

Benthic Foraminiferal Assemblages from the Eastern Levantine Coast of Turkey

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Abstract

Foraminiferal assemblages of the coasts of Samandağ and Yayladağı (Hatay, SE Turkey), were investigated. Species composition of the assemblage and abundance of some dominant species were determined. Indo-Pacific originated alien species were found to be dominant as it is the case on southwestern coast of Turkey. *Amphistegina lobifera* Larsen was the most abundant species and *Pararotalia calcariformata* McCulloch also showed extensive abundance in some sampling sites. *Siphonina tubulosa* Cushman is recorded first time in the Mediterranean.

Keywords: Foraminifera, alien species, *Siphonina tubulosa*, Levantine Sea, Mediterranean Sea

Introduction

Foraminiferal assemblages of the Eastern Mediterranean coasts of Turkey have been well studied (Avşar et al., 2001; Meriç et al., 2008). A rich benthic foraminifer fauna dominated by native species was observed. However, almost all studies have been conducted deeper than 20 m. Shallow nearshore waters of the Eastern Mediterranean coasts are invaded by Indo-Pacific originated alien species. 42 alien foraminifer species have previously been reported from Turkish waters (Çınar et al., 2011). However, majority of the alien species introduced via Suez Canal prefers shallow waters. Thus in order to figure out the influence of alien foraminifers on the native fauna, shallow sandy and rocky habitats on the easternmost part of the Mediterranean coast of

Turkey (Samandağ and Yayladağı) was investigated.

Materials and Methods

Surface sediment samples were manually collected from eight different sites at depths between 2 and 8 m from sandy or rocky bottoms by SCUBA diving (Figure 1, Table 1). Samplings were carried out in October 2008 and May 2009. For each sample, 5 grams of dried sediment was disaggregated in water with 10% H₂O₂ and washed through a 0.063 mm sieve. The residues were oven-dried at 50 °C. Subsequently, the samples were dry-sieved through a series of sieves (2, 1, 0.5, 0.250 and 0.125 mm). The benthic foraminifers were identified under a stereo microscope.



Figure 1. Map of the study area showing the sampling sites.

Table 1. Coordinates, depths and some physico-chemical characteristics of the sampling sites.

Site No. (Map Ref.)	Date of Sampling	Coordinate	Depth (m)	Temperature (°C)	Salinity (‰)
1	24.10.2008	36°00'34"N, 35°58'48"E	3	26	39.1
2	25.10.2008	36°10'23"N, 35°52'43"E	3	27	39.4
3	25.10.2008	36°08'55"N, 35°54'06"E	3	27	39.4
4	26.10.2008	36°07'41"N, 35°54'48"E	4	27	39.3
5	26.10.2008	36°13'53"N, 35°50'19"E	3	27	39.5
6	26.10.2008	36°12'33"N, 35°51'11"E	2	27	39.5
7	02.05.2009	35°57'05"N, 35°55'10"E	8	24	39.0
8	03.05.2009	35°58'59"N, 35°57'22"E	8	24	39.0

Results

A total of 57 species of foraminifera representing 41 genera were identified in the examined sediment samples (Table 2, Plates 1-

2). Among these, eight species belonging to seven genera, *Spiroloculina antillarum* d'Orbigny, *Hauerina diversa* Cushman, *Coscinospira arietina* (Batsch), *Siphonina tubulosa* Cushman, *Cymbaloporeta plana*

(Cushman), *Amphistegina lessonii* d'Orbigny, are of Indo-Pacific origin (Meriç et al., 2008; A. *lobifera* Larsen, *Pararotalia calcariformata* Koukousioura et al., 2010). McCulloch, *Heterostegina depressa* d'Orbigny,

Table 2. List of species found at each sampling site.

Species	Sampling Site							
	1	2	3	4	5	6	7	8
<i>Spiroplectammina sagittula</i> (Defrance, 1824)	+							
<i>Bigenerina nodosaria</i> d'Orbigny, 1826	+							
<i>Textularia bocki</i> Höglund, 1947	+	+	+	+	+	+	+	+
<i>Adelosina cliarensis</i> (Heron-Allen & Earland, 1930)					+			+
<i>Adelosina mediterraneensis</i> (Le Calvez, J. & Y., 1958)							+	
<i>Spiroloculina antillarum</i> d'Orbigny, 1839					+	+	+	+
<i>Spiroloculina ornata</i> d'Orbigny, 1839								+
<i>Siphonaperta aspera</i> (d'Orbigny, 1826)	+	+	+					
<i>Cycloforina contorta</i> (d'Orbigny, 1839)						+		
<i>Cycloforina villafranca</i> (Le Calvez, J. & Y., 1958)	+							
<i>Hauerina diversa</i> Cushman, 1946								+
<i>Massilina gualteriana</i> (d'Orbigny, 1839)		+		+	+	+		
<i>Quinqueloculina bidentata</i> d'Orbigny, 1839		+						
<i>Quinqueloculina disparilis</i> d'Orbigny, 1826								+
<i>Quinqueloculina lamarckiana</i> d'Orbigny, 1839								+
<i>Quinqueloculina seminula</i> (Linnaeus, 1758)	+	+	+	+	+	+		
<i>Miliolinella elongata</i> Kruit, 1955			+					
<i>Miliolinella subrotunda</i> (Montagu, 1803)		+	+		+			
<i>Pseudotriloculina laevigata</i> (d'Orbigny, 1826)							+	
<i>Triloculina bermudezi</i> Acosta, 1940		+						
<i>Triloculina marioni</i> Schlumberger, 1893			+	+	+			+
<i>Triloculina tricarinata</i> d'Orbigny, 1826								+
<i>Sigmella edwardsi</i> (Schlumberger, 1887)							+	+
<i>Sigmoilina costata</i> Schlumberger, 1893								+
<i>Coscinospira arietina</i> (Batsch, 1791)						+		
<i>Peneroplis pertusus</i> (Forskål, 1775)			+		+	+	+	+
<i>Peneroplis planatus</i> (Fichtel & Moll, 1798)		+			+	+	+	+
<i>Sorites orbiculus</i> (Forskål, 1775)					+			+
<i>Laevidentalina inornata</i> (d'Orbigny, 1846)	+	+						
<i>Dentalina leguminiformis</i> (Batsch, 1791)	+							
<i>Lenticulina cultrata</i> (Montfort, 1808)	+	+	+	+				
<i>Bolivina spathulata</i> (Williamson, 1858)	+							
<i>Cassidulina carinata</i> Silvestri, 1896	+							

Table 2. (continued).

Species	Sampling Site							
	1	2	3	4	5	6	7	8
<i>Protoglobobulimina pupoides</i> (d'Orbigny, 1846)	+		+					
<i>Uvigerina mediterranea</i> Hofker, 1932	+							
<i>Fursenkoina acuta</i> (d'Orbigny, 1846)	+							
<i>Eponides concameratus</i> (Montagu, 1808)	+							
<i>Osangulariella bradyi</i> (Earland, 1934)	+							
<i>Neoconorbina terquemi</i> (Rzehak, 1888)			+					
<i>Siphonina tubulosa</i> Cushman, 1924	+	+						
<i>Cibicides pachyderma</i> (Rzehak, 1886)	+		+	+				
<i>Cibicoides pseudoungeriana</i> (Cushman, 1922)	+	+	+	+				
<i>Discorbinella bertheloti</i> (d'Orbigny, 1839)				+				
<i>Planulina ariminensis</i> d'Orbigny, 1826	+	+	+	+				
<i>Lobatula lobatula</i> (Walker & Jacob, 1798)		+						
<i>Planorbulina mediterraneensis</i> d'Orbigny, 1826						+		
<i>Cymbaloporeta plana</i> (Cushman, 1924)					+			
<i>Amphistegina lessonii</i> d'Orbigny in Guerin-Meneville, 1843	+							
<i>Amphistegina lobifera</i> Larsen, 1976	+	+	+	+	+	+	+	+
<i>Hansenisca soldanii</i> (d'Orbigny, 1826)	+		+					
<i>Pararotalia calcariformata</i> McCulloch, 1977	+	+	+	+	+	+		
<i>Ammonia parkinsoniana</i> (d'Orbigny, 1839)	+	+	+	+	+	+		
<i>Challengerella bradyi</i> Billman, Hottinger & Oesterle, 1980		+	+					
<i>Elphidium advenum</i> (Cushman, 1922)	+							
<i>Elphidium crispum</i> (Linnaeus, 1758)	+			+				
<i>Heterostegina depressa</i> d'Orbigny, 1826								+

The most remarkable feature of the assemblage is the high abundance of *Amphistegina lobifera* Larsen found in three samples collected from sediment deposition on rocks. Population densities were found to be 348 individuals per 5 grams of dry sediment (ind./5 g) in Site 5, 317 ind./5 g in Sample 6 and 4408 ind./5 g in Site 7. In addition, *Pararotalia calcariformata* McCulloch showed high abundance in Site 5. *Haddonina* sp., *Spiroloculina antillarum* d'Orbigny, *Hauerina diversa* Cushman, *Coscinospira arietina* (Batsch), *Siphonina*

tubulosa Cushman, *Cymbaloporeta plana* (Cushman), *Amphistegina lessonii* d'Orbigny, *A. lobifera* Larsen, *Heterostegina depressa* d'Orbigny are the Indo-Pacific members of the assemblage inhabiting the easternmost part of the Turkish Levantine coast (Hatta & Ujiie, 1992; Hottinger et al., 1993; Loeblich & Tappan, 1994; Meriç et al., 2008; Koukousioura et al., 2010) (Table 2, Plate 1-2). Among these species *Siphonina tubulosa* Cushman were recorded for the first time in the Mediterranean Sea.

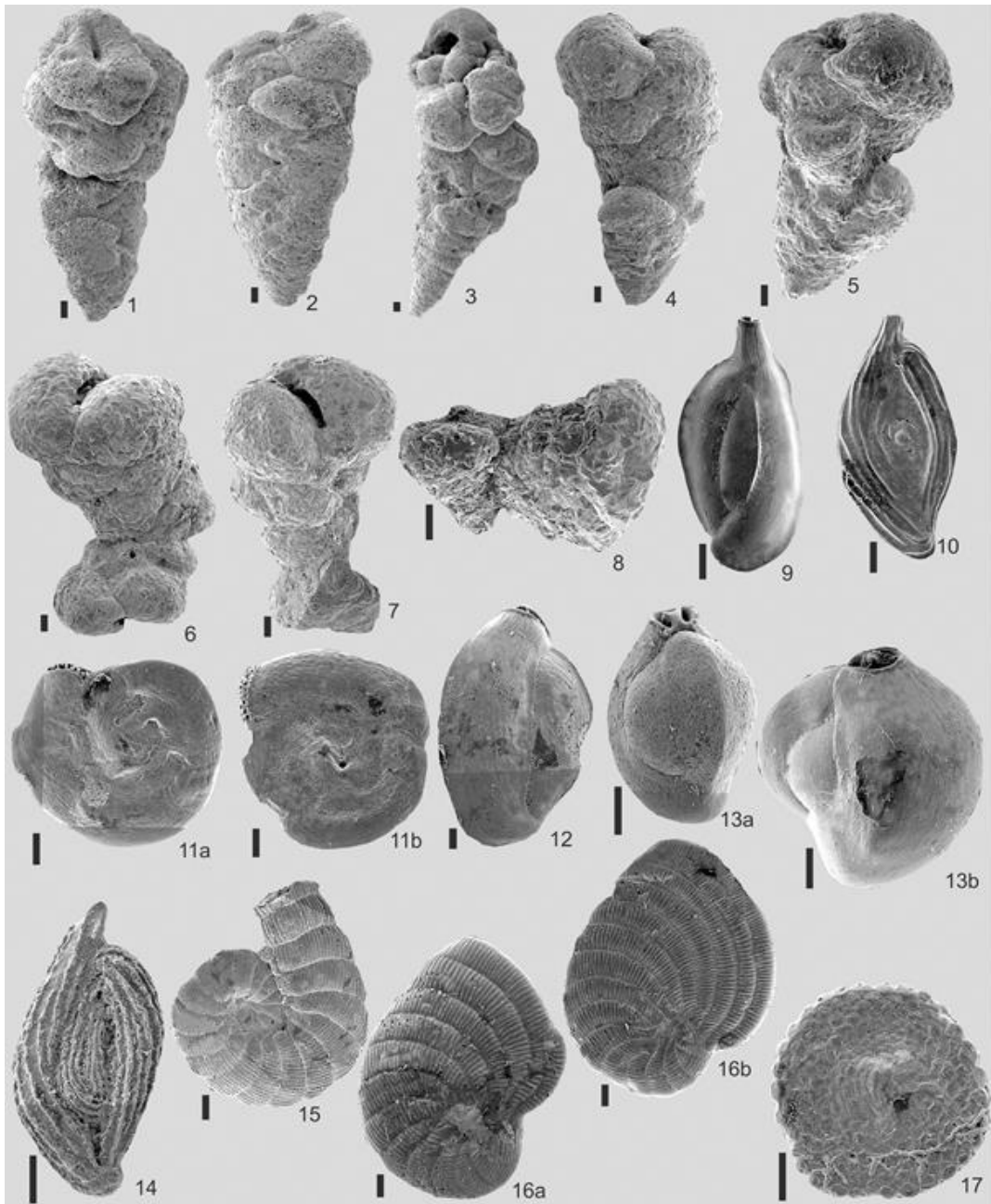


Plate 1.

1. *Textularia bocki* Höglund; Side view, abnormal specimen, Site 2.
2. *Textularia bocki* Höglund; Side view, Site 2.
3. *Textularia bocki* Höglund; Side view, abnormal specimen, Site 2.
4. *Textularia bocki* Höglund; Side view, abnormal specimen, Site 2.
5. *Textularia bocki* Höglund; Side view, twins, Site 2.
6. *Textularia bocki* Höglund; Side view, twins, Site 2.
7. *Textularia bocki* Höglund; Side view, twins, Site 2.
8. *Textularia bocki* Höglund; Side view, twins, Site 2.
9. *Adelosina cliarensis* (Heron-Allen & Earland); Side view, Site 8.
10. *Spiroloculina antillarum* d'Orbigny; Side view, Site 8.

11. *Hauerina diversa* Cushman; Side views, Site 8.
12. *Massilina gualteriana* (d'Orbigny); Side view, Site 5.
13. *Triloculina marioni* Schlumberger; Side views, a, Site 4 and b, Site 8.
14. *Sigmoilina costata* Schlumberger; Side view, Site 8.
15. *Coscinospira arietina* (Batsch); Side view, Site 6.
16. *Peneroplis planatus* (Fichtel and Moll); Side views, Site 6.
17. *Sorites orbiculus* Ehrenberg; Side view, Site 8.

Scales = 100 µm

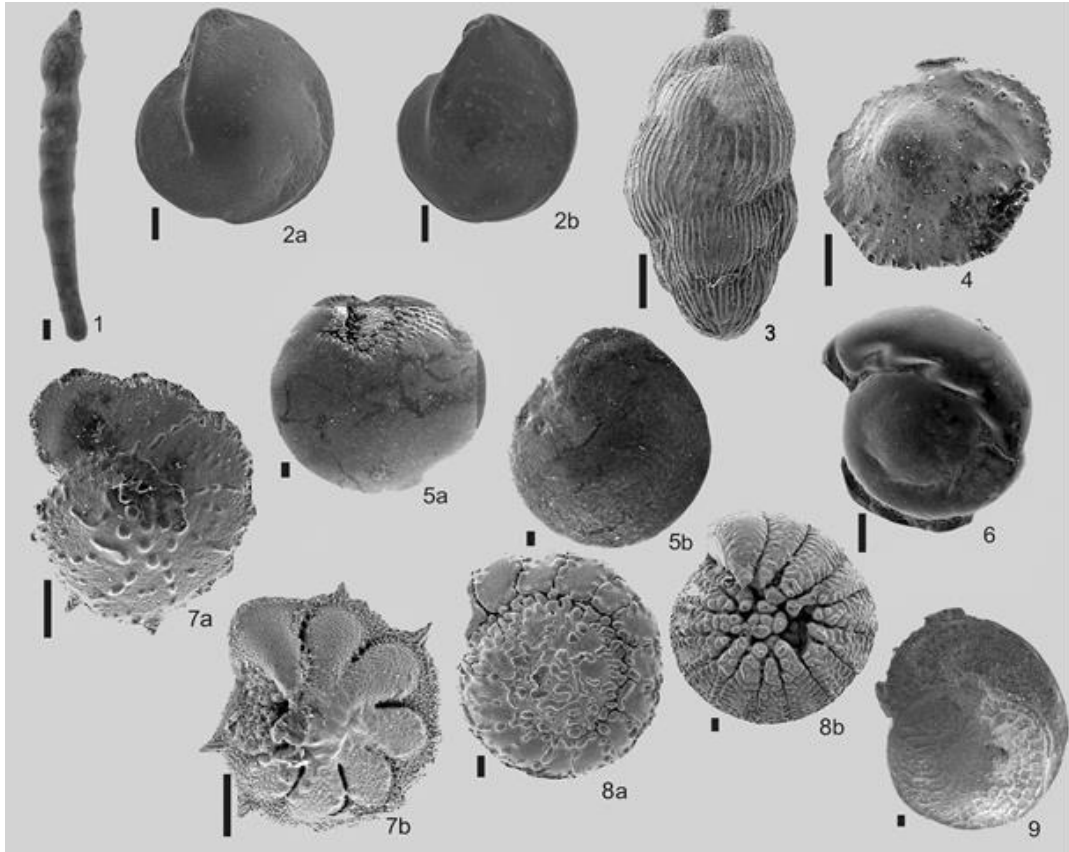


Plate 2.

1. *Laevidentalina inornata* (d'Orbigny); Side view, Site 1.
2. *Lenticulina cultrata* (Montfort); Side views, Site 1.
3. *Uvigerina mediterranea* Hofker; Side view, Site 1.
4. *Siphonina tubulosa* Cushman; Side view, Site 2.
5. *Amphistegina lobifera* Larsen; Side views, Site 2.
6. *Hansenisca soldanii* (d'Orbigny); Side view, Site 1.
7. *Pararotalia calcariformata* McCulloch; Side views, Site 4.
8. *Challengerella bradyi* Billman, Hottinger & Oesterle; Side views, Site 2.
9. *Heterostegina depressa* d'Orbigny; Side view, Site 8.

Scales = 100 µm

Conclusion

In the present study very shallow waters (2-8m) were investigated. The benthic foraminiferal assemblage of the Eastern Mediterranean coasts of Turkey has been previously studied. But the previous studies have been conducted at deeper depths. The results show that the coasts of Samandağ and Yayladağı have rich benthic foraminiferal assemblages and the species composition is in accordance with the Eastern Mediterranean foraminiferal fauna. Majority of the species are native, however, unlike deeper waters, Indo-Pacific originated aliens dominate the shallow water assemblages and have much higher abundance compared to the natives.

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