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DI ATENE E DELLE MISSIONI

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2020





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# PALAEOSHORELINE RECONSTRUCTION OF AGIOS VLASSIS BAY (ANCIENT EPIDAUROS, EAST PELOPONNESE, GREECE)\*

ELENI KOLAITI

**Riassunto.** In questo lavoro si propone la rappresentazione paleogeografica del golfo di Agios Vlassis, che si estende per una lunghezza di km 3.4 a sud dell'antica Epidaurò, sulla costa orientale del Peloponneso. La registrazione, l'analisi e l'interpretazione di tutti gli indicatori disponibili del cambiamento del livello del mare in questo tratto di costa e la correlazione con gli stessi dati per il contesto più ampio del Golfo Saronico e della Penisola Argolica, hanno permesso di interpretare l'impatto che questi fattori hanno avuto sull'ambiente costiero e sulle attività umane che ha ospitato nel corso degli anni. Durante il periodo romano e tardo-romano, il livello medio del mare era  $m\ 3.70 \pm 0.10$  più basso di quello attuale e la costa del golfo di Agios Vlassis, posta all'estremità meridionale dove si trova la "Villa dei dolia", era significativamente più ampia di oggi. I vari edifici, collocati nella zona costiera dalla penisola Nisis (antica Epidaurò) fino a Gialasi, attualmente sono tutti sommersi. Erano situati nella pianura e tutti lontani da quella che all'epoca era la linea di costa, tranne la "Villa dei dolia", probabilmente per assolvere a funzioni agri/vitivinicole, per la pesca e come luogo di deposito per le merci prodotte *in situ* e pronte per essere trasportate via mare verso destinazioni vicine.

**Περίληψη.** Στην παρούσα εργασία επιχειρείται η παλαιογεωγραφική αναπαράσταση του κόλπου του Αγίου Βλάσσης, που εκτείνεται σε μήκος 3.4 χιλιομ. νότια της Παλαιάς Επιδαύρου, στην ανατολική ακτή της Πελοποννήσου. Η καταγραφή, ανάλυση και ερμηνεία όλων των διαθέσιμων δεικτών της μεταβολής του επιπέδου της θάλασσας στη θέση αυτή, καθώς και η συσχέτισή τους με τις παλαιότερες στάθμες της θάλασσας που έχουν προσδιοριστεί για τον Σαρωνικό κόλπο και την Αργολική χερσόνησο, επέτρεψε την αποκωδικοποίηση των σχετικών μεταβολών του επιπέδου της θάλασσας, ιχνηλατώντας τις επιπτώσεις τους στο παράκτιο ανθρωπογενές περιβάλλον, και στις δραστηριότητες που φιλοξένησε στη διάρκεια του χρόνου. Κατά τους Ρωμαϊκούς-Υστερορωμαϊκούς χρόνους το μέσο επίπεδο της θάλασσας βρισκόταν  $3.70 \pm 0.10$  μ. χαμηλότερα από το σημερινό. Η ακτή του κόλπου του Αγίου Βλάσσης, στο νότιο άκρο της οποίας βρίσκεται η επονομαζόμενη "έπαυλη με πίθους", ήταν σημαντικά πλατύτερη σε σχέση με τη σημερινή. Οι διάφορες κατασκευές, σήμερα όλες βυθισμένες στην παράκτια ζώνη από τη Χερσόνησο Νησί (Παλαιά Επίδαυρος) έως το Γιάλασι, βρίσκονταν στην πεδιάδα, απομακρυσμένες από την τότε ακτογραμμή. Μόνο η έπαυλη-αγροικία ήταν παραθαλάσσια, πιθανόν για να εξυπηρετεί τη χρήση της για αγροτική παραγωγή/αμπελοκαλλιέργεια, αλιεία/επεξεργασία ψαριών, αλλά κι ως σημείο αποθήκευσης και μεταφοράς των παραγόμενων προϊόντων μέσω της θαλάσσιας οδού.

**Abstract.** In this paper, there is an attempt to reconstruct the palaeogeographic shoreline of Agios Vlassis Bay, stretching for km 3.4 south of Palaia Epidaurus on the eastern coast of the Peloponnese. Analyzing the available archaeological and geomorphological sea level indicators in this particular coastal area, and combining them with the former sea level stands determined for the Saronic Gulf and Argolis Peninsula, we attempt to decode the relative sea level (rsl) changes, tracing their impacts on the coastal anthropogenic environment and the human activities developed there over time. During Roman-Late Roman times, the sea level was at  $m\ 3.70 \pm 0.10$  bmsl. The coast of Agios Vlassis Bay, at the southern end of which the so-called "Villa of the Dolia" is located, was significantly wider than at present. The various structures once located in the coastal plain inland from the then shoreline between the Nissi Peninsula (Palaia Epidaurus) and Yialasi are today submerged. Only the villa-farmstead was close to shore, probably to serve its agriculture/viticulture, fishing/fish processing functions, and as a storage spot for goods of local production to be transported by sea to nearby destinations.

## 1. INTRODUCTION

### 1.1 Location

Agios Vlassis Bay is situated on the eastern coast of the Peloponnese in Argolis (Fig. 1A). It stretches for km 3.4 from the south bay of the Nissi Peninsula (Figs. 1A, 1B), which bounds to the south the bay of Palaia Epidaurus as far as the southern end of the Yialasi coast (Figs. 1A, 1C). All along the coastal

\* I would like to thank Dr. Nikos Mourtzas, Geologist NTUA, who greatly contributed to the fieldwork. Thanks are also due to Mr.

Stephen Taylor, Consultant at Cambridge Assessment English for editing the English text.

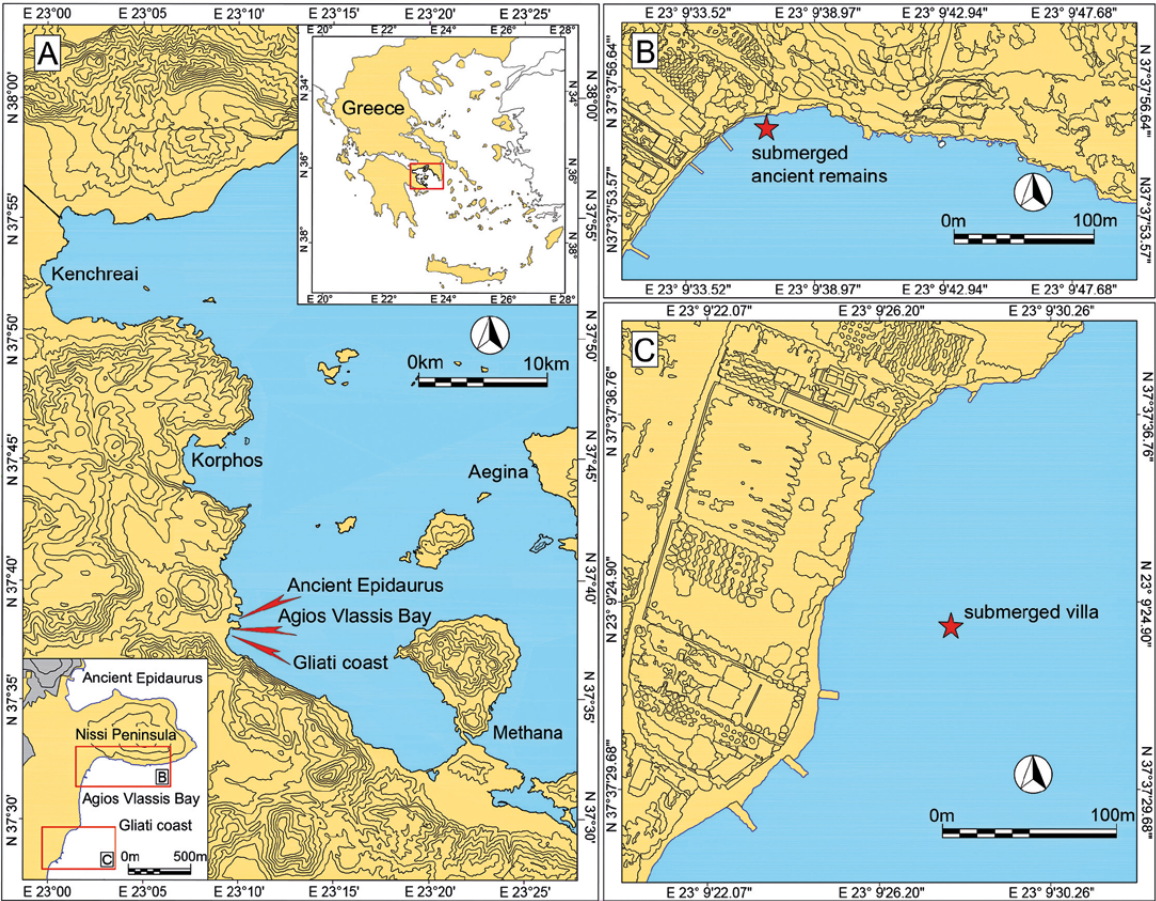


Fig. 1. Location maps of the: A) West Saronic Gulf. The bottom left map indicates the areas of interest shown on maps B and C. B) South bay of the Nissi Peninsula in Agios Vlassis Bay, where the Roman/Late Roman remains are submerged. C) Gliati coast, where the submerged villa - farmstead is submerged (2019; el. A. © Eleni Kolaiti).

zone, many submerged relics of ancient buildings, walls and other structures have been found, while the major archaeological interest is a large building complex submerged m 50 offshore at Gliati or Kalimnios, known to the locals as the “sunken city” (Fig. 1C). The ancient remains were first reported in 1972<sup>1</sup> and later, in 2016 and 2019, recorded and mapped, their depths measured in detail in the context of the geoarchaeological survey of the eastern coast of the Peloponnese conducted by the author<sup>2</sup>. In 2017, within a training programme of in situ conservation of underwater archaeological sites carried out by the Ephorate of Underwater Antiquities (EEA, Greece) and the Istituto Superiore per la Conservazione ed il Restauro (ISCR, Italy), the submerged building complex in Gliati (the so-called “Villa of the Dolia”) was selected as the pilot site<sup>3</sup>. In 2018, there began an archaeological underwater excavation and restoration of selected sectors of the Villa, in the context of an agreement between the EEA, the ISCR and the IASA (Italian School of Archaeology at Athens)<sup>4</sup>. In this study, the former sea level stands for the period the various coastal constructions were in use and the changes in the coastal landscape over time are presented<sup>5</sup>.

1.2 Historical context

The area of what is nowadays Palaia Epidaurus has been occupied since prehistoric times. A remarkable settlement is evidenced on the hill, west of the Nissi Peninsula and the contemporary village.

<sup>1</sup> KΡΙΤΖΑΣ 1972, 192-194.  
<sup>2</sup> KOLAITI-MOURTZAS 2016, 80-82; ΚΟΛΑΪΤΗ 2019, 271-287.  
<sup>3</sup> DAVIDDE *et alii* 2019, 543.  
<sup>4</sup> *Ibid.*, 544; GALLATSATOU *et alii* 2019, 566.  
<sup>5</sup> The geoarchaeological survey in Agios Vlassis Bay was part of a PhD Thesis (see ΚΟΛΑΪΤΗ 2019), performed under the supervision of Assoc. Professor Evyenia Yiannouli, with the permission of the Ministry of Culture, Ephorate of Underwater Antiquities (EEA) and approved by the University of Peloponnese, Department of History Archaeology and Cultural Resources Management. The preliminary results were first presented in KOLAITI-MOURTZAS 2016.

During the Middle Helladic period, the peninsula was settled for a better control of the area. The location of the Mycenaean settlement remains unknown, except for the cemetery to the west of the peninsula<sup>6</sup>. Finds from the Geometric and Archaic periods are located at the eastern edge of the Akros mountain and Cape Agios Nikolaos, where remains of the Sanctuaries of Artemis (8<sup>th</sup> c. BC) and Hera (6<sup>th</sup> c. BC) were found, still in use until Pausanias' time (2<sup>nd</sup> c. AD)<sup>7</sup>. The town on the Nissi Peninsula was fortified in the late 5<sup>th</sup> c. BC. In the Hellenistic period (mid 4<sup>th</sup> c. BC), the (small) theatre was built there, and to the north of it, on the peninsula, the Ancient Agora<sup>8</sup>. The Roman town spread mainly across the slopes of the two hills, the isthmus and the north and south bay of the peninsula, but also further north at Cape Agios Nikolaos. The ancient harbour of Epidauros<sup>9</sup> was bounded to the north by the rubble mound breakwater and to the south by the extended dock, which hosted some buildings, probably a lighthouse at its northern end and various structures immediately to the east of it, all today submerged below the sea, which indicates the key role it played as an important trade and transport spot to the adjacent Asclepius Sanctuary during Classical and Roman antiquity. Findings indicating purple dye production, still in use until the third quarter of the 4<sup>th</sup> c. BC, have been found in the area of the modern port of Palaia Epidauros<sup>10</sup>. On the SW side of it, remains of a Roman bath (*balneae*), houses and walls of a Late Roman building with a private portrait dated back to the 3<sup>rd</sup> c. AD have also been found, today largely inundated by the sea<sup>11</sup>. At the southernmost end of the modern port, the remains of a Byzantine church have been reported<sup>12</sup>. On the narrowest part of the peninsula have been found a built aqueduct and a reservoir, whereas on the outskirts of the peninsula there are sporadic remains of walls of various periods, most notably Mediaeval<sup>13</sup>. Human activity during the Roman/Late Roman period is evidenced in the south bay of the Nissi Peninsula, in Agios Vlassis Bay, where fuzzy submerged relics of walls have been reported<sup>14</sup> which clearly indicate that the core of the Roman/Late Roman town of Epidauros had transferred there<sup>15</sup>. The large building complex found submerged some m 700 to the south was initially interpreted as a Roman villa-farmstead, and the relics of three buildings some m 200 further south as "poor houses" of the same period<sup>16</sup>. The archaeological survey and interpretation of the building complex revealed that it was a rural establishment (*villa rustica*) and, due to some pithoi (*dolia*) that were found in it, it was given the name "Villa of the Dolia"<sup>17</sup>.

The establishment of villas<sup>18</sup> in the Greek territory from the 1<sup>st</sup> c. AD onwards was the result of significant changes in the structure of the production economy, cultivation strategy and agricultural practices, as well as in land sharing and property, that took place after the Romans dominated Greece<sup>19</sup>. Villas (*villae rusticae*, *villae maritimae* etc.) flourished in the Peloponnese during the 1<sup>st</sup>/2<sup>nd</sup> c. AD and in the first half of the 3<sup>rd</sup> c. AD<sup>20</sup>. In the Argolis Peninsula, most of the agricultural settlements of the Hellenistic period remained inhabited during early Roman times, although the exploitation of land was less intensive<sup>21</sup>. Roman trade increased in the Mediterranean after the 2<sup>nd</sup> c. AD, during the *pax romana*, bringing about great growth, which - although temporarily obstructed by the barbarian raids - accelerated in the early 4<sup>th</sup> c. AD with the reforms of Diocletian and Constantine and culminated in the 5<sup>th</sup> and 6<sup>th</sup> c. AD<sup>22</sup>. The villa-farmstead model was finally abandoned at the end of the 6<sup>th</sup> c. AD<sup>23</sup>.

It is worth mentioning that, during the geoarchaeological survey along the coast of the Argolis Peninsula<sup>24</sup>, in total ten building complexes - villas (varying in dimensions and use, but probably belonging to the same time period) have been surveyed and mapped, and the depths of their functional features have been recorded.

<sup>6</sup> ΠΡΟΣΚΥΝΗΤΟΠΟΥΛΟΥ 2011, 274-275.

<sup>7</sup> *Ibid.*

<sup>8</sup> *Ibid.*; ΠΡΩΤΟΝΟΤΑΡΙΟΥ-ΔΕΪΛΑΚΗ 1972.

<sup>9</sup> The ancient harbour of Epidauros in relation to the relative sea level changes since the period it was in use and the palaeogeography of the gulf of Palaia Epidauros have been extensively studied by the author, see ΚΟΛΑΪΤΗ-ΜΟΥΡΤΖΑΣ 2016 and ΚΟΛΑΪΤΗ 2019, 257-270.

<sup>10</sup> ΠΡΟΣΚΥΝΗΤΟΠΟΥΛΟΥ 2011, 112.

<sup>11</sup> *Ibid.*, 111.

<sup>12</sup> ΚΡΙΤΖΑΣ 1972, 186.

<sup>13</sup> *Ibid.*

<sup>14</sup> *Ibid.*, 192-194; ΚΟΛΑΪΤΗ 2019, 271-287.

<sup>15</sup> ΠΡΟΣΚΥΝΗΤΟΠΟΥΛΟΥ 2011, 111.

<sup>16</sup> ΚΡΙΤΖΑΣ 1972, 194-195.

<sup>17</sup> DAVIDDE *et alii* 2019, 547.

<sup>18</sup> MARZANO 2013, 8-11 and related references therein.

<sup>19</sup> RIZAKIS 2013, 35.

<sup>20</sup> ΠΕΤΡΟΠΟΥΛΟΣ 2013, 156.

<sup>21</sup> ΖΟΥΜΒΑΚΙ 2013, 53-54; ΣΑΡΡΗ 2013, 276.

<sup>22</sup> *Ibid.*, 276.

<sup>23</sup> RIZAKIS 2013, 51.

<sup>24</sup> ΚΟΛΑΪΤΗ-ΜΟΥΡΤΖΑΣ 2016; ΚΟΛΑΪΤΗ 2019, 271, 287, 311, 339, 350, 366, 383, 397.

## 2. INDICATORS OF THE RELATIVE SEA LEVEL CHANGE

### 2.1 Methods

The determination of the several sea level stands was based on geomorphological indicators, i.e. marine notches and various beachrock generations. An underwater snorkelling geological survey in Agios Vlassis Bay revealed many geomorphological indicators of the past sea levels, which were mapped using satellite images (Google Earth Pro, v. 7.3.2) and high-resolution orthophotos at a scale of 1:500 (Ktimatologio S.A.). During this survey, their features were recorded, and depths at selected points were measured. All measurements of depths were collected during calm sea conditions using mechanical methods (measuring tape and invar rod) and were repeated during three different survey periods (May 2015, June 2016, September 2017). An accuracy of  $\pm 1$  cm along the vertical is estimated. To account for tides, observational data have been reduced for tide values at the time of the surveys with respect to mean sea level, using tidal data from the Hellenic Navy Hydrographic Service for the closest tide-gauge station of Piraeus. The effect of atmospheric pressure on the sea level was corrected using the meteorological data for the site at the time of the surveys ([www.meteo.gr](http://www.meteo.gr)). Therefore, all depths reported herein correspond to depths below mean sea level (bmsl).

Various ancient coastal constructions, although now submerged, were strictly related to the sea level at the time they were in use and can therefore be used as precise archaeological indicators for the determination and dating of the former sea level stands inferred along the coast of Agios Vlassis Bay. The measurement of the elevations/depths of particular functional features of the ancient installations can lead us to the determination of their functional elevation with sufficient accuracy. The archaeological interpretation and age of the ancient structure enable us either to define the time period when the change in sea level occurred or to determine at least a maximum dating limit (*terminus post quem*) after which the structure could not have been in use according to its initial design, or a minimum dating limit (*terminus ante quem*) prior to which the sea level could not have changed since the structure was in use<sup>25</sup>.

### 2.2 Archaeological indicators

#### *South bay of the Nissi Peninsula*

Numerous ancient remains, mostly submerged, have been identified on the shore and in the coastal area of the south bay of the Nissi Peninsula, in the northernmost part of Agios Vlassis Bay: indicative-ly, these include building foundations and superstructure, various structures (e.g. water basin/pool, well mouth, etc.) and remnants of two pairs of parallel walls spaced evenly, each pair perpendicular to the other, built of ashlar blocks (Figs. 2, 3A, 3B, 3C, 3D). The underwater archaeological survey of this structure revealed that it was a monumental public building of the Classical or Hellenistic period with a later Roman use<sup>26</sup>. An inscription found in one of its walls, probably dated back to between the last quarter of the 3<sup>rd</sup> and the first half of the 2<sup>nd</sup> c. BC, has been reused as a building element after the destruction of the theatre of Epidauros between the end of the 3<sup>rd</sup> c. AD and early 5<sup>th</sup> c. AD<sup>27</sup>. At a short distance from the shoreline on land, two massive rubble walls with lime mortar, probably belonging to a Roman built water-basin/pool connected to an underground aqueduct located northeastward, have been reported<sup>28</sup>. Additionally, remains of a built basin/pool have been found on the contemporary coastline, the use of which might be related to the installations on land (Fig. 3A)<sup>29</sup>. It is built of stones, tiles and mortar, and lined with mortar. Furthermore, there is reference to fortifications made of two parallel walls filled with rubble and soil that were built in Epidauros, as the raids of Goths (395 AD) created new needs for defense<sup>30</sup>. Whatever the case may be, this coastal area was land at that time, and seems to have been in use at least until the end of the 4<sup>th</sup> c. - early 5<sup>th</sup> c. AD.

The remains of wall foundations and superstructure were observed and recorded m 35 offshore to a depth of 2.10 m below mean sea level (bmsl). Rubble and fuzzy relics were found at a depth of m 2.40 bmsl

<sup>25</sup> ΚΟΛΑΪΤΗ 2019, 98-131.

<sup>26</sup> ΓΑΛΙΑΤΣΑΤΟΥ 2019, 566.

<sup>27</sup> *Ibid.*, 568-569.

<sup>28</sup> ΚΡΙΤΖΑΣ 1972, 186.

<sup>29</sup> Photos with archaeological content are published under the permission of the Ministry of Culture, Ephorate of Underwater Antiquities (EEA).

<sup>30</sup> ΦΑΡΑΚΛΑΣ 1972, 72.

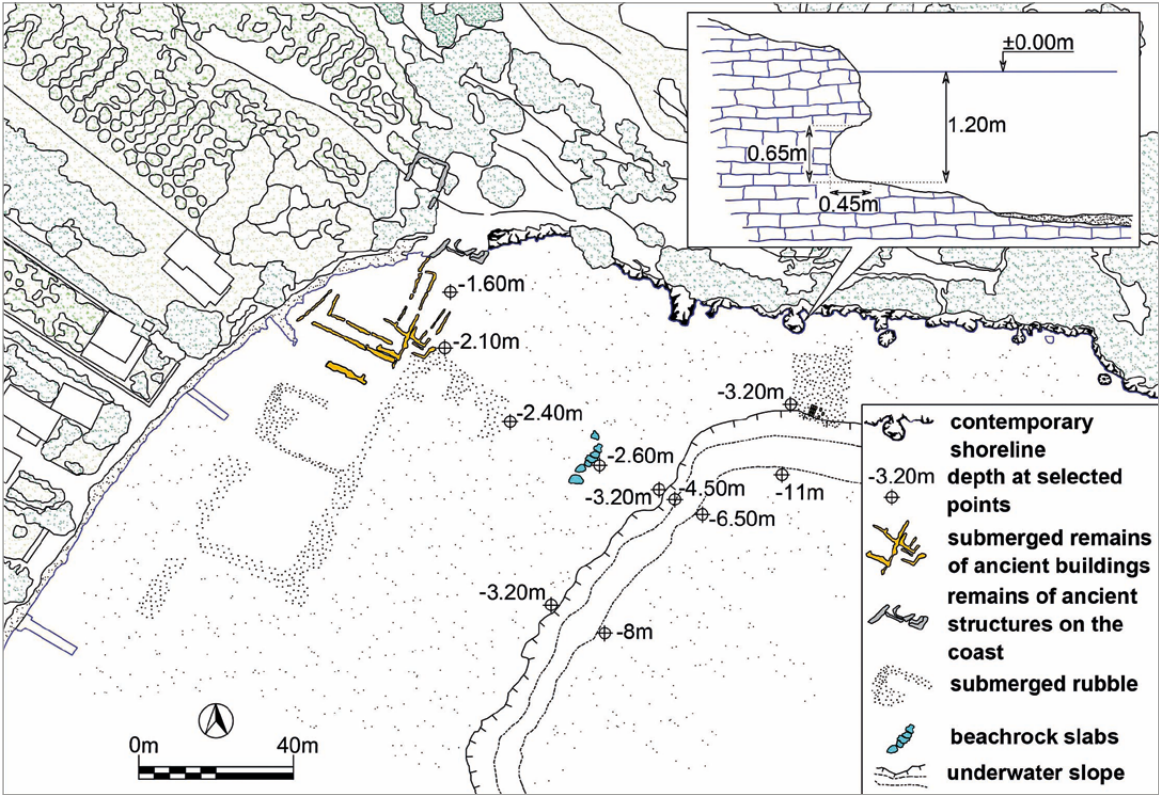


Fig. 2. Schematic representation of the coastal area in the south bay of the Nissi Peninsula, in the northernmost part of Agios Vlassis Bay. The Roman/Late Roman remains and the geomorphological features are depicted. In detail (top right): the profile of the submerged tidal notch observed all along the south limestone cliff of the Nissi Peninsula (2019; el. A. © Eleni Kolaiti).

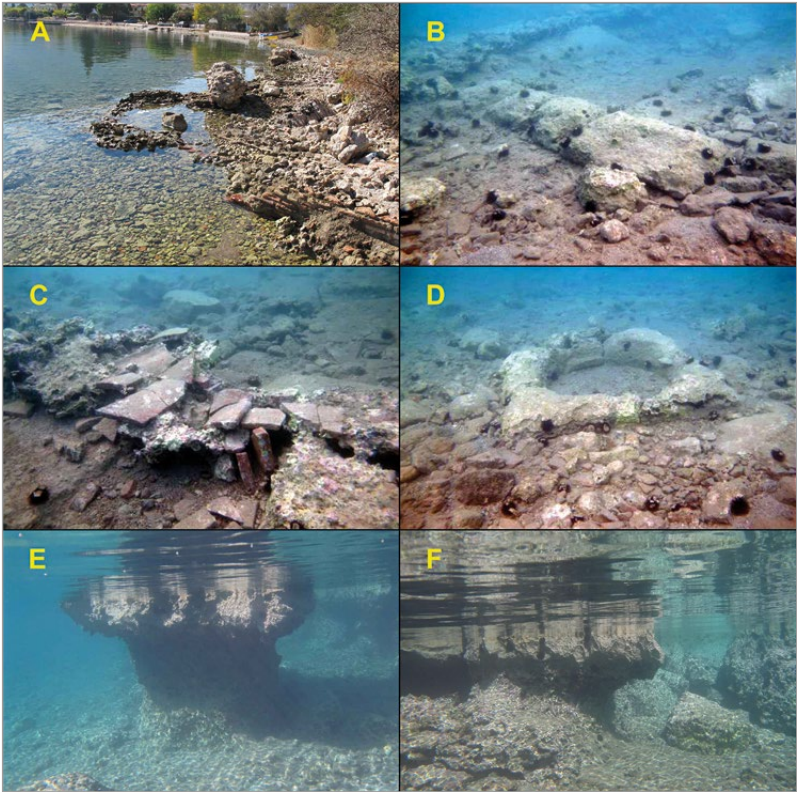


Fig. 3. South bay of the Nissi Peninsula in Agios Vlassis Bay. A: view of the inundated remains of the basin/pool on the contemporary shoreline. B, C: underwater views of the submerged walls. D: underwater view of the well mouth. E: underwater view of the tidal notch incised on the south cliff of the Nissi Peninsula. F: the ‘mushroom-type’ tidal notch (photos A. © Eleni Kolaiti).

at a max distance of m 65 from the western shoreline of the bay and at a depth of 3.20 m bmsl at a distance of m 25 from the northern shoreline, as far as the top of the underwater slope (Fig. 2).

At a distance of m 200 to the south towards the villa-farmstead, submerged ancient remains, building foundations, and rubble (*ερείπιώνας*) are scattered over a coastal zone, m 250 long and m 80 wide, thus indicating human activity all along the coastal area of the bay (Fig. 8B).

#### *Gliati coast*

The schematic plan of the villa-farmstead was released in 2016 and updated in 2019<sup>31</sup>, while in 2018 the planimetric scheme was presented<sup>32</sup>. In addition, the building techniques were studied and a preliminary archaeological interpretation of the several structures was provided<sup>33</sup>. The building complex is now entirely submerged, occupies an area of ca. m<sup>2</sup> 1300 and can be distinguished in three sections, from the NW to the SE (Fig. 4):

(a) The NW parallelogram section, measuring ca. m 32x14 (ca. m<sup>2</sup> 450), is divided into two separate rooms: The eastern storage room - warehouse (*πιθεών*) with twenty preserved large pithoi (*dolia*) of varying size, arranged in four parallel rows and fixed in the floor (Fig. 5E). These were probably used for wine storage (*cella vinaria*)<sup>34</sup>. On the north side, there are three sizeable rooms, the southeastern of which is divided into two smaller ones. The whole section projects outwards from the exterior outline of the building and appears to post-date the main building, as it partly covers the underlying previous masonry, still visible. The western room is divided into eight small successive parallelogram rooms and on its SW side ends in an apse seemingly belonging to an earlier construction phase; the western room and the *dolia* storage room were probably built later<sup>35</sup>. On the outside SE side, a pavement made of *opus figlinum*<sup>36</sup>, occupying an area of ca. m<sup>2</sup> 10 is very well-preserved. It is made of ceramic tiles, mainly uniform in size, set with uniform orientation in a layer of mortar (one or more preparatory layers supporting the ceramic elements). Its use is probably associated with wine production or it may have served for the drying of goods.

(b) Attached building masonry immediately to the east, occupying an area of ca. m<sup>2</sup> 125, is divided into two parallelogram rooms and connects the NW section of the complex with the SE section.

(c) In the largest SE section of the villa, measuring ca. m 35x18 (ca. m<sup>2</sup> 630), there are two large main rooms in its central and southern parts and five smaller parallelogram rooms peripherally placed. On the north side of the southern room, there are two smaller rooms, the eastern one of which is paved with a *bessales* floor that might belong to a *hypocaustum*<sup>37</sup>. In the central part of this section, there are three basins (Fig. 5A), the southernmost of which is paved with *opus spicatum* and is probably connected with a well, where a fragment of an oil lamp of the middle 3<sup>rd</sup> c AD and pottery ware dated back to the middle Imperial period were found<sup>38</sup>. This part of the construction may have served as a *lenos* and *hypolenion* for wine production, typical of farmsteads of the Late Roman period<sup>39</sup> (Fig. 5D). After all, the Homeric designation *αμπελόεις* of the Epidauros region denotes the viticultural economic activity of the area over time<sup>40</sup>. However, archaeological findings related to fishing/fish processing in the area (e.g. weights for fishing nets) indicate that the residents of the villa would also exploit the marine wealth of the bay. Three smaller spaces, ca. m<sup>2</sup> 100 in area, have been attached to the east side of the NE section, projecting outwards from the exterior outline of the building, and which may have served as auxiliary rooms. Their toothed oblique layout was probably related to the passage of an access road on the seaward side of the villa.

The sections (a), (b) and the central part of the visible section (c) of the villa (Fig. 4) most likely constituted the production-service area, while the residential-private area is assumed to be located at the eastern and southern part of section (c), where the probable *hypocaustum* is, extending SE towards the sea<sup>41</sup>. The walls of the villa, partly preserved up to a height of m 1, are made of stones, ashlar blocks, bricks, tiles and

<sup>31</sup> KOLAITI-MOURTZAS 2016; ΚΟΛΑΪΤΗ 2019, 282-283.

<sup>32</sup> DAVIDDE *et alii* 2019, 546.

<sup>33</sup> *Ibid.*, 552-554.

<sup>34</sup> *Ibid.*, 548 see also the description of the *dolia* given there.

<sup>35</sup> KRITZAS 1972, 193; DAVIDDE *et alii* 2019, 550.

<sup>36</sup> *Ibid.*, 548.

<sup>37</sup> *Ibid.*, 547.

<sup>38</sup> *Ibid.*, 548.

<sup>39</sup> ΚΟΛΑΪΤΗ 2019, 274; DAVIDDE *et alii* 2019, 550.

<sup>40</sup> ΠΡΟΣΚΥΝΗΤΟΠΟΥΛΟΥ 2011, 274.

<sup>41</sup> DAVIDDE *et alii* 2019, 547-548.

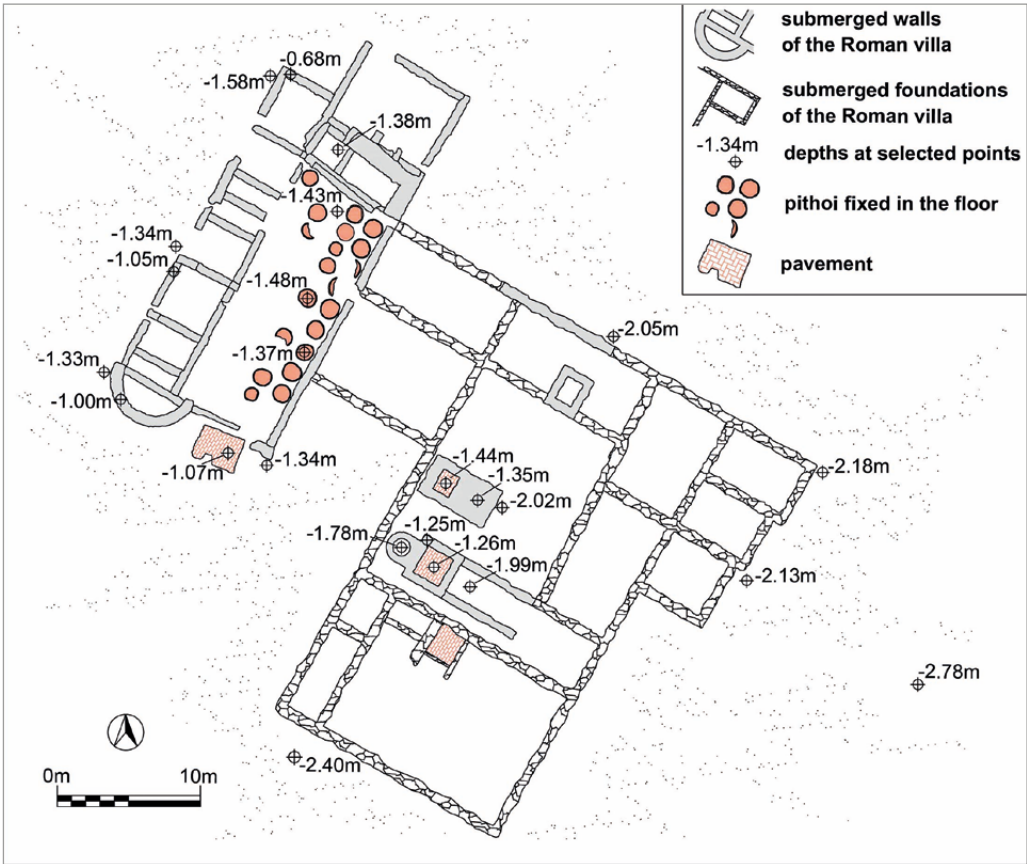


Fig. 4. Schematic plan of the submerged villa-farmstead (2019; el. A. © Eleni Kolaiti).

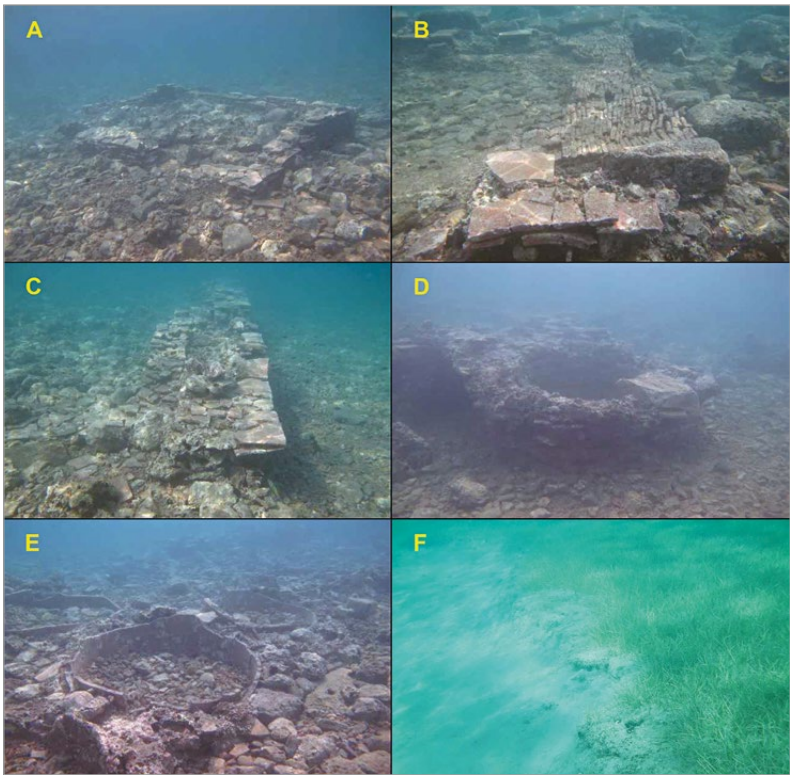


Fig. 5. Underwater views of the villa-farmstead. A) built basin. B, C: masonry of rooms. D) well (probably *hypoleion* used for wine production). E) one of the pithoi (*dolia*) fixed in the floor of the storage room (*πιθεών*). F: the underwater sandy platform and the top of the underwater slope in front of the villa towards the open sea (the outline of the underwater slope is shown on Fig. 6) (photos A. © Eleni Kolaiti).

mortar, following various construction techniques<sup>42</sup> (Figs. 5B, 5C). The building foundations consist of large rectangular stone blocks.

The external pavement is today at m 1.07 bmsl, the floor of the storage room (πιθῳν) at m 1.48 bmsl and the foundations on the north side of the NW section at m 1.58 bmsl. The floor in the central part of the SE section is at m 2.02 bmsl, whereas the top of the visible foundations on its NE and SW sides is at m 2.18 and m 2.40 bmsl, respectively (Fig. 4). Taking into consideration a further depth of at least m 0.50 for a block below the visible top of the foundation at the sea bottom, and assuming that construction was carried out on land or in dry conditions, we conclude that the level of foundation should have been at least m 3 bmsl.

### 2.3 Geomorphological indicators

#### *South bay of the Nissi Peninsula*

All along the limestone cliff of the south bay of the Nissi Peninsula, in the northernmost part of Agios Vlassis Bay, a well-formed tidal notch was cut, with typical traces left by bioeroding organisms (Figs. 2, 3F). A “mushroom-type” notch is also observed on the rocky reefs offshore (Fig. 3E). The base of the tidal notch is at m 1.20 bmsl, with an average opening of m 0.65 and an average inward depth m 0.45 (Fig. 2). In the same area, and at a distance of m 50 from the submerged ancient relics towards the open sea, some sizeable beachrock slabs develop for a length of m 20 along the sandy sea bottom. These are well-preserved *in situ*, with their seaward base at m 2.40 bmsl (Fig. 2). The gentle morphology of the sea bottom is interrupted by an underwater slope dipping 15° SE. It can be observed throughout the northern and western coastal area of the bay, m 25 and m 110 offshore, respectively. The average depth of the top of the underwater slope is m 3.20 bmsl, while the depth of the sea bottom at the slope toe ranges between m 6.50 and m 11 bmsl (Fig. 2). The sloping morphology is interrupted at a depth of m 4.50 bmsl. Consequently, the palaeoshoreline would have been between m 3.20 and m 4.50, at a mean depth of m  $3.85 \pm 0.65$  bmsl (Fig. 2).

#### *Gliati coast*

The ancient villa-farmstead is located at the south margin of an underwater sandy platform that extends towards the east for at most m 250 offshore from the contemporary coastline of Agios Vlassis Bay (Fig. 6). The platform narrows at the villa's location and at a maximum m 150 offshore is interrupted by an underwater slope, which surrounds the eastern and southern seaward sides of the farmstead (Figs. 5F, 6). The depth of the top of the underwater slope varies between m 2.40 and 2.90 bmsl, while the depth of the sea bottom at the slope toe ranges from m 4.80 to 5.55 bmsl. The sloping morphology is interrupted between m 2.80 and 3.45 bmsl. Therefore, the palaeoshoreline is estimated to have been between m 2.80 and 4.80 bmsl, at a mean depth of m  $3.80 \pm 1.00$  bmsl (Fig. 6).

## 3. DISCUSSION

To determine the sea level stand when an ancient coastal construction was in use is a challenging problem, which presupposes the recording and interpretation of all available archeological and geomorphological evidence in the study area and requires reassessment, along with relevant data from the wider geotectonic area. From the study of the aerial images of 1972, it was deduced that there was a sea level rise since Roman times of roughly m 3 to 4, as a result of an abrupt subsidence of the area, proof of which were the pithoi found *in situ*<sup>43</sup>. The interpretation of the depth of a gutter channel lined with tiles in the north bay of the Nissi Peninsula found at m -2.50, which should be above the then sea level, in combination with the depth of the ashlar walls in the south bay of the peninsula at m -2.0, which had been considered as dockside structures rather than the monumental building, erroneously led to the estimation of a probable m 2.70 submergence in the area<sup>44</sup>.

The depths of the top and toe of the underwater slope clearly represent the upper and lower limit of a former sea level at m  $3.70 \pm 0.10$  bmsl, when the various ancient coastal structures were in use (Figs. 2, 6).

<sup>42</sup> Regarding the building techniques, see description in DAVIDDE *et alii* 2019, 552-554, mainly *opus incertum*, *opus mixtum* and *opus testaceum*.

<sup>43</sup> KPITZAE 1972, 195.

<sup>44</sup> FLEMING *et alii* 1973, 5.

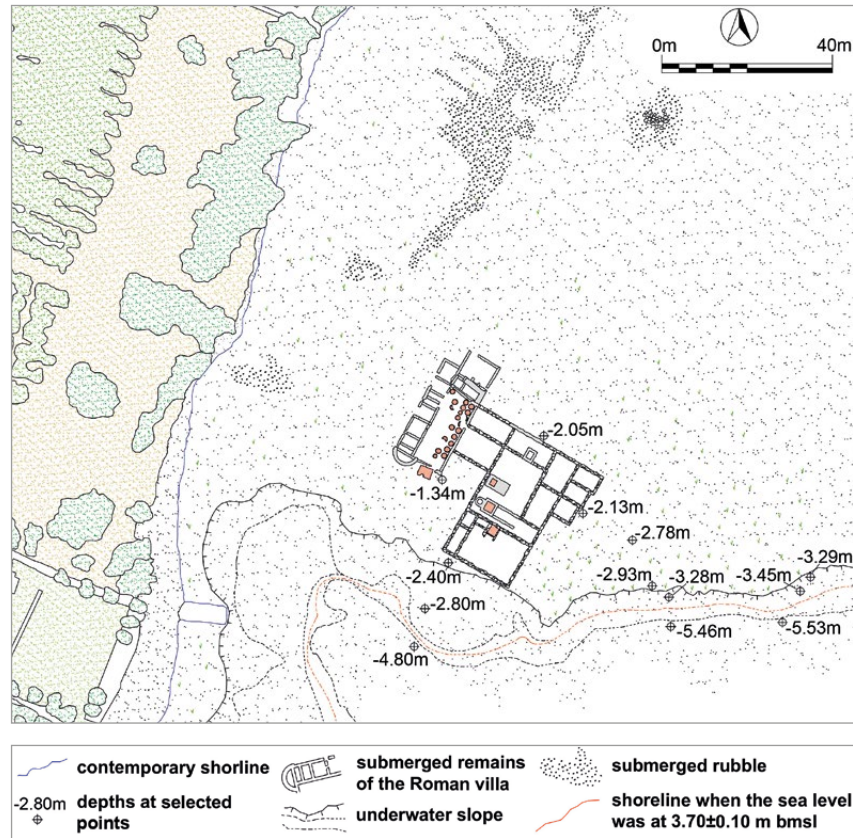


Fig. 6. Schematic representation of the coastal area surrounding the villa-farmstead. The outline of the underwater slope that indicates the palaeoshoreline when the villa was in use and the submerged building remains and rubble (ερείπια) to the north of the villa are shown (2019; el. A. © Eleni Kolaiti).

The inferred mean sea levels at m 3.85 bmsl for the northernmost part of Agios Vlassis Bay and m 3.80 bmsl for the southern part of the bay where the villa-farmstead is located, despite the relatively large uncertainties (m  $\pm 0.65$  and m  $\pm 1.0$ , respectively), fall within the range of the Roman/Late Roman sea level stand at m  $3.70 \pm 0.10$  bmsl determined for the north bay of the Nissi Peninsula, based on robust archaeological sea level indicators: in particular the functional elevations of the north breakwater and the south jetty of the Roman harbour of ancient Epidaurus during the period in which it was in use<sup>45</sup>. This is the critical correlation that limits the uncertainty. With a mean sea level m 0.50 to 0.90 lower than the top of the underwater slopes in both locations, the buildings near the then shore could have been protected against the waves. It should be noted that there is an obvious parallel between the then coastal landscape and that of the present day, as the contemporary coastal plain abruptly ends in the shoreline forming a coastal slope m 1 high. The determined foundation level of the villa (>3 m) is also within the mean sea level determined for the area of Epidaurus. This sea level stand was the functional level during the period that the Roman/Late Roman constructions found in Agios Vlassis Bay were in use and according to historical evidence and archaeological findings would appear to have lasted at least until the 4<sup>th</sup> c. AD or even later to the 6<sup>th</sup> c. AD.

The sea level of m  $3.70 \pm 0.10$  bmsl has been identified in the entire western Saronic Gulf and Argolis Peninsula: Classical and Roman harbour installations of ancient Aegina, the Roman harbour of ancient Epidaurus, the Roman/Late Roman villas in Psifta, Phourkari, Dardiza, and Thalassopetra, and the Late Roman to Byzantine buildings in Palaiokastro (Methana). It ranges within the chronology of the Archaic period (700 BC, 2700 yr before present) to Late Roman times (4<sup>th</sup> c. AD, 1600 yr before present or 6<sup>th</sup> c. AD, 1400 yr before present), indicating a period of rsl stability of at least 1000 or 1200 years<sup>46</sup>.

<sup>45</sup> KOLAITI-MOURTZAS 2016; KOLAITI 2019, 257-271.

2019, 606-628.

<sup>46</sup> MOURTZAS-KOLAITI 2013; KOLAITI-MOURTZAS 2016; KOLAITI

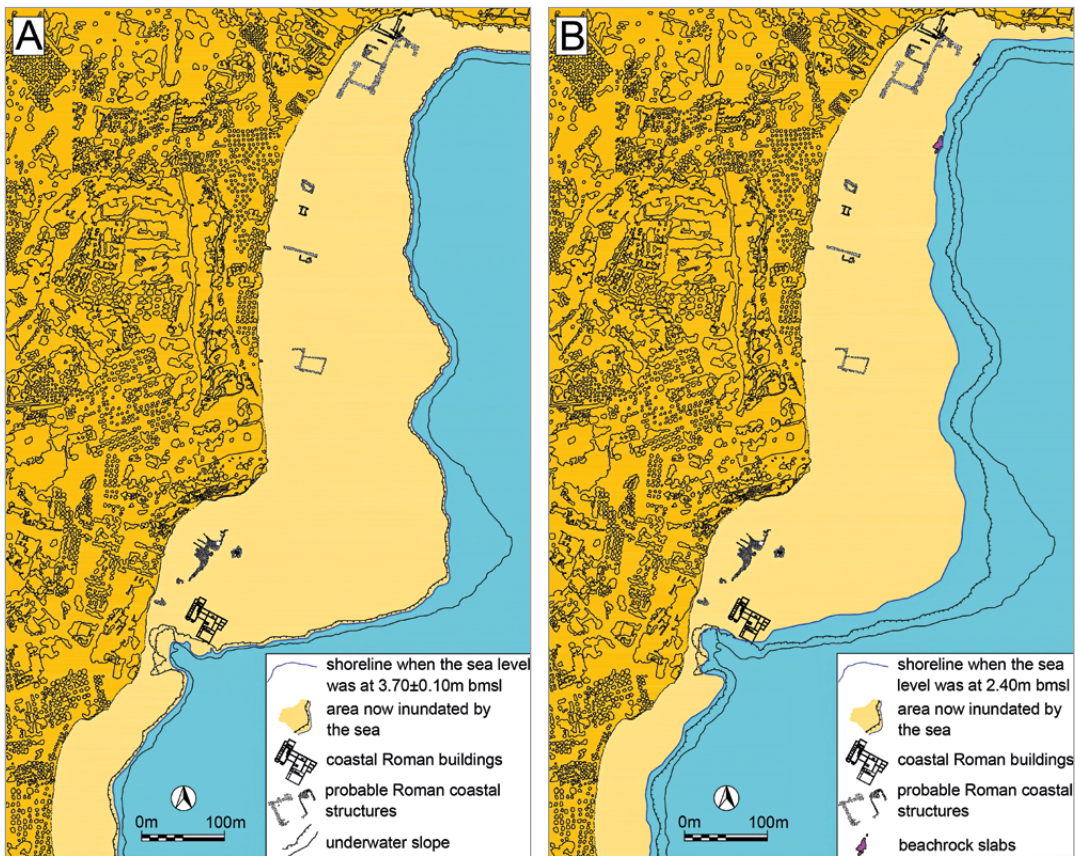


Fig. 7. Palaeogeographic shoreline reconstruction of Agios Vlassis Bay during Roman/Late Roman times, when the sea level was at m  $3.70 \pm 0.10$  bmsl (A) and at m 2.40 bmsl (B) (2019; el. A. © Eleni Kolaiti).

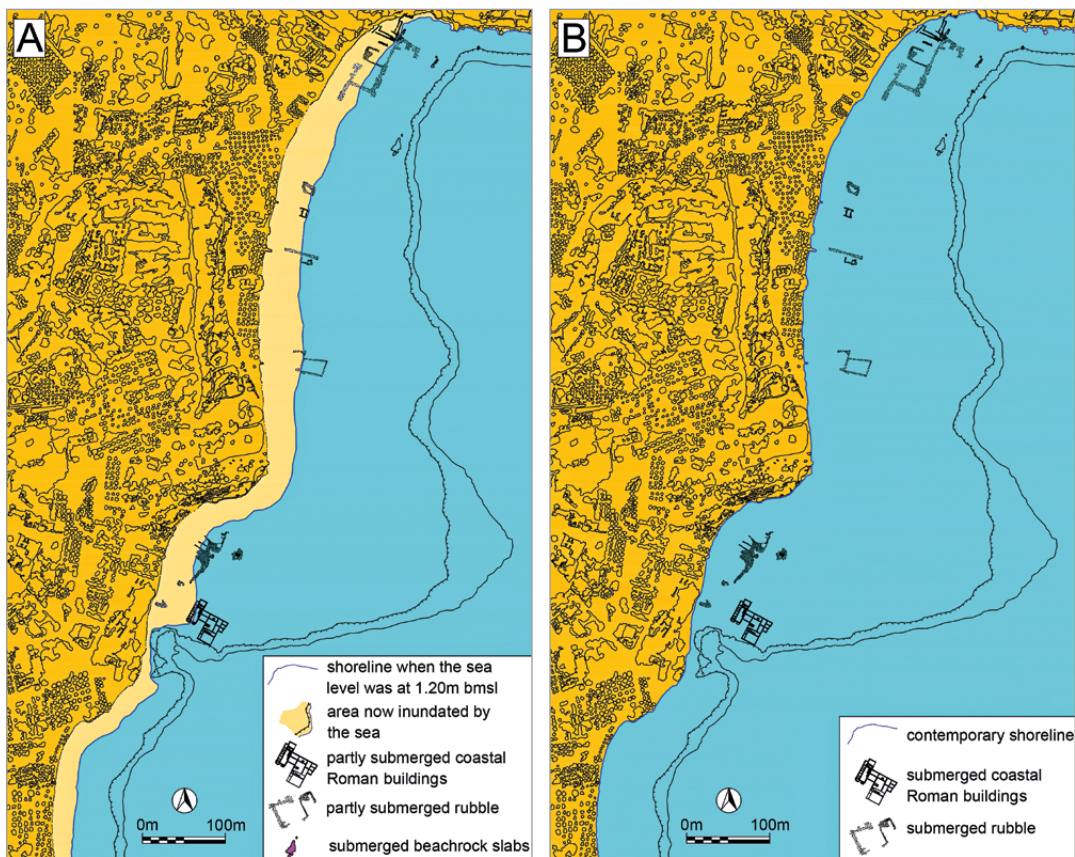


Fig. 8. Palaeogeographic shoreline reconstruction of Agios Vlassis Bay during Roman/Late Roman times, when the sea level was at m 1.20 bmsl (A) and today (B) (2019; el. A. © Eleni Kolaiti).

Evidence of a second sea level stand at m 2.40 bmsl provides the beachrock formation observed in the northernmost part of Agios Vlassis Bay. Geomorphological indications of this sea level have been recorded in the western Saronic Gulf and Argolis Peninsula, e.g.: Aegina Island, Soupia Bay, Plaka-Lazaretto, Mpouka, Doroufi and Drepano. It is dated back to between the 13<sup>th</sup> c. AD (800-700 yr before present) and precedes the First Venetian occupation (14<sup>th</sup> c. AD) based on the harbour installations at Agios Athanasios in Soupia Bay<sup>47</sup>.

A younger sea level stand at m 1.20 bmsl is identified in Agios Vlassis Bay by the submerged tidal notch incised on the Nissi Peninsula. It matches the m  $1.45 \pm 0.25$  sea level stand, which is well-determined by tidal notches and beachrock formations found at the same depth throughout the coast of the entire Saronic Gulf and Argolis Peninsula (from Kakia Skala and Aegina Island to Drepano). Based on relevant archaeological evidence found in Aegina Island, Palaiokastros (Methana) and Mpourtzi (Nafplio), it dates to the First Venetian occupation - First phase of Ottoman domination in 1389 (600 yr before present) and it seems to have lasted until about 1840 (160 yr before present), thus defining a period of rsl stability of at least 450 years<sup>48</sup>.

#### 4. CHANGES IN THE COASTAL ANTHROPOGENIC LANDSCAPE

During Roman/Late Roman times, the sea level was at m  $3.70 \pm 0.10$  bmsl (Fig. 7A). The sandy-gravelly coast of Agios Vlassis Bay was significantly wider than at present, by at least m 35 to 120 in the northern part of the bay, further increasing towards the south and reaching some m 350 before the villa. The seaward sides of the coastal villa were surrounded by land, about m 35 wide on the eastern part to m 20 on the southern part, where a small cove was probably formed, enabling mooring. After the villa to the south, the coast would have been some m 75 wider than at present. The various structures located at the south side of the Nissi Peninsula, and the scattered buildings all along the coast of Agios Vlassis Bay, were located in the coastal plain, m 60 to 120 distant from the then shoreline. The location of the villa-farmstead near the then shoreline may have served both its functions in terms of viticulture and exploitation of the marine wealth of the bay or as a spot for storage of the goods produced there and sea transport to nearby destinations.

When the sea level was at m 2.40 bmsl (Fig. 7B), during the 13<sup>th</sup>-14<sup>th</sup> c. AD, the coastal plain in Agios Vlassis Bay was further inundated and the shoreline shifted slightly inland, the coastal constructions, still being on land, were not significantly affected, while only the southern part of the villa may have been washed by the waves.

The villa-farmstead was entirely submerged when the sea level rose to m 1.20 bmsl and the coast retreated by even more than m 100 in parts (Fig. 8A). The coastal installations all along the bay of Agios Vlassis were fully or partly covered by the sea. After the 14<sup>th</sup> c. AD, the once prosperous villa-farmstead was no longer a landmark in the coastal environment and local society. It remained drowned by the sea for centuries, until the geoarchaeological and archaeological survey brought it back to light (Fig. 8B).

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<sup>47</sup> ΚΟΛΑΪΤΗ 2019, 606-628.

<sup>48</sup> *Ibid.*

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