

## The American piddock *Petricola pholadiformis* Lamarck, 1818 spreading in the Mediterranean Sea

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### Abstract

*Petricola pholadiformis*, native of American shores, is currently established in the Mediterranean Sea. More than ten live adult specimens were collected in Saronikos Gulf, eastern Mediterranean, in 2007. Possible pathways of introduction are discussed.

**Key words:** alien Mollusca, Mediterranean Sea, Greece, *Petricola pholadiformis*

*Petricola pholadiformis* Lamarck 1818, (syn. *Petricolaria pholadiformis*) is widely known as the American piddock. The species originates from the East coast of America (Gulf of St Lawrence to Uruguay), from where it was unintentionally introduced into southern England with *Crassostrea* oysters, not later than 1890 (Naylor 1957). Rosenthal (1980) suggested that from the British Isles, the species has colonized several northern European countries by means of its pelagic larvae and may have also spread via driftwood. It is now well established in England, Germany, Denmark, Sweden, Norway, The Netherlands and Belgium (NOBANIS 2009; ERMS 2009).

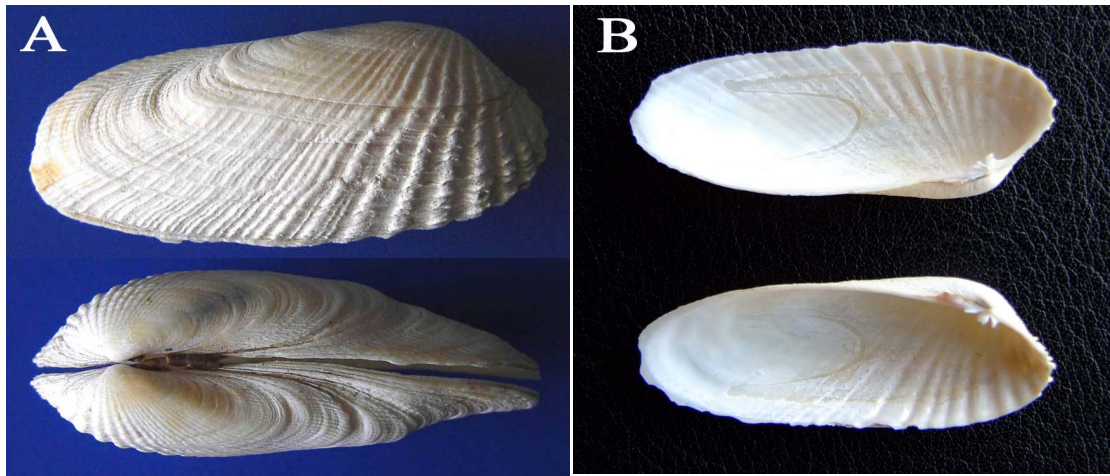
Its record in the western Mediterranean was disputed by Zenetos et al. 2004 as non documented, while its occurrence in Greece, based on a single record, has been to date considered accidental and related to shipping (Zenetos et al. 2005). The present work reviews earlier literature and provides new evidence on its establishment in the Mediterranean.

The fortuitous finding of many specimens in the west Saronikos area (Greece), has led us to re-assess the Goulandris Museum molluscan collection. Furthermore, earlier literature on the occurrence of the species was reviewed.

The areas of *P. pholadiformis* findings in the Mediterranean are presented in Annex 1.

The literature review revealed that a record of *P. pholadiformis*, based on Hayward and Ryland (1990), has been arbitrarily mapped in the central Mediterranean (OBIS 2009).

More than 10 live adult specimens of *P. pholadiformis* were collected from rocks at 2-3 m depth in Taktikoupolis, Saronikos Gulf in May 2007 (Figure 1A). The individuals collected measured on average 37 mm in length and 15 mm in height. Moreover, the investigation of the Goulandris Museum collection rendered a specimen collected from Loutra Oraias Elenis, Saronikos Gulf, GMNH number 12.377 (Figure 1B). All specimens exhibit the same general morphology as described and figured in the literature (Tebble 1976).



**Figure 1.** *P. pholadiformis* A) from Taktikoupoli (colln P. Ovalis) 37 mm x 15 mm, B) from Loutra Oraias Elenis (colln A. Pesiridis) 34.5 mm x 12.4 mm

*P. pholadiformis* is unable to live on open surfaces and requires a hard substratum (hard clay, mud, peat, wood or limestone) to bore into, while it breathes and filters food through two long siphons. As the animal becomes older, it bores deeper into the substratum. *P. pholadiformis* is generally found in shallow waters, and probably at depths not greater than about 8 m. However, the maximum water depth for this species is not known. The record by Hayward & Ryland (1990) in the central Mediterranean is considered uncertain as it is probably based on Tebble (1976) with no further details; hence it is not verified.

At all sites where *P. pholadiformis* has been found there is some freshwater inflow into the sea. According to the literature, the species in its native range inhabits environments with salinities between 29 and 35ppt, while in the Baltic Sea it is reported from salinities 10-30 psu (Gollasch and Mecke 1996). According to Castagna and Chanley (1973) the lower salinity tolerance of *P. pholadiformis* is 7.5-10 psu. It thus appears that reduced salinity facilitates its establishment.

The presence of at least 20 specimens of *Petricola pholadiformis* distant in place and time suggests that the American piddock is well established in Greek waters, at least in the Saronikos Gulf. In Belgium and The Netherlands, *P. pholadiformis* has almost completely displaced the native piddock *Barnea candida*

(Linné 1758) (ICES 1972). In Britain, however, where the American piddock is also common, it has not outcompeted the native species (Budd 2005).

Its establishment in the Saronikos Gulf coincides with the extended introduction and establishment of other molluscan species such as *Strombus persicus* Swainson 1821 (Young 2007), *Cellana rota* (Gmelin, 1791) (Fountoulakis and Sabelli 1999), *Chama asperella* Lamarck, 1819 (Ovalis and Zenetos 2007), *Fulvia fragilis* (Forsskål in Niebuhr, 1775), *Bursatella leachii* DeBlainville, 1817, etc. (Zenetos et al. 2007).

With regard to the vector responsible for its introduction in the Mediterranean, the possibility of spreading by means of its pelagic larvae or via driftwood - as it has been assumed for the colonization of several northern European countries (Rosenthal 1980) - should be ruled out, because of its absence from the western Mediterranean Sea. *P. pholadiformis* was reported by Poutiers (1987) from Spain to Tunisia but these records were not substantiated by literature and according to local experts the species is absent from both areas (S. Gofas and J. Zaouali, pers. commun.). Ship transfer can be considered as the most possible way of its introduction into the Saronikos Gulf, as it hosts the major Greek harbour (Peiraias). Indeed, shipping is the second most important vector in the primary as well as secondary spread of alien species in Greece (Pancucci-Papadopoulou et al. 2006).

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## Annex 1

Mediterranean sites where *P. pholadiformis* has been collected/traced

Location	Geographic coordinates		Date of record	Number of specimens found	Source
	Latitude, N	Longitude, E			
Greece: Evvoikos/Oropos	38°19'17"	23°47'13"	<1994	1 shell	Delamotte and Vardala-Theodorou 1994, 2006
Greece: Saronikos/Loutra Oraias Elenis	37°51'56"	22°59'49"	1980s	alive 1 indiv.	Goulandris Museum present study
Greece: Saronikos/Taktikoupolis	37°33'05"	23°22'37"	May 2007	alive >10 indiv.	present study
Central Mediterranean	?	?	unknown	unknown	OBIS 2009