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GEORGE E. SYRIDES

# Marine and terrestrial molluscs in the sanctuary

## The molluscan remains from the 2003–2004 excavations in the Sanctuary of Poseidon at Kalaureia

### Abstract
This paper presents the hand-collected molluscan remains that were recovered from the excavations in Areas C and D of the Sanctuary of Poseidon at Kalaureia, Poros, in the years 2003–2004. The paper aims at the presentation of the finds and at using the molluscan biological and ethological traits to provide insights into the possible capture methods and use. Land snails are also summarily presented.

*Keywords*: Kalaureia, Poros, Poseidon, molluscs, ancient gastronomy, purple shells, archaeomalacology

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## Introduction

This report presents the marine and terrestrial molluscs that have been hand-collected in the course of the excavations in the Sanctuary of Poseidon at Kalaureia during 2003 and 2004.[1] Most of the remains belong to marine molluscs; only a small fraction comes from terrestrial snails (*Table 1*). These materials were found in strata from different chronological periods in Areas D and C (*Figs. 1* and *2*).

The purpose of this paper is not to offer an archaeological interpretation of the molluscan remains under study, but rather to present them in detail and offer insights to their use derived from the various species' biology. Contextual analysis and treatment of wider archaeological questions are beyond the scope of the present work.[2]

Identifications of the molluscan remains are based on the molluscan reference collections of the Laboratory of Geology and Palaeontology, Department of Geology, Aristotle University of Thessaloniki, the author's personal mollusc collection, and relevant atlases.[3] Identification to species was not achieved for all specimens. In several cases identification only to the level of genus or even family was possible (broken shells or shells of uncertain identification characteristics). Quantification is based on MNI, with the exception of the largest species, such as *Pinna* sp., *Charonia* sp., and *Tonna galea*. For those no such calculation was possible due to the extreme fragmentation of their shells and the almost complete absence of countable elements such as collumelae, apexes, or umbones. As a result they are over-represented in the relevant statistics.[4]

Bibliographic references on fishing and gathering methods as well as on edibility of the various molluscan species that are represented in this assemblage are very scarce and where they exist, they mostly refer to cultures in far-distant places such as the Pacific Islands.[5] The information included here originates from the author's own ethnographic research in various locations along the Aegean insular and Mainland coasts, which is, at present, unpublished.

Nomenclature for the various taxa follows the most up-to-date World Register of Marine Species (WoRMS).[6] The material is presented here by excavation area and by phases and/or features, as described by Arto Penttinen and Dimitra Mylona,[7] in an attempt to facilitate future incorporation of this mate-

[1] Wells *et al.* 2005; 2006–2007. The shells from the water-floated samples have regrettably not been included.
[2] For an example of such an approach to marine molluscs from cultic contexts see Theodoropoulou 2013.

[3] Cossignani *et al.* 1992; Dellamotte & Vardala-Theodorou 2001.
[4] These numbers are placed in parenthesis in *Tables 1, 2,* and *4*.
[5] See for example Veropoulidou 2011, at various places. For information in edibility of various molluscan taxa see indicatively Davidson 1972; Dalby 1996, 72–75.
[6] WoRMS Editorial Board 2019; certain taxa may be referred to in other publications by an older, now unaccepted, name, e.g. *Euthria cornea* was in older publications referred to as *Buccinulum corneum*.
[7] Penttinen & Mylona 2019.

### Editorial note

The section on the bioarchaeological remains from the Sanctuary of Poseidon at Kalaureia, published in the *OpAthRom* 12, includes seven articles: Penttinen & Mylona 2019; Mylona 2019; Serjeantson 2019; Lymberakis & Iliopoulos 2019; this contribution by George E. Syrides; Ntinou 2019; Sarpaki 2019. Summary of chronological phases (presented in Penttinen & Mylona 2019):

| Abbreviation | Phase | Chronology | Area | Comment |
|---|---|---|---|---|
| EIA I | Early Iron Age | *c.* 750 BC | D | Fills of Features 07, 08, and 09 (three pits). Fill underneath Early Iron Age building. |
| EIA II | Early Iron Age | *c.* 750–700 BC | D | Floor accumulation in Early Iron Age building. |
| A I | Archaic | 7th century BC | D | – |
| A II | Archaic–Hellenistic | 6th century–Hellenistic | C | Construction of Wall 24. |
| | | | D | Remains from outdoor activities. Feature 05 (supposed altar). |
| A III | Archaic | *c.* 500 BC | C | – |
| | | | D | Construction of Stoa D and Features 03 and 04 (interconnected cisterns). Feature 10 (kiln). |
| A IV | Archaic | after *c.* 500 BC | D | Life span of buildings constructed during A III. |
| C I | Late Classical/Early Hellenistic | *c.* 325 BC | C | Construction of Building C. |
| | | | D | Construction of back part of Building D, including Feature 06 (staircase), Feature 01, and Feature 02 (unknown, altar?). |
| C II | Late Classical/Early Hellenistic | after *c.* 325 BC | D | Finds in the dirt floors of Building D. |
| H I | Hellenistic | *c.* 165 BC | D | "Dining deposit" west of Building D. |
| H II | Late Hellenistic/Early Roman | *c.* 50 BC–*c.* AD 100 | D | Fill of Feature 03 (cistern). Finds from trench against Wall 11, which exposed Wall 33. |

Other abbreviation used: E = edible; MNI = Minimum number of individuals; nE = non-edible; NISP = Number of identifiable specimens; WF = Water flotation.

rial to broader discussion on the use of marine resources in the sanctuary.[8] All in all, material from 383 contexts has been examined,[9] dating from the Early Iron Age to the Early Roman period (*Tables 2*, *3*, *4,* and *5*).[10] Although both terrestrial and marine molluscs have been selected and recorded, discussion in this paper will focus more on the marine animals.

## The marine molluscs

Among the 4,663 marine molluscs that were hand collected during the 2003–2004 excavations at the Sanctuary of Poseidon, twelve taxa of marine bivalves (90 shells) and 22 taxa of gastropods (4,573 shells) have been identified. These are presented in *Table 1*.

The bivalves are benthic (epi-, semi-, or endo-benthic) animals,[11] the majority of them free-living on soft, unconsolidated sea-beds. Only a few are sessile animals[12] attached or cemented on hard substrata (e.g. *Arca noae, Spondylus gaederopus*). Gastropods are also benthic animals but very mobile in comparison to the bivalves. They are also as epi-, semi-, or endo-benthic animals, but many of them are versatile and they can move between different substrata and habitats. All bivalves are suspension feeders, filtering food particles from the water. Gastropods, on the other hand, feed on larger food items using their radulae to rasp their food in small pieces. Gastropods are distinguished as herbivorous and carnivorous, which, depending on the species, may be predators and/or scavengers (for relevant information on each taxon that is identified in the Kalaureia assemblage see *Appendix*). Taking the above ob-

[8] Such interpretation has already been attempted to a restricted degree, Mylona 2013; 2015.

[9] For a description of the way contexts were assigned and numbered, see Wells *et al.* 2005, 128–135, for their spatial distribution Penttinen & Mylona 2019.

[10] For a discussion of the spatial position and the characteristics of these contexts see the excavation reports, Wells *et al.* 2005, esp. 135, 183–186; 2006–2007, esp. 34–48, 99–102; synopsis and site plans in Penttinen & Mylona 2019.

[11] Benthic animals are those that live on the sea bottom; of those the epibenthic live on the surface, while the semi-benthic are semi-buried and the endo-benthic are found buried.

[12] Sessile are those shells that live attached on a hard substratum, e.g. rock.

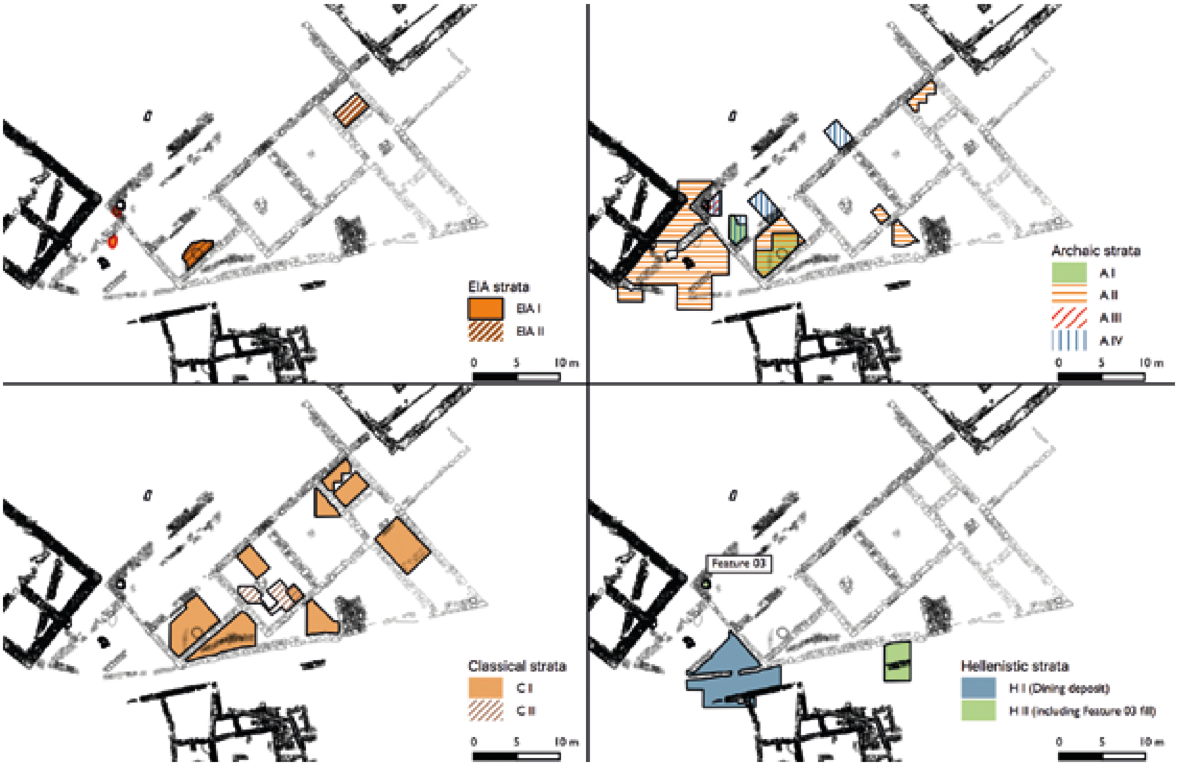


*Fig. 1. Area D. Distribution of archaeological strata by chronological phases. By R. Rönnlund.*

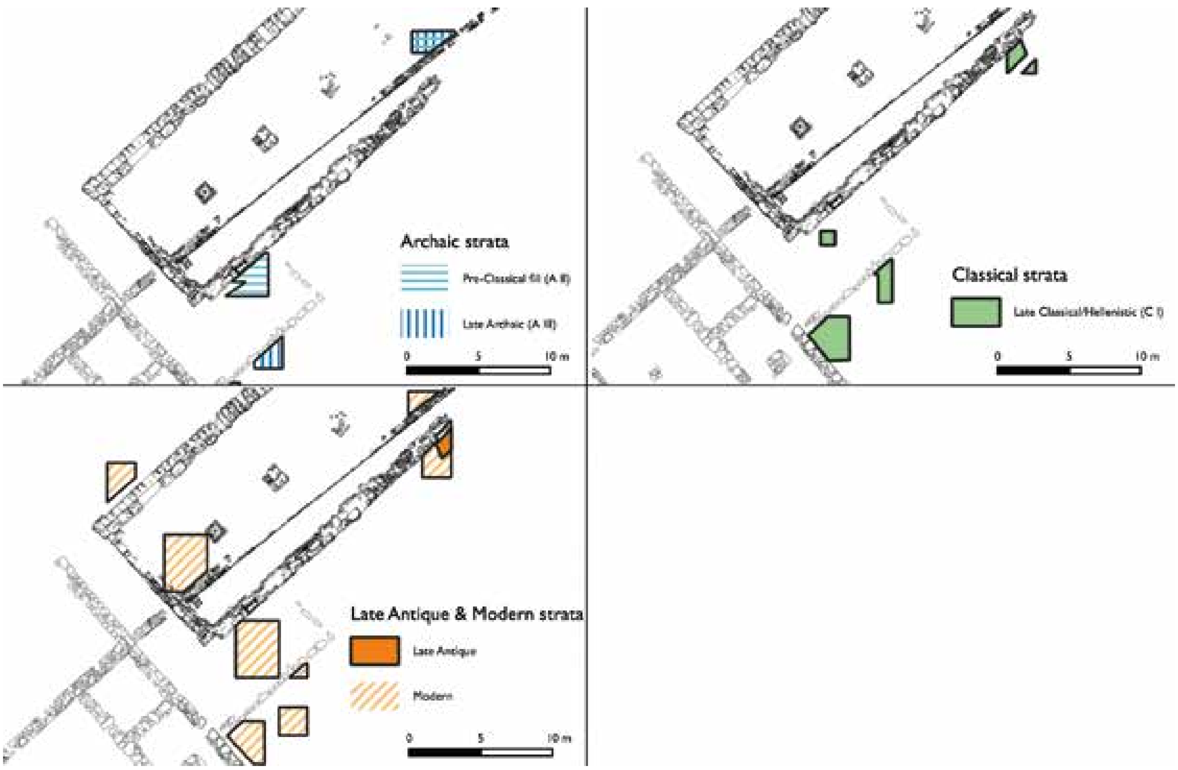


*Fig. 2. Area C. Distribution of archaeological strata by chronological phases. By R. Rönnlund.*

| | MNI total | % | Edibility |
|---|---|---|---|
| **Land snails** | | | |
| *Cecilioides* sp. | 5 | 0.414 | nE |
| *Chondrula* sp. | 3 | 0.248 | nE |
| Clausilidae | 32 | 2.649 | nE |
| Helicidae 1 | 358 | 29.64 | E |
| Helicidae 2 (small-sized) | 94 | 7.781 | E |
| *Lindholmiola* sp. | 126 | 10.43 | nE |
| *Rumina* sp. | 586 | 48.51 | nE |
| Zonitidae | 3 | 0.248 | nE |
| **Total** | **1,208** | **100** | |
| **Marine shells** | | | |
| **Bivalves** | | | |
| *Acanthocardia tuberculata* | 3 | 0.064 | E |
| *Arca noae* | 7 | 0.15 | E |
| *Barbatia barbata* | 1 | 0.021 | E |
| *Callista chione* | 2 | 0.043 | E |
| *Cerastoderma glaucum* | 4 | 0.086 | E |
| *Chlamys* sp. | 1 | 0.021 | E |
| *Glycymeris* sp. | 1 | 0.021 | E |
| *Ostrea edulis* | 1 | 0.021 | E |
| *Pinna nobilis* | (26) | (0.558) | E |
| *Spondylus gaederopus* | 19 | 0.407 | E |
| *Tapes* sp. | 2 | 0.043 | E |
| *Venus verrucosa* | 23 | 0,493 | E |
| **Gastropods** | | | |
| *Aplus d'orbignyi* | 3 | 0.064 | nE |
| *Aporrhais pespelecani* | 2 | 0.043 | E |
| *Astraea rugosa* | 11 | 0.257 | E |
| *Bittium* sp. | 24 | 0.510 | nE |
| *Bolinus brandaris* | 2,367 | 50.95 | E |
| *Cerithium vulgatum* | 297 | 6.562 | E |
| *Charonia tritonis* | 23 | 0.493 | E |
| *Columbella rustica* | 1 | 0.021 | nE |
| *Conus mediterraneus* | 3 | 0.064 | nE |
| *Cypraea lurida* | 1 | 0.021 | nE |
| *Euthria cornea* | 85 | 1.823 | nE |
| *Fusinus syracusanus* | 1 | 0.021 | nE |
| *Gibbula magus* | 3 | 0.043 | E |
| *Hexaplex trunculus* | 485 | 10.40 | E |
| *Muricipsis cristata* | 1 | 0.021 | E |
| *Nassarius incrassatus* | 2 | 0.043 | nE |
| *Naticarious stercusmuscarum* | 2 | 0.043 | nE |
| *Patella rustica* | 75 | 1.608 | E |
| *Patella ulyssiponensis* | 738 | 15.83 | E |
| *Phorcus turbinatus* | 432 | 9.264 | E |
| *Tarantinea lignaria* | 12 | 0.257 | nE |
| *Tonna galea* | (5) | (0.107) | E |
| **Total** | **4,663** | **100** | |

*Table 1. Molluscan taxonomic representation in the Kalaureia assemblage (all phases). Counts are based on MNI, except for Charonia and Tonna for which NISP are counted instead.*

servations into account, we may conclude that bivalves have to be gathered, while the gastropods can either be gathered or trapped, lured into bait baskets, or even caught by nets.[13]

## INFERENCES ON EDIBILITY, FISHING GROUNDS, AND FISHING METHODS

All bivalves in this molluscan assemblage are edible and could be considered as food remains (*Table 1*). However, they make up less than 2% of the assemblage. Among them venus (*Venus* sp.) predominates with 23 shells (0.49% of the total), the spiny oyster (*Spondylus* sp.) follows with 19 shells (0.40%),[14] while the pen shell (*Pinna* sp.) with 26 shell fragments (0.55%), is probably over-represented due to the high fragmentation that characterizes this shell. These fragments probably represent more than one individual, as they have been found widely scattered spatially and among chronological phases, and thus exact estimation of MNI is impossible.

Gastropods are the most numerous taxa (4,663 shells, 98.13% of the total) (*Table 1*). Among them one species of purple shellfish, the *Bolinus brandaris* is predominant (2,367 intact shells, 50.95%), followed by the limpets, *Patella* sp. (813 shells or 17.4%), the second species of purple shellfish, the *Hexaplex trunculus* (at least 485 broken shells or 10.40%), the top shells, *Phorcus turbinatus* (432 shells or 9.26%), and the ceriths, *Cerithium vulgatum* (297 shells or 6.56%). The five gastropod genera, which taken together make up almost 95% of the assemblage, are all edible (*Table 1*). The exceptionally high numbers of the *Bolinus brandaris* however may be rather misleading. Almost all originate from a single deposit of unusual character[15] and they do not represent a regular foodstuff or cult item in the sanctuary. Some of the gastropods do show signs of being consumed by humans: almost all the top shells and probably some of the limpets as well, have broken apexes (*Figs. 3* and *4*).[16] Despite the occasional presence of modern abrasion traces, the breakage appears to be ancient. The breaking of the apex is still a common practice in coastal areas in

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[13] See *Appendix* for relevant information on individual taxa in the assemblage.

[14] A few of the *Spondylus gaederopus* remains are beach-worn and they do not represent primary food waste.

[15] These *Bolinus brandaris* shells were deposited in Feature 03 (the cistern), in a single thick layer during the H II phase. They were found in association with several unusual finds such as snake bones, dog bones, eggshells, bird bones, echinoid spines, and some broken glass vessels in a context probably linked to some out-of-the-ordinary cultic activity. For contextual details and discussion of the significance of this deposit and of the purple shellfish in it see Wells *et al.* 2006–2007, 73–80; Mylona 2013.

[16] For the breakage with a stone as a method to dislodge a mollusc from a rock see references in Veropoulidou 2011, 56, n. 22.

*Fig. 3. Phorcus turbinatus shells from the "dining deposit" (H I) with broken apex. This could be taken as related to flesh extraction during cooking/consumption. Photograph: G. Syrides.*

*Fig. 5. Hermit crab (Paguroidae) remains retrieved from the interior of a Cerithium vulgatum shell. Photograph: G. Syrides.*

Greece, and aims to facilitate either the removal of the limpet from the rocks or the extraction of the shellfish's soft flesh in the case of the top shells.[17]

The remaining 17 gastropod species include few edible varieties (*Astraea rugosa*, *Tonna galea*, *Charonia tritonis*), which, however, because of their large size or aesthetic qualities (colour, gloss etc.) are known to have been used, both in antiquity and in recent times, as ornaments, tools, or in cult.[18] Given their versatility, but also their low numbers in the deposits within the Sanctuary of Poseidon, we cannot presume their primary use as food. Other taxa from this assemblage (*Cypraea lurida, Bittium* sp., *Aplus d'orbignyi, Nassarius incrassatus*, etc.) are either not edible or too small to be considered as food (*Table 1*).

Some of the shells were already dead when collected. This is indicated by the presence of holes opened by carnivorous gastropods (such as *Natica* sp., purple shellfish, etc.), encrustations by serpulid worms, and clionid sponge perforations on the inner surface of several shells. Certain shells were beachworn (e.g. some *Spondylus* sp. fragments). The fragile remains of one hermit crab (Paguroidea) (*Fig. 5*) have been retrieved

*Fig. 4. Patella sp. shells with broken apexes. Some of them still preserve fragments of the crushed apexes attached to the shell. Photograph: G. Syrides.*

from the interior of a *Cerithium vulgatum* shell.[19] Several of the shells that appear to have been collected dead might also have hosted hermit crabs. This allows for the hypothesis that the shells had been misidentified by the ancient fishermen and collected by hand with other similar shells; alternatively they may have been side-catches during fishing for other gastropods, such as the purple shellfish. Hermit crabs might have been attracted to bait baskets that were set with other targets in mind. The same applies to other carnivorous species (*Nassarius incrassatus, Muricopsis cristata, Alpuss d'orbignyi*, etc.)

[17] Syrides, pers. obs.; see also n. 15.
[18] Examples of such uses can be found in Karali 1999 and more generally in Çakirlar 2011.

[19] This shell originates in the "dining deposit" and dates to around 165 BC (H I). For details on this context see Wells *et al.* 2005, 166–179; Penttinen & Mylona 2019; Mylona 2019.

*Fig. 6. A Spondylus gaederopus shell with traces of the volcanic rock to which the shellfish was attached. Photograph: G. Syrides.*

that were possibly attracted to the bait. Such unintentional, rather accidental gathering, might explain the low numbers of these taxa in this assemblage.[20] Some shells could have been collected for their decorative properties or as curiosity items (*Cypraea lurida, Naticarius stercusincrassatus*). Additionally, none of them bear suspension holes or binding traces that would link them to jewellery.

The documented molluscan taxonomic range at Kalaureia indicates exploitation of specific habitats. The splash zone, especially on the rocky coast, is the habitat for limpets and top shells (*Patella* sp. and *Phorcus* sp.). Shell gathering from this zone is technically very simple.[21] Top shells are literally picked from the rocks. Limpet gathering on the other hand requires the use of a pointed or sharp instrument to detach them from the rock. The use of an empty limpet shell is the simplest, impromptu tool, but less efficient than a knife or a pick. Alternatively, the crushing of the limpet's apex with a stone could accomplish the same goal. Simple gathering can be applied to all free-moving shells to depths of down to 1.5 m (e.g. *Hexaplex* sp., *Cerithium* sp., *Euthria* sp., etc.).

Gathering of shells that inhabit somewhat deeper waters requires swimming and diving ability on the part of the fisherman and waters with good visibility to spot the shells. Detaching of certain shells such as the oysters, spiny oysters, and pen shells (*Ostrea* sp., *Spondylus* sp., *Pinna* sp.), requires the use of tools. From the sandy bottom down to the depth of a man's height, bivalves (*Venus, Callista, Glycimeris*, etc.) can be collected by digging with the foot. The most efficient gathering technique, however, especially for carnivorous gastropods (e.g. *Bolinus brandaris* and *Hexaplex trunculus*), is the use of bait baskets.[22] Baits for *Hexaplex trunculus* would be set on the shallow rocky or sandy sea bottoms while those targeting *Bolinus brandaris* on sandy bottoms of greater depth. In both cases, such traps would also attract numerous other carnivorous gastropods as well a hermit crabs in borrowed shells, resulting in a collection of taxa very similar to that observed in the Kalaureia assemblage, especially in the sub-assemblage from the Late Hellenistic/Early Roman (H II) fill of the cistern Feature 03 (see discussion below).

One of the thorny oysters (*Spondylus gaederopus*) from the so-called "dining deposit" at Kalaureia (H I, *Fig. 6*) preserves an exciting clue to its origin. A lower valve[23] was found preserving on its outer surface, between the irregular scaly lamellas of the shell, small fragments of rock. These are remnants of the former rock surface to which the shell was attached, comprising small parts of a grey volcanic rock with well-visible elongated hornblende crystals. This indicates that this shell was initially attached to a submerged volcanic rock with an irregular (not smooth) surface, from which it was detached. Volcanic rocks are absent from the island of Kalaureia, but are present around the smaller Spheria,[24] the Methana peninsula, Aegina, and various other spots around the Saronic Gulf. So we must accept one of these areas as the source area for this specimen. A further detailed petrographic study of the rock remains could provide more accurate data on the origin of the specimen.

The *Cerastoderma glaucum* is also interesting in respect to its place of origin. It is a brackish water shellfish. Nowadays, the Peloponnesian coast that faces Kalaureia provides such brackish, marshy environments. This might also have been the case in antiquity.[25] What is of particular interest however, is the low numbers of this species. It appears that brackish waters in the area of Kalaureia were not exploited systematically for shellfish, although some fishing was taking place there.[26]

## Terrestrial molluscs

The assemblage of land snails consists of 1,208 specimens which belong to eight gastropod genera (*Table 1*). *Rumina* sp. predominates with 586 shells (48.51%), followed by large Helicidae (the edible snails) with 358 shells (29.64%), and *Lind-*

[20] For an experimental documentation of this phenomenon see Ruscillo 2006, 811–813.
[21] The following discussion is based on the author's own ethnographic research.
[22] For an extensive discussion of this technique and references to ancient written sources see Alfaro & Mylona 2014.
[23] The valve that is attached to a firm surface.
[24] Poros island consists of two islands, Spheria and Kalaureia, now divided by a channel dug through a sand bank. Spheria is built of volcanic andesites, while Kalaureia is not. IGME 2006; Basiakos 2007.
[25] Mylona 2015 with relevant bibliography.
[26] See Mylona 2019.

*Table 3. Kalaureia. Area C. Taxonomic representation of terrestrial molluscs at different phases.*

| | Archaic–Hellenistic (A II) | Pre-Classical/Pre-Hellenistic fill (A II) | Late Classical/ Early Hellenistic (C I) | Late Antique disturbance | Mixed/modern |
|---|---|---|---|---|---|
| *Cecilioides* sp. | 0 | 0 | 0 | 0 | 0 |
| *Chondrula* sp. | 0 | 0 | 0 | 0 | 0 |
| Clausilidae | 0 | 1 | 0 | 0 | 0 |
| Helicidae 1 | 2 | 1 | 4 | 70 | 1 |
| Helicidae 2 (small-sized) | 2 | 0 | 10 | 5 | 0 |
| *Lindholmiola* sp. | 0 | 0 | 4 | 50 | 0 |
| *Rumina* sp. | 2 | 4 | 11 | 72 | 11 |
| Zonitidae | 0 | 0 | 0 | 0 | 0 |
| **Total** | **6** | **6** | **29** | **197** | **12** |

*holmiola* sp. with 126 shells (10.43%). With the exception of the Helicidae, all the other land snails are very small in size. All are glossy and perfectly preserved, none has been found burned or in a context that would indicate the antique origin of these shells. They are all most probably intrusive, entering the archaeological strata at any time in the past.

## Molluscan remains by spatial and chronological context

### AREA C (*TABLES 2* AND *3*)

The excavation and hand-collection in Area C produced 13 land snails and 72 marine shells. The molluscs from Area C are few, with no obvious chronological or contextual differentiation.

### AREA D (*TABLES 4* AND *5*)

#### Early Iron Age contexts (EIA I and II)

The Early Iron Age contexts include 22 land snails, and 314 marine shells. These shells are edible and they probably represent food remains.

#### Archaic contexts

The Archaic contexts include 151 land snails, and 648 marine shells. These shells are edible and possibly represent food leftovers. The two concentrations of crushed purple shells

*Table 2. Kalaureia. Area C. Taxonomic representation of marine molluscs at different phases. Counts are based on MNI, except for Charonia and Tonna for which NISP are counted instead.*

| | Archaic–Hellenistic (A II) | Pre-Classical/ Pre-Hellenistic fill (A II) | Late Classical/Early Hellenistic (C I) | Late Antique disturbance | Mixed/ modern |
|---|---|---|---|---|---|
| **Bivalves** | | | | | |
| *Acanthocardia tuberculata* | 0 | 0 | 0 | 0 | 0 |
| *Arca noae* | 1 | 0 | 0 | 0 | 0 |
| *Barbatia barbata* | 0 | 0 | 0 | 0 | 0 |
| *Callista chione* | 0 | 0 | 0 | 0 | 0 |
| *Cerastoderma glaucum* | 0 | 0 | 0 | 0 | 0 |
| *Chlamys* sp. | 0 | 0 | 0 | 0 | 0 |
| *Glycymeris* sp. | 0 | 0 | 0 | 0 | 0 |
| *Ostrea edulis* | 0 | 0 | 0 | 0 | 0 |
| *Pinna nobilis* | 1 | 0 | 3 | 0 | 0 |
| *Spondylus gaederopus* | 1 | 1 | 1 | 1 | 0 |
| *Tapes* sp. | 0 | 0 | 0 | 0 | 0 |
| *Venus verrucosa* | 0 | 0 | 0 | 0 | 0 |
| **Gastropods** | | | | | |
| *Aplus d'orbignyi* | 0 | 0 | 0 | 0 | 0 |
| *Aporrhais pespelecani* | 0 | 0 | 0 | 0 | 0 |
| *Astraea rugosa* | 0 | 0 | 0 | 0 | 0 |
| *Bittium* sp. | 0 | 0 | 0 | 0 | 0 |
| *Bolinus brandaris* | 0 | 0 | 1 | 1 | 0 |
| *Cerithium vulgatum* | 1 | 5 | 2 | 1 | 3 |
| *Charonia tritonis* | 0 | 0 | (1) | 0 | 0 |
| *Columbella rustica* | 0 | 0 | 0 | 0 | 0 |
| *Conus mediterraneus* | 0 | 0 | 0 | 0 | 0 |
| *Cypraea lurida* | 0 | 0 | 0 | 0 | 0 |
| *Euthria cornea* | 0 | 0 | 0 | 0 | 0 |
| *Fusinus syracusanus* | 0 | 0 | 0 | 0 | 0 |
| *Gibbula magus* | 0 | 0 | 0 | 0 | 0 |
| *Hexaplex trunculus* | 15 | 1 | 6 | 0 | 3 |
| *Muricipsis cristata* | 0 | 0 | 0 | 0 | 0 |
| *Nassarius incrassatus* | 0 | 0 | 0 | 0 | 0 |
| *Naticarious stercusmuscarum* | 0 | 0 | 0 | 0 | 0 |
| *Patella rustica* | 1 | 1 | 0 | 0 | 0 |
| *Patella ulyssiponensis* | 5 | 1 | 0 | 0 | 2 |
| *Phorcus turbinatus* | 3 | 2 | 1 | 1 | 4 |
| *Tarantinea lignaria* | 0 | 0 | 1 | 0 | 0 |
| *Tonna galea* | 0 | 0 | 0 | 0 | (1) |
| **Total** | **28** | **11** | **16** | **4** | **13** |

*Table 4. Kalaureia. Area D. Taxonomic representation of marine molluscs at different phases. Counts are based on MNI, except for Charonia and Tonna for which NISP are counted instead.*

| | Early Iron Age | Archaic | Late Classical/Early Hellenistic | Hellenistic (H I). "Dining deposit" | Late Hellenistic/Early Roman | Late Hellenistic/Early Roman (H II). Feature 03 |
|---|---|---|---|---|---|---|
| *Acanthocardia tuberculata* | 0 | 2 | 1 | 0 | 0 | 0 |
| *Arca noae* | 1 | 4 | 0 | 0 | 1 | 0 |
| *Barbatia barbata* | 1 | 0 | 0 | 0 | 0 | 0 |
| *Callista chione* | 0 | 0 | 0 | 1 | 1 | 0 |
| *Cerastoderma glaucum* | 1 | 0 | 1 | 1 | 1 | 0 |
| *Chlamys* sp. | 0 | 0 | 0 | 1 | 0 | 0 |
| *Glycymeris* sp. | 0 | 0 | 0 | 0 | 1 | 0 |
| *Ostrea edulis* | 1 | 0 | 0 | 0 | 0 | 0 |
| *Pinna nobilis* | 2 | 16 | 2 | 1 | 1 | 0 |
| *Spondylus gaederopus* | 2 | 3 | 1 | 3 | 6 | 0 |
| *Tapes* sp. | 0 | 1 | 1 | 0 | 0 | 0 |
| *Venus verrucosa* | 1 | 2 | 2 | 13 | 3 | 2 |
| **Gastropods** | | | | | | |
| *Aplus d'orbignyi* | 0 | 3 | 0 | 0 | 0 | 0 |
| *Aporrhais pespelecani* | 0 | 0 | 0 | 0 | 0 | 2 |
| *Astraea rugosa* | 0 | 0 | 0 | 1 | 0 | 10 |
| *Bittium* sp. | 0 | 0 | 0 | 2 | 22 | 0 |
| *Bolinus brandaris* | 4 | 9 | 6 | 7 | 13 | 2,326 |
| *Cerithium vulgatum* | 21 | 62 | 14 | 169 | 13 | 6 |
| *Charonia tritonis* | 0 | 0 | 0 | 0 | (22) | 0 |
| *Columbella rustica* | 1 | 0 | 0 | 0 | 0 | 0 |
| *Conus mediterraneus* | 0 | 1 | 1 | 0 | 1 | 0 |
| *Cypraea lurida* | 0 | 0 | 0 | 1 | 0 | 0 |
| *Euthria cornea* | 1 | 2 | 0 | 0 | 1 | 81 |
| *Fusinus syracusanus* | 0 | 0 | 0 | 0 | 0 | 1 |
| *Gibbula magus* | 1 | 0 | 0 | 0 | 1 | 1 |
| *Hexaplex trunculus* | 135 | 251 | 35 | 35 | 0 | 4 |
| *Muricipsis cristata* | 1 | 0 | 0 | 0 | 0 | 0 |
| *Nassarius incrassatus* | 1 | 1 | 0 | 0 | 0 | 0 |
| *Naticarious stercusmuscarum* | 1 | 0 | 0 | 1 | 0 | 0 |
| *Patella rustica* | 0 | 12 | 2 | 59 | 0 | 0 |
| *Patella ulyssiponensis* | 111 | 196 | 54 | 313 | 24 | 32 |
| *Phorcus turbinatus* | 28 | 80 | 11 | 302 | 0 | 0 |
| *Tarantinea lignaria* | 0 | 1 | 0 | 4 | 0 | 6 |
| *Tonna galea* | 0 | (2) | 0 | 0 | (1) | (1) |
| **Total** | **314** | **648** | **131** | **914** | **112** | **2,472** |

*Table 5. Kalaureia. Area D. Taxonomic representation of terrestrial molluscs at different phases.*

| | Early Iron Age (EIA I–II) | Archaic (A II–III) | Late Classical/Early Hellenistic (C I) | Hellenistic (H I). "Dining deposit" | Hellenistic (H I) | Late Hellenistic/Early Roman (H II) |
|---|---|---|---|---|---|---|
| *Cecilioides* sp. | 5 | 0 | 0 | 0 | 0 | 0 |
| *Chondrula* sp. | 1 | 1 | 0 | 0 | 1 | 0 |
| Clausilidae | 2 | 0 | 0 | 0 | 7 | 22 |
| Helicidae 1 | 6 | 26 | 3 | 6 | 9 | 230 |
| Helicidae 2 (small-sized) | 2 | 33 | 0 | 18 | 12 | 12 |
| *Lindholmiola* sp. | 1 | 1 | 5 | 21 | 29 | 15 |
| *Rumina* sp. | 5 | 90 | 7 | 16 | 33 | 335 |
| Zonitidae | 0 | 0 | 0 | 1 | 2 | 0 |
| **Total** | **22** | **151** | **15** | **62** | **93** | **614** |

(*Hexaplex trunculus*) that have been tentatively been assigned to these Archaic strata,[27] and probably represent building material,[28] will not be included here.

### Late Classical/Early Hellenistic contexts

The Late Classical/Early Hellenistic contexts include 15 land snails, and 131 marine shells. Almost all the shells, with the exception of two limpets that originate from the late 4th-century construction fill excavated in the back part of Building D.

### Hellenistic and Early Roman contexts

Taken together, these contexts produced 769 land snails and 3,508 marine shells. Two contexts are of specific interest, the Hellenistic "dining deposit" (H I), and the Late Hellenistic/Early Roman contents of Feature 03 (the cistern, H II).

#### "Dining deposit" (H I, *c.* 165 BC)

Here were found 62 land snails and 914 marine shells: the limpets (both *Patella ulyssiponensis* and *Patella rustica*) with a total of 372 shells, the top shells (*Phorcus turbinatus*) with 302 shells, and the cerith (*Cerithium vulgatum*) with 169 shells, make up most of the assemblage. The rest of the taxa identified from this context are present in very low numbers (*Table 1*). The majority of the edible shells reveal marks of consumption. From the 302 top shells,

[27] See Penttinen & Mylona 2019.

[28] As for example in the Archaic Building Q at Kommos where such crushed *Hexaplex trunculus* shells were used as floor packing. Reese 2000, 645.

258 have cut-off apexes obviously for flesh extraction. Many of the cerith shells are broken in a similar pattern and many limpets have chipped margins and fractured apexes (*Figs. 3* and *4*). We may consider this context as containing typical food remains.

**Fill of Feature 03—The cistern (H II)**
Here 614 land snails and 2,472 marine shells were found. The composition of this assemblage is quite peculiar: 94% of it consists of *Bolinus brandaris* shells, one of the purple shellfish available in the Aegean waters. All shells originate from strata 5, 6, and 7, and are intact.[29] The shells were found concentrated in one thick homogenous layer, above the layer of animal bones,[30] and it seems that their deposition was not gradual but happened in one episode or during a very short period of time. It is interesting that almost all the *Euthria cornea* (81 out of 87) and *Astraea rugosa* (10 out of 12) shells as well as half of the *Fasciolaria lignaria* (6 out of 12) are found in this context. No top shells had been deposited there. This peculiarity in the composition of the assemblage along with the extraordinary number of the purple shells support the idea that this is a special deposit.

[29] For a brief description of the stratigraphy see Penttinen & Mylona 2019.
[30] See Mylona 2019.

# Concluding remarks

The molluscan assemblage under consideration is fairly large and taxonomically rich. It reflects a richness similar to that of the archaeoichthyological record from the sanctuary.[31] Both these bodies of evidence apparently reflect the fishing economy of the area and the significance of marine resources in cult. These issues have not been touched upon in this paper, but a consideration of the biological and technical aspects of the marine molluscs that were brought on site and their capture suggests the exploitation of more than one type of habitat, even though the littoral rocky environments were the preferred ones. The predominant taxa on site and the fragmentation patterns of some of them suggest that the majority of shells (with the unclear case of the *Bolinus brandaris*) were brought on site as food. Some might even have been brought in because of their aesthetic value, perhaps as offerings. The land snails were probably intrusive.

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[31] Mylona 2015; 2019.

# Appendix. Kalaureia. Description of the marine molluscan taxa recovered at the Sanctuary of Poseidon

CEN: Common English name; CGN: Common Greek name; AGN: Ancient Greek name.

| Taxon | Name[I] | Habitat[II] | Comments[III] | Edibility[IV] |
|---|---|---|---|---|
| **Bivalves** | | | | |
| *Acanthocardia tuberculata* | CEN: Rough cockle<br>CGN: Αχιβάδα, or μεθύστρα κόκκινη, or γαϊδουροκουλουβάρα<br>AGN: κόγχος ραβδώτος τραχυόστρακος | It lives buried in sandy and muddy bottoms. | | E. |
| *Arca noae* | CEN: Noah's ark<br>CGN: Καλόγνωμη<br>AGN: χήμη | Adult shells are anchored with thick byssus on rocky or gravelly substratum, in the upper part of littoral zone among seaweed. | The area below umbo bears many Λ-shaped grooves for ligament attachment. These are often misidentified as man-made engravings. | E; eaten raw or cooked; tasty, spicy flesh. |

*[I] Binomial names are consistent with current records in WoRMS Editorial Board 2019, and common English names are from Boitani 1982. Common Greek names, which exhibit considerable geographical variation, are based on the author's ethnographic research in various locations in the Aegean Sea (unpublished), and are also obtained from Manousis 2012. Ancient Greek names follow Voultsiadou & Vafidis 2007; Thompson 1947 or authorities cited therein.*
*[II] The information on habitat is based on Dance 1977; Dellamote & Vardala-Theodorou 2001; Lellak 1977; Campbell 2006.*
*[III] Comments include information about the mollusc's shape, biology, occurrence, ethnographically recorded fishing and gathering methods etc. which are considered relevant to its use and significance in antiquity. Ethnographic comments are based on the author's personal research.*
*[IV] Marine molluscs in this Appendix are described as edible or inedible on the basis of the author's own ethnographic research in the Aegean Sea region, and after Davidson 1982 (with some references to ancient Greek sources); Potamianos 1956.*

| | | | | |
|---|---|---|---|---|
| *Barbatia barbata* | CEN: Hairy ark<br>CGN: Ψευτοκαλόγνωμη<br>AGN: χήμη | Similar to Arca noae. | | E; eaten raw; tasty, spicy flesh. |
| *Callista chione* | CEN: Smooth venus<br>CGN: Γυαλιστερή<br>AGN: - | It lives buried in sandy bottoms. | The shell has a smooth shiny surface which could be considered as having decorative value. | E; eaten raw or cooked. |
| *Cerastoderma glaucum* | CEN: Lagoon cockle<br>CGN: Πουρλίδα, κατρουλίδα<br>AGN: κόγχος ραβδώτος τραχυόστρακος | It lives buried in sandy and muddy bottoms. It is very adaptable to salinity fluctuations and prefers shallow protected bays and lagoons. | It is usually found in large numbers in numerous historic and prehistoric sites, a fact that reflects its dense concentrations in the water.[V] | E; eaten raw. |
| *Chlamys* sp. | CEN: Scallop<br>CGN: Χτένι<br>AGN: κτείς | It lives either attached with byssus on hard substratum, or free-lying on the sea bottom. It has some swimming ability, flapping the valves to escape predators. | | E. |
| *Glycymeris* sp. | CEN: dog cockle<br>CGN: Μηλοκύδωνο, or αλογοπόδαρο<br>AGN: - | Lives buried in sandy or mixed sandy–muddy sea bottoms. | The shell of large individuals is thick and could be used for artefacts. | E; eaten raw; it has hard flesh. |
| *Ostrea edulis* | CEN: Common oyster, or European edible oyster<br>CGN: Στρείδι<br>AGN: λιμνόστρεον | It lives cemented with left valve on hard substrata such as rocks or older shells, in some cases forming extensive colonies. | | E; eaten raw or cooked. |
| *Pinna nobilis* | CEN: Noble pen shell or fun mussel<br>CGN: Πίννα<br>AGN: πίννα | It is the largest of the Mediterranean bivalves, reaching 80–90 cm in length when fully grown. It lives semi-buried in the sea bed with the pointed beaks into sandy bottoms, anchored also with thick, strong byssus. | The interior of the valves is pearly, especially close to the pointed beaks. In antiquity it was used as raw material for tools or inlays.[VI] The shell is anchored with thick, strong byssus in depths greater than 3 m. It requires strength and diving ability to detach it. At present Pinna is an endangered species in the Mediterranean and its fishing is strictly forbidden. Until a few decades ago fishermen used special equipment to retrieve pen shells known as πιννολόγος (pinnológos). This tool enabled them to explore depths down to 15 m. The tool consists of a pincer attached to the end of a long (~5 m), wooden shaft. A strong rope is connected to the pincer which is manipulated by pulling it. The fisherman inspected the sea bottom with a γυαλί (gialí), a bucket with glass bottom. If a pen shell was spotted the πιννολόγος was placed open around it, with the help of the wooden shaft, which could be extended up to ~15 m by connecting additional parts. Twisting of the shafts and a slow pulling of the rope led to the trapping of the shell and its detachment from the sea bottom. | E; eaten raw or cooked. It is considered a delicacy. |
| *Spondylus gaederopus* | CEN: Thorny oyster, or spiny oyster<br>CGN: άγριο στρείδι, αγκαθωτό στρείδι, γαϊδουροπόδαρο<br>AGN: - | It lives cemented with left valve on hard substratum (i.e. rock). | The shell of this species is white on the inside and purple on the surface. This, in addition to its compact thickness, renders it a suitable raw material for ornamental artefacts.[VII] | E, eaten raw. |
| *Tapes* sp. | CEN: Carpet shell<br>CGN: Αχιβάδα<br>AGN: - | It lives buried in sandy bottoms. | | E. |
| *Venus verrucosa* | CEN: Warty venus<br>CGN: Κυδόνι<br>AGN: Κόγχος, or γλυκυμαρίς | It lives buried in sandy bottoms. | | E; eaten raw or cooked. |

[V] *E.g. Prummel 2003, 156.*
[VI] *Several instances of such a use of the pen shell are presented in Theodoropoulou 2007, e.g. 317, 320, fig. 20e.*
[VII] *E.g. Karali 1999, 24; Seferiades 2000; various papers in Ifantidis & Nikolaidou 2011.*

| **Gastropods** | | | | |
|---|---|---|---|---|
| *Aplus d'orbignyi* | CEN: -<br>CGN: -<br>AGN: - | A carnivorous species living in the shallow rocky littoral zone among the seaweed. | It is a small shellfish (up to 20 mm), probably caught unintentionally in bait baskets or brought on site along with seaweeds. | No data. |
| *Aporrhais pespelecani* | CEN: Pelican's foot<br>CGN: Χηνοπόδαρο<br>AGN: αιμορροΐς, or απορραΐς | It is common on firm, sandy bottoms, deeper than 10 m. | | E. |
| *Astraea rugosa* | CEN: Rough star-shell<br>CGN: Στρόμπος, στρουμπίλι, ήμερο ή μεγάλο στρουμπίλι<br>AGN: - | It lives on hard rocky bottoms of the littoral and sub-littoral zone and deeper (80 m) but not in large numbers, herbivorous, feeds on algae. | A large shell (up to 60 mm), with a thick pearly interior. It is highly decorative. Its operculum is nowadays used in jewellery making and in modern Greece it is known as Μάτι της Παναγίας (the Eye of Virgin Mary). | E; eaten cooked. When the shell is boiled the flesh can be easily removed using a pin, unlike other gastropods such as *Phorcus* sp. |
| *Bittium* sp. | CEN: Small needle whelk, needle shell<br>CGN: -<br>AGN: - | It is common on stony and soft bottoms among vegetation. | These small shells could have entered the archaeological site along with seaweeds, which might have been used for various purposes, but usually do not leave any direct archaeological traces.[VIII] | No data. Its small size makes it an unlikely food item. |
| *Bolinus brandaris* | CEN: Purple shellfish, dye murex<br>CGN: Πορφύρα, ακανθωτός στρόμπος<br>AGN: πορφύρα, or κάλχη, or κάλυξ | It inhabits sandy bottoms at depths of 10–20 m. It is a predatory species (like all purple shellfish) feeding mostly on bivalves by opening a conical hole on the shell surface. | This species, along with *Hexaplex trunculus* was widely used in antiquity for the production of purple dye.[IX] | E; eaten cooked. Although all parts of the flesh are edible the inner part is considered best (softer). |
| *Cerithium vulgatum* | CEN: Common cerith, or horn shell<br>CGN: Κεράτιος<br>AGN: στρόμβος | Common on stony and firm sandy bottoms, grazing seaweed; on rocks in lower intertidal zone. | At Kalaureia several ceriths had been collected dead, probably containing hermit crabs. These crabs might have been attracted to baited baskets. | E; eaten cooked. Flesh is extracted after boiling. Breakage of the apex (the last whorl) facilitates the procedure. |
| *Charonia* sp. | CEN: Triton's trumpet<br>CGN: Μπουρού<br>AGN: κήρυξ | A predatory species living on rocky, muddy and sandy bottoms. | It is considered the largest gastropod in the Mediterranean reaching 45 cm in length. Triton shells have been found in several cultic contexts throughout Greece.[X] Its use as war trumpet the Buccina in the Roman period is documented.[XI] It is still used as trumpet for signalling at sea. | E. |
| *Columbella rustica* | CEN: Dove shell<br>CGN: -<br>AGN: - | It lives and feeds in great numbers on rocky littoral areas just below the sea surface. | Its shell could be considered decorative.[XII] | No data. |
| *Conus mediterraneus* | CEN: Mediterranean cone shell<br>CGN: -<br>AGN: - | A carnivorous species living in the shallow rocky littoral zone among the seaweed. | | nE—poisonous. |
| *Cypraea lurida* | CEN: Lurid cowrie<br>CGN: γουρουνίτσα<br>AGN: - | A predatory species living on muddy and sandy bottoms as well as under rocks at depths larger than 8 m. When washed out on sandy beaches sand abrasion and strong sunlight destroys its glossy surface. | This shell's shape and glossy surface renders it highly decorative. In antiquity it had a symbolic dimension and was used as an ornament.[XIII] | No data. |

[VIII] *For the use of seaweed in antiquity see Tsimbidou-Avloniti 2005, 42, 66; see also Veropoulidou 2011, 98 for ethnographic examples.*
[IX] *For example: Moatsos 1932; Ruscillo 2006, 811–813; Alfaro & Mylona 2014.*
[X] *For some examples see Reese 2000, 632 and references therein.*
[XI] *Lellak 1977, 140.*
[XII] *See several instances in Veropoulidou 2011, e.g. 82, 98, figs. 2.16, 2.5.*
[XIII] *Reese 2000, 635–636 and references therein.*

| | | | | |
|---|---|---|---|---|
| *Euthria cornea* | CEN: Horn whelk<br>CGN: -<br>AGN: - | Carnivorous scavenger; lives hidden beneath stones in the infra-littoral zone as well as on rocky and sandy bottoms at greater depths. | They may have been caught unintentionally in bait baskets. | No data. Larger northern European varieties of Euthria are considered edible. |
| *Fusinus syracusanus* | CEN: Sicilian spindle shell<br>CGN: -<br>AGN: - | Carnivorous, lives on stony and muddy bottoms between 1 and 50 m depth. | | No data. |
| *Gibbula magus* | CEN: Great top shell<br>CGN: Τρόχος, στρουμπίλι<br>AGN: νηρείτης | It is common on all types of sea beds, rocky and sandy, in the littoral zone, deeper than 10 m. Its gathering requires diving. | | No data, presumably edible. |
| *Hexaplex trunculus* | CEN: Purple shellfish<br>CGN: Πορφύρα, στρόμπος<br>AGN: πορφύρα | Inhabits the littoral zone (splash zone to a depth of a few metres), prefers rocky bottoms but lives also on the sand. It is a predatory species (like all purple shellfish) feeding on bivalves, by opening a conical hole on the shell surface. | This mollusc has been widely used in antiquity for the production of purple dye.[XIV] | E; eaten boiled. |
| *Muricopsis cristata* | CEN: -<br>CGN: -<br>AGN: - | A carnivorous species living in the shallow rocky littoral zone among the seaweed. | Small size shell. Looks like a small elongated *Hexaplex trunculus*. It had probably been caught unintentionally in bait baskets. | No data. |
| *Nassarius incrassatus* | CEN: Angulate nassa<br>CGN: -<br>AGN: - | A carnivorous scavenger species, living on the littoral zone on rocky shores, in crevices and under stones. | Small size shell (up to 20 mm); probably caught unintentionally in bait baskets. In prehistory they were used for ornamental purposes.[XV] | No data. |
| *Naticarius stercusmuscarum* | CEN: Many-spotted moon shell, natica<br>CGN: -<br>AGN: - | A carnivorous predatory species (like all naticas) living on sandy and muddy bottoms at depths deeper than 10 m. It feeds on any sand-dwelling bivalve or gastropod (even its own species) by drilling holes on shell surfaces and eating the flesh with its proboscis. The geometry of natica boring is hemi-spherical (as opposed to the boring of *Hexaplex trunculus* which is conical). | The shells may have ended up at the site either by being collected dead or being inhabited by hermit crabs caught in bait baskets. In the first case they must have been found on sandy, not gravelly or rocky shores, or the shells would have broken. | No data. |
| *Patella rustica* | CEN: Limpet<br>CGN: Πεταλίδα<br>AGN: λεπάς, a name also used for a shallow cooking pot.[XVI] | It lives adhered firmly on rocky surfaces in the coastal splash zone. Typical inhabitant of rocky coasts. | Similar to *Patella ulyssiponensis* but smaller in size, more prominent apex, outline less irregular, axial ridges more thin and regular. | E; eaten raw and cooked. |
| *Patella ulyssiponensis* | Same as with *Patella rustica* | Similar to *Patella rustica*. | | E; eaten raw and cooked. |
| *Phorcus turbinatus* | CEN: Top shell<br>CGN: Τρόχος, στρουμπίλι, παπούδι<br>AGN: νηρείτης | A typical inhabitant of rocky coasts in the coastal and splash zone. | Top shells can be found on the same rocks as limpets and are often collected and cooked together.[XVII] | E; eaten cooked. The flesh is extracted with a pin; the shell's apex is often broken to facilitate the extraction. |
| *Tarantinaea lignaria* | CEN: Mediterranean tulip shell<br>CGN: -<br>AGN: - | Carnivorous, lives on rocky substratum, endemic in the Mediterranean. | | No data. |

*[XIV] For a general review see indicativelly Moatsos 1932; for a review of the archaeological correlation of the shells to the production of purple dye see Alfaro & Mylona 2014, for an example of an archaeological assemblage of Hexaplex trunculus that is linked to purple dye production see Reese 1980.*
*[XV] E.g. Bar-Yosef Mayer 2015.*
*[XVI] Sparkes & Talcott 1970, 3, 27.*
*[XVII] Pers. comm. with Mrs C. Stamataki, Rethymno.*

| | | | | |
|---|---|---|---|---|
| *Tonna galea* | CEN: Mediterranean tunshell<br>CGN: Κοχύλα<br>AGN: - | A predatory species living mainly on muddy and sandy bottoms at depths >8 m. | Large globular shell (up to 30 cm in length) is considered highly decorative. At Methana empty *Tonna galea* shells were used in the past as dippers for the extraction of olive oil from large *pithoi*. Two tasks were performed at the same time: the oil was separated from the settled residue at the bottom of the *pithos* and it was poured into bottles from the siphonal canal.[XVIII] | E; in southern Italy and Sicily sold in the fish markets. |

[XVIII] *Such studies have not been performed on materials from historic periods. For prehistoric examples see indicatively Binnberg 2013; Apostolakou et al. 2014.*

## Bibliography


Alfaro, C. & D. Mylona 2014. 'Fishing for purple shellfish (*Muricidae*) in ancient Greece. Acquisition technology and first steps in purple dye production', in *Purpurae vestes* 4. *Production and trade of textiles and dyes in the Roman Empire and neighbouring regions*, eds. C. Alfaro, M. Tellenbach & J. Ortiz, Valencia, 149–166.

Apostolakou, S., P.P. Betancourt, T.M. Brogan, D. Mylona & C. Sofianou 2014. 'Tritons revisited,' in *PHYSIS. L'environment naturel et la relation Homme-Milieu dans le monde Égéen Protohistorique, Actes de la 14e Rencontre égéenne internationale, Paris, Institut National d'Histoire de l'Art (INHA), 11–14 Décembre 2012* (Aegaeum, 37), eds. G. Touchais, R. Laffineur & F. Rougemont, Leuven, 325–332.

Bar-Yosef Mayer, D.E. 2015. 'Nassarius shells. Preferred beads of the Palaeolithic', *Quaternary International* 390, 79–84. https://doi.org/10.1016/j.quaint.2015.05.042

Basiakos, Y. 2007. 'Πρώτες ύλες και μετασχηματισμός τους στον ΠΕ οικισμό του Κάβου Βασσίλη (Πόρος) και στην ΥΕ εγκατάσταση Μόδι', in *ΕΠΑΘΛΟΝ. Αρχαιολογικό συνέδριο προς τιμήν του Αδονιδος Κύρου, Πόρος 7-9 ΙΟπ΄πυνίου 2002*, ed. E. Konsolaki-Giannopoulou, Athens, 199–220.

Binnberg, J. 2013. 'Form, Funktion und Kontext der Tritonschnecken in der minoischen Kultur', *AA* 2013:1, 1–30.

Boitani, L. 1982. *The Macdonald encyclopedia of shells*, London.

Çakirlar, C. ed. 2011. *Archaeomalacology revisited. Non-dietary use of molluscs in archaeological settings. Proceedings of the archaeomalacology sessions at the 10th ICAZ Conference, Mexico City, 2006*, Oxford. https://doi.org/10.2307/j.ctvh1dwt0

Campbell, A. 2006. *Seashores and shallow seas of Britain and Europe*, London.

Cossignani, T., A. Di Nisio & M. Passamonti 1992. *Atlas of shells from Central Adriatic Sea*, Ancona.

Dalby, A. 1996. *Siren feasts. A history of food and gastronomy in Greece*, London.

Dance, P. 1977. *Seashells*, London.

Davidson, A. 1972. *Mediterranean seafood*, London.

Dellamotte, M. & E. Vardala-Theodorou 2001. *Shells from the Greek seas*, Kifissia.

Ifantidis, F. & M. Nikolaidou, eds. 2011. *Spondylus in prehistory. New data and approaches. Contributions to the archaeology of shell technologies* (BAR-IS, 2216), Oxford.

IGME 2006 = Institute of Geology and Mineral Exploration, *Geological map of Greece. 1:50.000, Methana sheet*, Athens.

Karali, L. 1999. *Shells in Aegean prehistory* (BAR-IS, 761), Oxford.

Lellak, J. 1977. *Shells of Britain and Europe*, London.

Lymberakis, P. & G. Iliopoulos 2019. 'Snakes and other microfaunal remains from the Sanctuary of Poseidon at Kalaureia', *OpAthRom* 12, 233–240. https://doi.org/10.30549/opathrom-12-06

Manousis, Th. 2012. *The sea shells of Greece*, Thessaloniki.

Moatsos, P.G. 1932. *Πορφύρα με δέκα εξ εικόνες*, Alexandria.

Mylona, D. 2013. 'Dealing with the unexpected. Strange animals in a Late Hellenistic/Early Roman cistern fill in the Sanctuary of Poseidon at Kalaureia, Poros', in *Bones, behaviour and belief. The osteological evidence as a source for Greek ritual practice* (ActaAth-4°, 55), eds. G. Ekroth & J. Wallensten, Stockholm, 149–166.

Mylona D. 2015. 'From the archaeological fish bones to the ancient fishermen. Views from the Sanctuary of Poseidon at Kalaureia', in *Classical archaeology in context. Theory and practice in excavation in the Greek world*, eds. D. Haggis & C. Antonaccio, Berlin, 385–417. https://doi.org/10.1515/9781934078471-017

Mylona, D. 2019. 'Animals in the sanctuary. Mammal and fish bones from Areas D and C at the Sanctuary of Poseidon at Kalaureia. With an appendix by Adam Boethius', *OpAthRom* 12, 173–221. https://doi.org/10.30549/opathrom-12-04

Ntinou, M. 2019. 'Trees and shrubs in the sanctuary. Wood charcoal analysis at the Sanctuary of Poseidon at Kalaureia, Poros', *OpAthRom* 12, 255–269. https://doi.org/10.30549/opathrom-12-08

Penttinen, A. & D. Mylona 2019. 'Physical environment and daily life in the Sanctuary of Poseidon at Kalaureia, Poros. The bioarchaeological remains. Introduction', *OpAthRom* 12, 159–172. https://doi.org/10.30549/opathrom-12-03

Potamianos, T. 1956. *Τα ψάρια και η μαγειρική*, Athens.

Prummel, W. 2003. 'Animal remains from the Hellenistic town of New Halos', in *Zooarchaeology in Greece. Recent advances* (BSA Studies, 9), eds. E. Kotzabopoulou, Y. Hamilakis, P. Halstead, C. Gamble & P. Elefanti, London, 153–159.

Reese, D.S. 1980. 'Industrial exploitation of murex shells. Purple-dye and lime production at Sidi Khrebish, Benghazi (Berenice)', *Libyan Studies* 11, 79–93. https://doi.org/10.1017/s026371890000858x

Reese, D. 2000. 'The marine invertebrates', in *Kommos* 4. *The Greek sanctuary*, eds. J.W. Shaw & M.C. Shaw, Princeton, 571–642.

Ruscillo, D. 2006. 'Faunal remains and murex dye production', in *Kommos* 5. *The monumental Minoan buildings at Kommos*, eds. J.W. Shaw & M. Shaw, Princeton, 776–844.

Sarpaki, A. 2019. 'Plants in the sanctuary. Charred seeds from Areas C and D at the Sanctuary of Poseidon at Kalaureia, Poros', *OpAthRom* 12, 271–286. https://doi.org/10.30549/opathrom-12-09

Seferiades, M.L. 2000. '*Spondylus gaederopus*. Some observations on the earliest European long distance exchange system', in *Karanovo* 3. *Beiträge zum Neolithikum in Südosteuropa*, eds. S. Hiller & V. Nikolov, Vienna 2000, 423–437.

Serjeantson, D. 2019. 'Animals in the sanctuary. Bird bones and eggshell', *OpAthRom* 12, 223–231. https://doi.org/10.30549/opathrom-12-05

Sparkes A.B. & L. Talcott 1970. *Black and plain pottery of the 6th, 5th and 4th centuries BC* (The Athenian Agora XII), Princeton.

Theodoropoulou, T. 2007. L'Exploitation des faunes aquatiques en Égée aux temps pré- et protohistoriques, Ph.D. thesis, University of Paris I Panthéon—Sorbonne.

Theodoropoulou, T. 2013. 'The sea in the temple? Shells, fish and corals from the sanctuary of the ancient town of Kythnos and other marine stories of cult', in *Bones, behaviour and belief. The osteological evidence as a source for Greek ritual practice* (ActaAth-4°, 55), eds. G. Ekroth & J. Wallensten, Stockholm, 197–222.

Thompson, D.A.W. 1947. *A glossary of Greek fishes*, Oxford.

Tsimbidou-Avloniti, M. 2005. *Makedonikoi tafoi ston Foinika kai ston Agio Athanasio Thessalonikis* (Dimosieymata tou Arxaiologikoy Deltioy, 91), Athens.

Veropoulidou, R. 2011. Ostrea apo tous oikismous toy Thermaikou kolpou. Anasynthetontas thn katanalosi ton malakion sti Neolithiki kai tin Epochi tou Chalkou, Ph.D. thesis, University of Thessaloniki.

Voultsiadou, E. & D. Vafidis 2007. 'Marine invertebrate diversity in Aristotle's zoology', *Contributions to Zoology*, 76:2, 103–120. https://doi.org/10.1163/18759866-07602004

Wells, B., A. Penttinen, J. Hjohlman & E. Savini 2005. 'The Kalaureia Excavation Project. The 2003 season. With an appendix by Kristian Göransson', *OpAth* 30, 127–215.

Wells, B., A. Penttinen & J. Hjohlman 2006–2007. 'The Kalaureia Excavation Project. The 2004 and 2005 seasons. With contributions by Kristian Göransson, Arja Karivieri and Maria Daniela Trifirò', *OpAth* 31–32, 31–129.

WoRMS Editorial Board 2019 = World Register of Marine Species. https://doi.org/10.14284/170