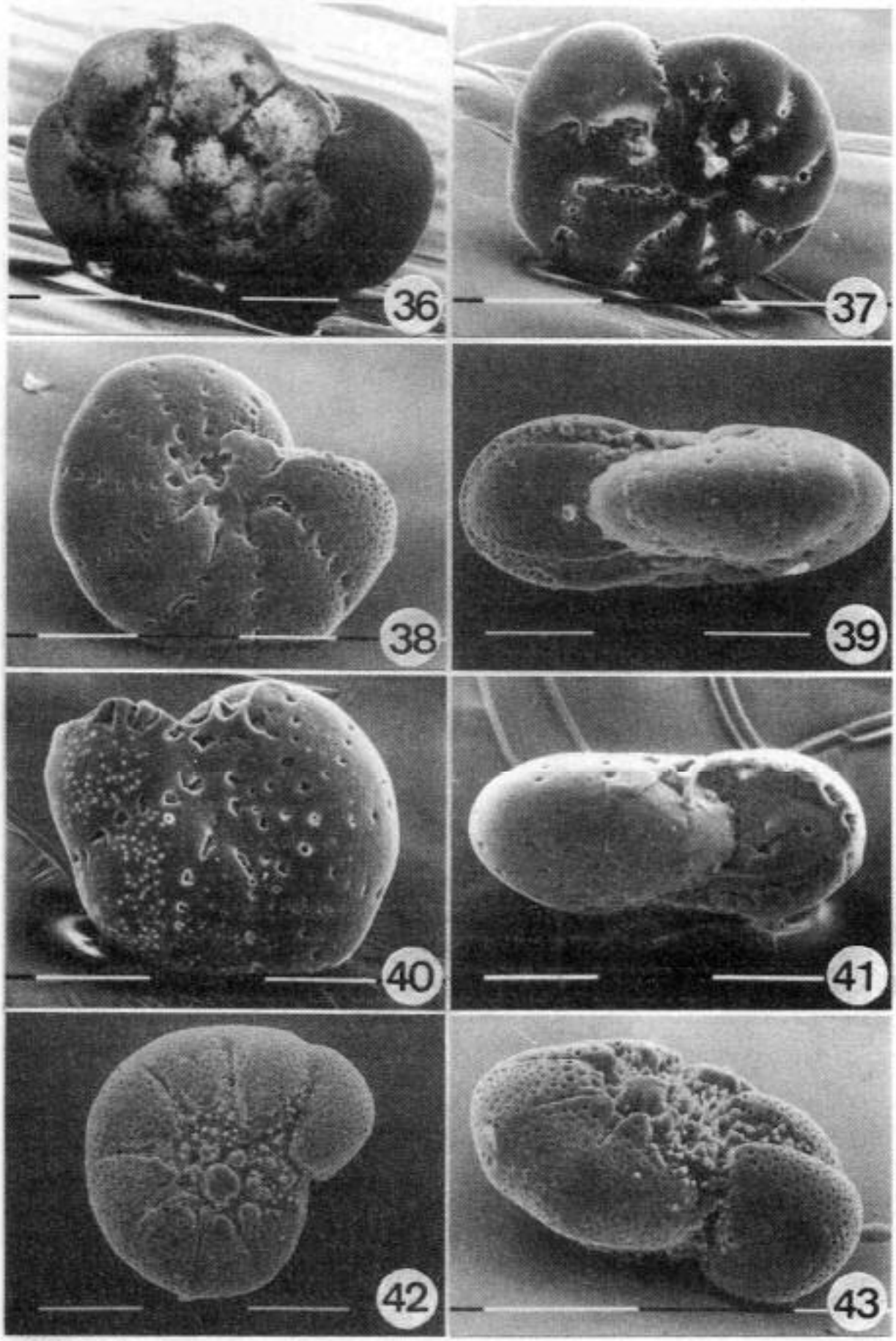
Figs 12-19. SEM photographs of Black Sea foraminifera. 12-13 – *Massilina secans*. 12 -lateral view, 13 – apertural view; 14 – *Lachlanella planciana*, lateral view; 15 – *Quinqueloculina laevigata*, lateral view; 16-17 – *Quinqueloculina seminula*, 16 - lateral view, 17 – apertural view; 18-19 – *Quinqueloculina lata*, 18 - lateral view, 19 – apertural view. Scale bars - 1000 μm (in Figs 12, 14), 100 μm (in Figs 13, 15-19).



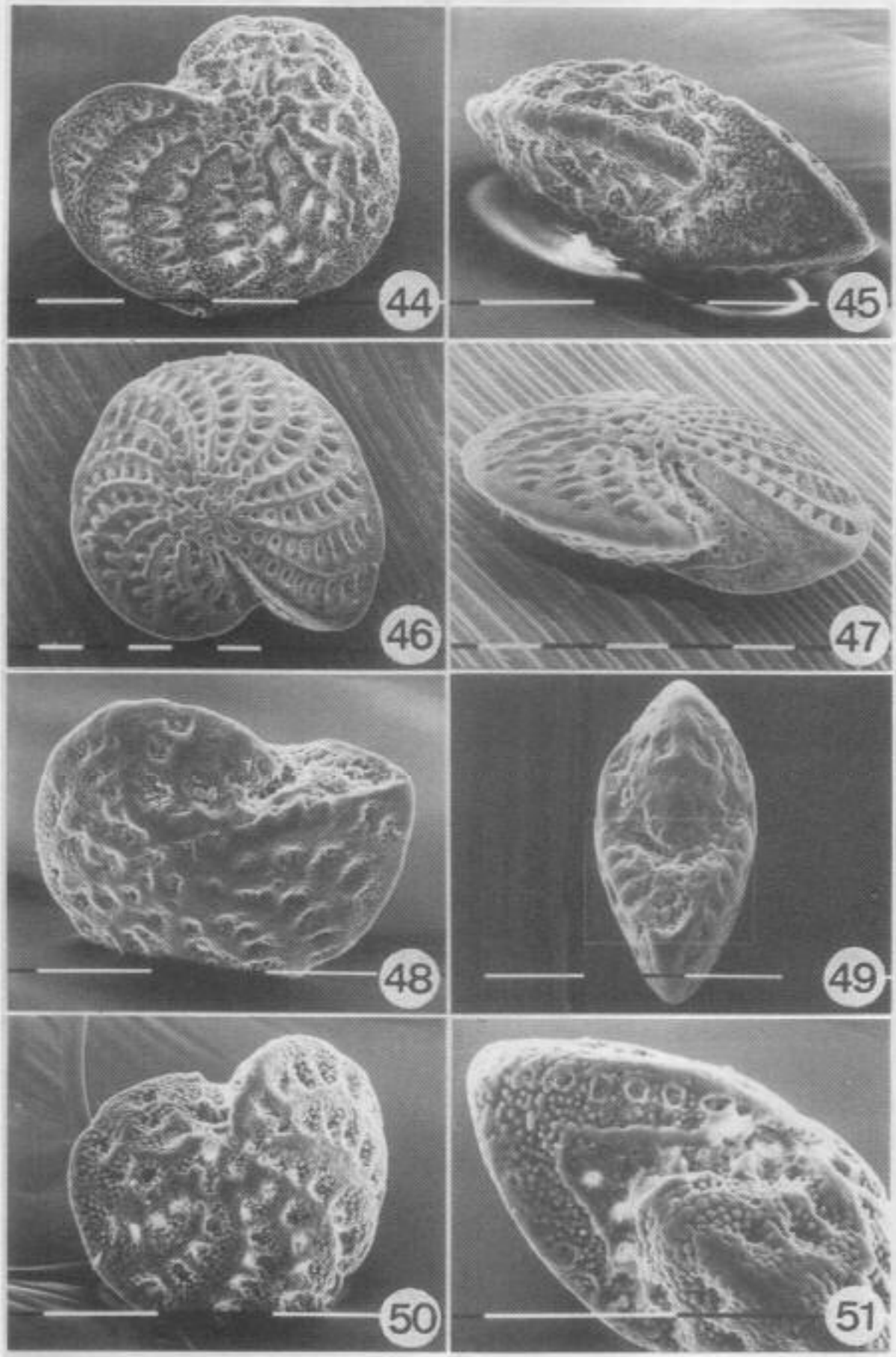
Figs 20-27. SEM photographs of Black Sea foraminifera. 20-21 – *Miliolinella subrotunda*. 20 - lateral view, 21 – apertural view; 22-23 – *Haynesina anglica*. 22 - lateral view, 23 – apertural view; 24-25 – *Nonion matagordanus*. 24 - lateral view, 25 – apertural view; 26-27 – *Nonion pauciloculum*, 26 - lateral view, 27 – apertural view. Scale bars - 100 μm (in Figs 20-27).



Figs 28-35. SEM photographs of Black Sea foraminifera. 28-29 – *Ammonia ammoniformis*. 28 - spiral view, 29 – apertural view; 30-31 – *Ammonia compacta*. 30 - umbilical view, 31 – apertural view; 32-34 – *Ammonia parkinsoniana*. 32 - spiral view, 33 – umbilical view, 34 – apertural view; 35 – *Ammonia tepida*, apertural view. Scale bars - 100 μm (in Figs 28-35).



Figs 36-43. SEM photographs of Black Sea foraminifera. 36 – *Ammonia tepida*, spiral view; 37 – *Cribroelphidium parkerae*, lateral view; 38-39 – *Cribroelphidium poeyanum*, 38 - lateral view, 39 – apertural view; 40-41 – *Cribroelphidium translucens*, 40 - lateral view, 41 – apertural view; 42-43 – *Porosononion martcobi ponticus*, 26 - lateral view, 27 – apertural view. Scale bars - 100 μm (in Figs 36-43).



Figs 44-51. SEM photographs of Black Sea foraminifera. 44-45 – *Elphidium* cf. *sculpturatum*, 44 - lateral view, 45 – apertural view; 46-47 – *Elphidium macellum*, 46 - lateral view, 47 – apertural view; 48-49 – *Elphidium ponticum*, 48 - lateral view, 49 – apertural view; 50-51 – *Elphidium* sp. 50 - lateral view, 51 – apertural view. Scale bars - 100 μm (in Figs 44-51).

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Осъвременен и илюстриран чек-лист на рецентните фораминифери от Българското черноморско крайбрежие

Б. Темелков, В. Големански, М. Тодоров

(Резюме)

В предлаганата работа е направен кратък исторически преглед на изследванията върху рецентните фораминифери от Българското черноморско крайбрежие. Досега от този регион са установени общо 107 вида и подвида фораминифери, които се отнасят към 56 рода, 32 семейства и 10 разреда. В резултат на таксономична ревизия на съобщените досега фораминифери е представен отделно и техния синонимен списък. Също така е дадено и хабитатното разпространение на рецентните фораминифери от Българското черноморско крайбрежие. Най-широко разпространените семейства, представени с най-много видове са: Hauerinidae (20 вида), Elphidiidae (15), Rotaliidae (9) и Ellipsolagenidae (8). Най-широко разпространени родове, представени с най-много видове са: *Quinqueloculina* (11), *Ammonia* (9), *Elphidium* (6), *Cribroelphidium* (5) and *Fissurina* (5). По-разпространените и интересните в таксономично отношение черноморски фораминифери са илюстрирани със снимки на сканиращ електронен микроскоп.