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## Two Rare Deep-Sea Bivalve Species from the Levantine Coast of Turkey: *Bathyarca philippiana* (Nyst, 1848) and *Verticordia granulata* Seguenza G., 1860

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**Abstract:** During 2 detailed surveys conducted along the Turkish coasts of the Aegean and Levantine seas in 2000 and 2005, respectively, 2 rare deep-water bivalve species, namely *Bathyarca philippiana* (Nyst, 1848) and *Verticordia granulata* Seguenza G., 1860, were recorded. Of these, *V. granulata* is new for the molluscan fauna of Turkish seas while *B. philippiana* is first record for the Levantine coast of Turkey. According to the literature at hand, *V. granulata* is also a new record for the Levantine Basin. In the present work, morphological, ecological, and distributional features of these 2 species are provided.

**Key Words:** *Bathyarca philippiana*, *Verticordia granulata*, Bivalvia, Turkey, eastern Mediterranean

### Türkiye'nin Akdeniz Kıyılarından İki Nadir Derin Deniz Bivalv Türü: *Bathyarca philippiana* (Nyst, 1848) ve *Verticordia granulata* Seguenza G., 1860

**Özet:** 2000 ve 2005 yıllarında, Türkiye'nin Ege Denizi ve Akdeniz kıyılarında gerçekleştirilen ayrıntılı iki araştırma çerçevesinde, nadir dağılımlı iki derin deniz bivalv türü (*Bathyarca philippiana* (Nyst, 1848) ve *Verticordia granulata* Seguenza G., 1860) tespit edilmiştir. Bu türlerden, *V. granulata* Akdeniz'in Levantin havzası ile Türkiye Mollusca faunası için ilk defa bildirilirken, *B. philippiana* Türkiye'nin Akdeniz kıyılarından ilk defa rapor edilmektedir. Bu çalışmada, incelenen iki türün morfolojik, ekolojik ve zoocoğrafik özellikleriyle ilgili bilgiler verilmiştir.

**Anahtar Sözcükler:** *Bathyarca philippiana*, *Verticordia granulata*, Bivalvia, Türkiye, Doğu Akdeniz

### Introduction

*Bathyarca philippiana* belongs to the family Arcidae, known as the ark shells, which includes solid, convex, and rectangular shells having a taxodont straight hinge line of numerous small teeth and often a well developed bysus. This family is represented by 14 species in the Mediterranean (Sabelli et al., 1990;

CLEMAM, 2008). Seven of the 11 arcid species are known to be distributed in Turkish seas. Among these, *Arca noae*, *Arca tetragona*, *Barbatia barbata*, *Anadara corbuloides*, *Anadara polii*, *Anadara natalensis*, and *Bathyarca pectunculooides* have been reported from the Turkish coast of the Levantine Sea (Öztürk and Çevik, 2000; Demir, 2003).

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The family Verticordiidae includes carnivorous deep sea species that secrete an adhesive fluid in order to assist the animal to maintain a position at the surface of the very soft abyssal sediment, and to capture food organisms such as copepods (Allen and Turner, 1974). Of the 6 species distributed in the Mediterranean (Sabelli et al., 1990, CLEMAM, 2008), none has been reported from Turkish seas to date, although some (*Halicardia ferruginea*, *Laevicordia gemma*, *Verticordia granulata*, and *Lyonsiella compressa*) have been reported from certain localities in the eastern Mediterranean (Cachia et al., 2004; Zenetos et al., 2005).

The present work reports on the finding of 2 rare deep-water species [*Bathyarca philippiana* (Nyst, 1848) and *Verticordia granulata* Seguenza G., 1860] recently collected along the Turkish coast.

### Materials and Methods

Benthic samples were collected using the R/V Hippocampus at 110 stations in the Turkish Aegean Sea between 28.07.2000 and 05.10.2000, and R/V Mustafa Kemal-1 and local fishing boats at 87 stations in the Turkish Levantine Sea between 08.09.2005 and 08.10.2005 by means of a dredge and Van Veen grab from various biotopes at depths between 5 and 200 m. Samples were sieved through a 0.5 mm mesh sized sieve, fixed with 10% formalin, and transferred to the laboratory for further treatment. Identification is based

on Parenzan (1974, 1976), Ardovini and Cossignani (1999), and Cachia et al. (2004) and systematic classification follows CLEMAM (2008). The investigated specimens were deposited at the Museum of Faculty of Fisheries, Ege University (EFSM).

### Results

Two rare deep-sea bivalve species were identified as a result of examining benthic samples collected from 197 stations along the Aegean and the Levantine coast of Turkey.

#### *Bathyarca philippiana* (Nyst, 1848) (Figure 1)

**Material examined:** One live specimen of *Bathyarca philippiana* was encountered at station 3 in the sandy mud bottom at 200 m depth off Anamur, Levantine coast of Turkey (Table 1, Figure 2).

**Description:** Shell white, with yellowish or light brown periostracum, solid, tumid shape. The dorsal margin is straight, anteriorly and posteriorly rounded, the ventral margin is slightly arched. Inequivalve, left valve bigger than the right one. Inequilateral, the beaks in the anterior half. Reticulated sculpture of fine radiating and concentric ribs that are stronger in the posterior area. Taxodont hinge line with about 5-6 anterior and 9-10 posterior teeth. Muscle scars and entire pallial line is clear. Margin finely crenulated. Size: 4.6 mm.

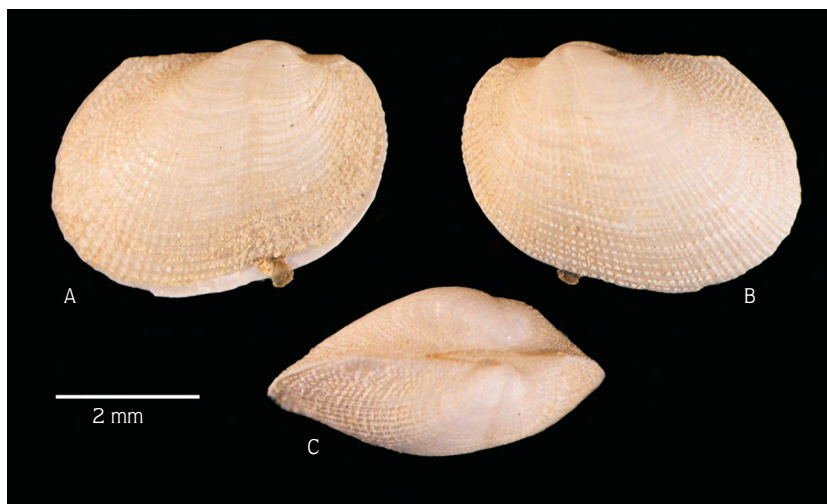


Figure 1. *Bathyarca philippiana*. View of the outside of the right (A) and left valve (B) and dorsal view of the shell (C).



Figure 2. Map showing the locations of the stations where the specimens were sampled (triangles denote presence of *V. granulata*, empty triangle *B. philippiana*).

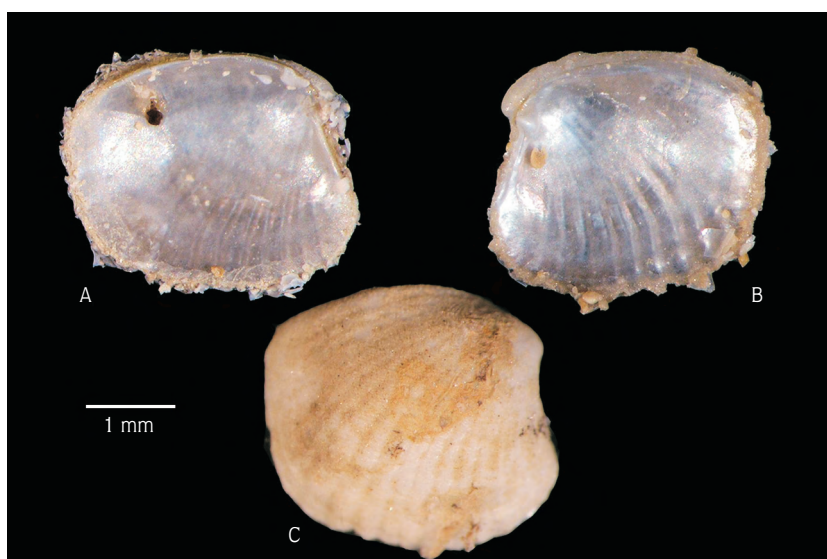


Figure 3. *Verticordia granulata*. View of the inside of the left (A) and the right (B) valve and outside of the right valve (C).

*Verticordia granulata* Seguenza G., 1860 (Figure 3)

**Material examined:** One live and 1 dead specimen were recorded. The live individual was found at station 1 to the south of Çeşme Peninsula, Aegean Sea. One shell was encountered at station 2, which was close to station 3, located also off Anamur, Levantine coast of Turkey. Both stations have muddy bottoms with depth ranges of 195 and 200 m respectively (Table 1, Figure 2).

**Description:** Shell solid, semitransparent, live specimens covered with small particles like fine

granular sand, possibly by the secretion, specific for the verticordiid species, rather squarish, inequivalve, right valve being more convex than the left one, inequilateral, the beaks situated close to the anterior margin, sculpture of about 20 strong radial ribs. One, strong, knob-like cardinal tooth in the right valve, corresponding pit under the umbo and a small posterior lateral in the left valve. Muscle scars and pallial line clear with inconspicuous pallial sinus. Margin smooth. Size: 3.4-3.5 mm.

Table 1. Characteristics of the stations where *B. philippiana* and *V. granulata* were encountered (\*: shell only).

Stations	Coordinates	Date	Depth (m)	Biotope	Species
1	38°06'15"N 26°27'22"E	14.09.2000	195	Mud	<i>Verticordia granulata</i>
2	36°02'02"N 32°53'59"E	23.09.2005	200	Mud	<i>Verticordia granulata*</i>
3	36°02'31"N 32°54'54"E	23.09.2005	200	Sandy mud	<i>Bathyarca philippiana</i>

## Discussion

*V. granulata*, new for the molluscan fauna of Turkish seas and the Levantine part of the eastern Mediterranean Sea, and *B. philippiana*, first record for the Levantine coast of Turkish seas, were identified as a result of 2 detailed studies carried out along the Aegean and Levantine coasts of Turkey, in 2000 and 2005, respectively.

To date, 12 arcid species, indicated in Table 2, have been reported from Turkish seas. Among the 4 alien species, *Anadara inaequalvis* has been recorded from the Aegean coast of Turkey (Engl, 1995). *Anadara demiri* is known only from İzmir Bay (Demir, 1977); *Anadara natalensis* and *Anadara inflata* are distributed only off the

Turkish Levantine coast (Niederhöfer et al., 1991; Çeviker and Albayrak, 2002).

*B. philippiana*, a deep sea and rare Atlanto-Mediterranean species, has only been reported by Demir (2003) hitherto from the Aegean coast of Turkey. This is the first record of the species from the Levantine coast of Turkey. On the other hand, *B. philippiana* has been reported by Nordsieck (1971), Bogi et al. (1983), Janssen (1989), Galil and Zibrowius (1998), Koutsoubas et al. (2000), and Panetta et al. (2003) from certain localities of the eastern Mediterranean. This species is also known from the Arctic Ocean, south to the Gulf of Mexico as well as the Azores and the Lusitanian Sea (Nordsieck, 1969; Poppe and Goto, 1993).

Table 2. Arcid species distributed in Turkish seas.

	Levantine Sea	Aegean Sea	Sea of Marmara	Black Sea
<i>Arca noae</i> Linné, 1758	+	+	+	-
<i>Arca tetragona</i> Poli, 1795	+	+	+	-
<i>Barbatia barbata</i> (Linné, 1758)	+	+	+	-
<i>Barbatia clathrata</i> (Defrance, 1816)	-	+	-	-
<i>Anadara corbuloides</i> (Monterosato, 1880)	+	+	-	-
<i>Anadara demiri</i> (Piani, 1981)	-	+	-	-
<i>Anadara inaequalvis</i> (Bruguière, 1789)	-	+	+	+
<i>Anadara inflata</i> (Reeve, 1844)	+	-	-	-
<i>Anadara natalensis</i> (Krauss, 1848)	+	-	-	-
<i>Anadara polii</i> (Mayer, 1868)	+	+	+	-
<i>Bathyarca philippiana</i> (Nyst, 1848)	+	+	-	-
<i>Bathyarca pectunculoides</i> (Scacchi, 1834)	+	+	+	-

*V. granulata* and *Haliris berenicensis* (Sturany, 1896) have been considered separate species in Piani (1980) and Sabelli et al. (1990), whereas *H. berenicensis* has been regarded as a synonym of *V. granulata* in CLEMAM (2008).

There is very little information on the distribution of *V. granulata* in the Mediterranean. The oldest record from the Mediterranean according to the literature we have is by Jeffreys (1881), who reported the species from the Aegean coast of Greece. Other records are from Bengasi (Libya) at 700 m depth (Nordsieck, 1969), Gorgona Island (Ligurian Sea, Italy) from muddy bottoms at 190 m (Rocchini, 1984), Anzio (Tyrrhenian Sea, Italy) at 500 m depth (Ardovini and Cossignani, 1999), from muddy bottoms western Malta at 140-200 m (Cachia et al., 2004), and from the northeast Aegean Sea (Zenetos et al., 2005; Streftaris and Zenetos, 2007). This is the first record of the species from the Levantine basin of the eastern Mediterranean. *V. granulata* has also been recorded by

Salas (1996) from the Atlantic coasts of Morocco and Spain at depth range of 180-370 m and it has been mentioned by Cachia et al. (2004) that this species is distributed in the North Atlantic as well at depths ranging from 30 to 1262 m.

No verticordiid species except *V. granulata* has been reported from Turkish seas to date. Additionally, *B. philippiana* is new record for the Turkish coast of the Levantine Sea although this species seems to be relatively common in the eastern Mediterranean. As can be seen from these examples, there is deficient knowledge on the biodiversity of deep water bivalvian species in Turkish seas. More detailed studies including deeper waters should be implemented in order to fill this gap.

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