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THE SUBMERGED “VILLA OF THE DOLIA” NEAR ANCIENT EPIDAUROS. THE PRELIMINARY RESULTS OF THE FIRST EXCAVATION AND CONSERVATION CAMPAIGN

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with contributions of Angelos Tsompanidis, Roberto Petriaggi, Riccardo Mancinelli,
Carlotta Sacco Perasso, Sandra Ricci, Helen-Margarita Bardas*

Riassunto. In questo articolo si propone una sintesi dei risultati preliminari della prima campagna di scavo e conservazione subacquea condotta nel luglio 2018 poco a largo dell'antica Epidaurus sulla cd. Villa dei dolia. Questo complesso di età romana si estende per ca. 1600 m² sotto il livello del mare ed è caratterizzato dalla presenza di numerosi ambienti per lo più connessi con l'attività agricola e la lavorazione dei prodotti della terra, fra cui un magazzino del quale si conservano ancora *in situ* venti dolia. La ricerca è stata finanziata dal progetto BLUEMED, *Plan/test/coordinate Underwater Museums, Diving Parks and Knowledge Awareness Centres in order to support sustainable and responsible tourism development and promote Blue growth in coastal areas and islands of the Mediterranean* (progetto N. 703), e si è svolta nell'ambito di un accordo di collaborazione firmato tra l'Ephorate of Underwater Antiquities, l'Istituto Superiore per la Conservazione ed il Restauro di Roma e la Scuola Archeologica Italiana di Atene.

Περίληψη. Σε αυτό το άρθρο προτείνεται μια περίληψη των προκαταρκτικών αποτελεσμάτων της πρώτης υποθαλάσσιας ανασκαφικής εκστρατείας και των εργασιών συντήρησης που έλαβαν χώρα τον Ιούλιο του 2018 στα ανοιχτά της Παλαιάς Επιδαύρου στην επονομαζόμενη Έπαυλη με πίθους (*dolia*). Το συγκεκριμένο συγκρότημα ρωμαϊκών χρόνων εξαπλώνεται για περίπου 1600 τετραγωνικά μέτρα κάτω από τη στάθμη της θάλασσας, ενώ χαρακτηρίζεται από την παρουσία πολυάριθμων χώρων, οι οποίοι μάλλον συσχετίζονται με αγροτικές δραστηριότητες και την επεξεργασία γεωργικών προϊόντων, μεταξύ των οποίων ένας αποθηκευτικός χώρος όπου σώζονται ακόμα *in situ* είκοσι πίθοι (*dolia*). Η έρευνα χρηματοδοτήθηκε από το σχέδιο BLUEMED, *Plan/test/coordinate Underwater Museums, Diving Parks and Knowledge Awareness Centres in order to support sustainable and responsible tourism development and promote Blue growth in coastal areas and islands of the Mediterranean* (progetto No. 703), και πραγματοποιήθηκε στο πλαίσιο της συμφωνίας συνεργασίας που υπογράφηκε από την Εφορία Εναλίων Αρχαιοτήτων, το Istituto Superiore per la Conservazione ed il Restauro της Ρώμης καθώς και την Ιταλική Αρχαιολογική Σχολή Αθηνών.

Abstract. This paper proposes a summary of the preliminary results of the first underwater excavation and conservation campaign conducted in July 2018 off the coast of ancient Epidaurus on the so called Villa of the dolia. This complex of Roman age extends for about 1600 square meters below sea level and it is characterized by the presence of several rooms mostly connected with the processing of the agriculture products, including a warehouse with twenty dolia still preserved *in situ*. The research is funded by the BLUEMED project *Underwater Museums Plan / Test / Coordinates, Diving Parks and Knowledge Awareness Centres in order to support sustainable tourism and promote sustainable growth and promote coastal areas* (project N. 703), and took place as part of a Collaboration Agreement signed between the Ephorate of Underwater Antiquities, the Istituto Superiore per la Conservazione ed il Restauro of Rome and the Italian Archaeological School at Athens.

1. PROJECT PRESENTATION

In July 2017 a Collaboration Agreement for an educational programme entitled *In situ conservation of underwater archaeological sites: methods and case studies* was signed between the Ephorate of Underwater Antiquities (EEA) and the Istituto Superiore per la Conservazione ed il Restauro (ISCR)¹. As pilot site to host the training programme, the ancient Villa submerged off the coast of Ancient Epidaurus was selected. At the end of the training programme, a systematic study of the marine area of Ancient Epidaurus

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Heritage and Tourism; S. Ricci, Biologist of the the Italian Ministry of Cultural Heritage and Tourism; Helen-Margarita Bardas, underwater restorer of the Hellenic Ministry of Culture and Sports, Greece.

¹ The director of the pilot educational program was on the Greek part the EAA through its former Director Dr. A. Simosi, the supervisor on the site being Dr. P. Galiatsatou, while on the Italian part the activities were coordinated by Diving Archaeologist Dr. B. Davidde Petriaggi, Director of Nucleo per gli Interventi di Archeologia Subacquea of ISCR.

was performed by both institutions, together with the underwater excavation and restoration of selected sectors of the Villa. The project became part of an agreement between the ISCR, the IASA (Italian School of Archaeology at Athens) and the EEA and the activities in the field started in July 2018².

The objectives of the 2018 campaigns were to:

- 1) document the site through photographic and video documentation, photogrammetric 3D recording, drone survey and differential GPS RTK documentation;
- 2) study the archaeological remains, with particular attention to the building techniques;
- 3) carry out underwater excavation in three areas (the room No. 28 paved with a *bessales* floor; the recent fill levels of the well No. 23 that will be continue in the 2019 campaign, and a trench in the rooms Nos. 21-18, in the SE of the complex;
- 4) to study and to document the state of conservation of the site;
- 5) study the biological degradation of the structures to characterize the bioerosion phenomena;
- 6) restore the room of the *dolia*;
- 7) protect selected area with geotextile at the end of the campaign.

B.D.P.

2. LOCALIZATION OF THE SITE AND HISTORY OF STUDIES

The archaeological site of Epidaurus, in the Peloponnese, is mainly known for the Asclepius Sanctuary and the Theatre. The ancient city of Epidaurus developed next to the unique natural harbor of the eastern coast of the Argolid peninsula to the Saronic Gulf³; its ancient piers (northern and southern) are now visible underwater (Fig. 1). Architectural remains of the ancient city have been preserved in the Agios Vlassios bay (on the S of “Nisi” peninsula), in the area which is referred to as the “Sunken City” by the locals. The city started sinking around 400 AD, after a period of relative stability that lasted 2.200 years. The most important buildings that have been preserved in the “Sunken City” date to the Roman period, during which Argolis, after the destruction of Corinth in 146 B.C., was included in *Provincia Achaia*. At those times, great building programs were completed in the Argolis as the community of «craftsmen around Dionysus from Isthmus and Nemea» became quite popular, elevating the Roman Empire⁴. Owing to the glory of Asclepius’ sanctuary as well as Hadrian’s visit in 124/5 AD, Epidaurus expanded from its classical core and bloomed once again in the Roman times.

The ancient buildings of the villa today lie at a depth of approximately two meters, due to changes in the sea level in this region. Along the Peloponnesian coast, in the Saronic Gulf and the coasts of Aegina and Poros, the geomorphologic features of underwater coastlines are closely related to the presence of sunken settlements. The initial change of the sea level took place certainly after 400 (±100) A.D⁵.

P.G.

3. THE SUBMERGED “VILLA OF THE DOLIA”: DESCRIPTION OF THE COMPLEX

The sunken architectural remains of the Villa, situated at the southern area of an extended undersea sandy terrace, are visible today at a depth about -1.00/-2.00 m, and stretch to an area of around 1600

² The project is funded in the frame of the activities conducted by ISCR in the BLUEMED project under the direction of B. Davidde. The BlueMed project *Plan/test/Coordinate Underwater Museums, diving parks and knowledge awareness centers in order to support sustainable and responsible tourism development and promote blue growth in coastal areas and island of the Mediterranean* (Ref. 703), is promoted by the European Union under the transnational cooperation programme INTERREG MED Programme 2014-2020. The underwater works in Ancient Epidaurus are conducted under the scientific direction of Panagiota Galiatsatou for EEA and Barbara Davidde for ISCR. In addition to the authors of this article, took

part to the 2018 campaign for ISCR the conservation Scientist Marco Ciabattoni and the safety responsible R. D’Urso; the underwater archaeologists and ISCR project collaborators: K. Schistocheili (technical support, underwater excavation; support for the logistic) and M. Secci (video, photographic documentation and photogrammetric 3D recording), and finally the volunteer E. Radioti, A. Mpei and G. Di Stefano.

³ ΛΑΜΠΡΙΝΟΥΔΑΚΗΣ-ΚΑΤΑΚΗΣ 2012.

⁴ ΜΠΑΝΑΚΑ 2012, 144.

⁵ On the sea level changes in the West Saronic Gulf see MOURTZAS-KOLAITI 2013; KOLAITI-MOURTZAS 2016.

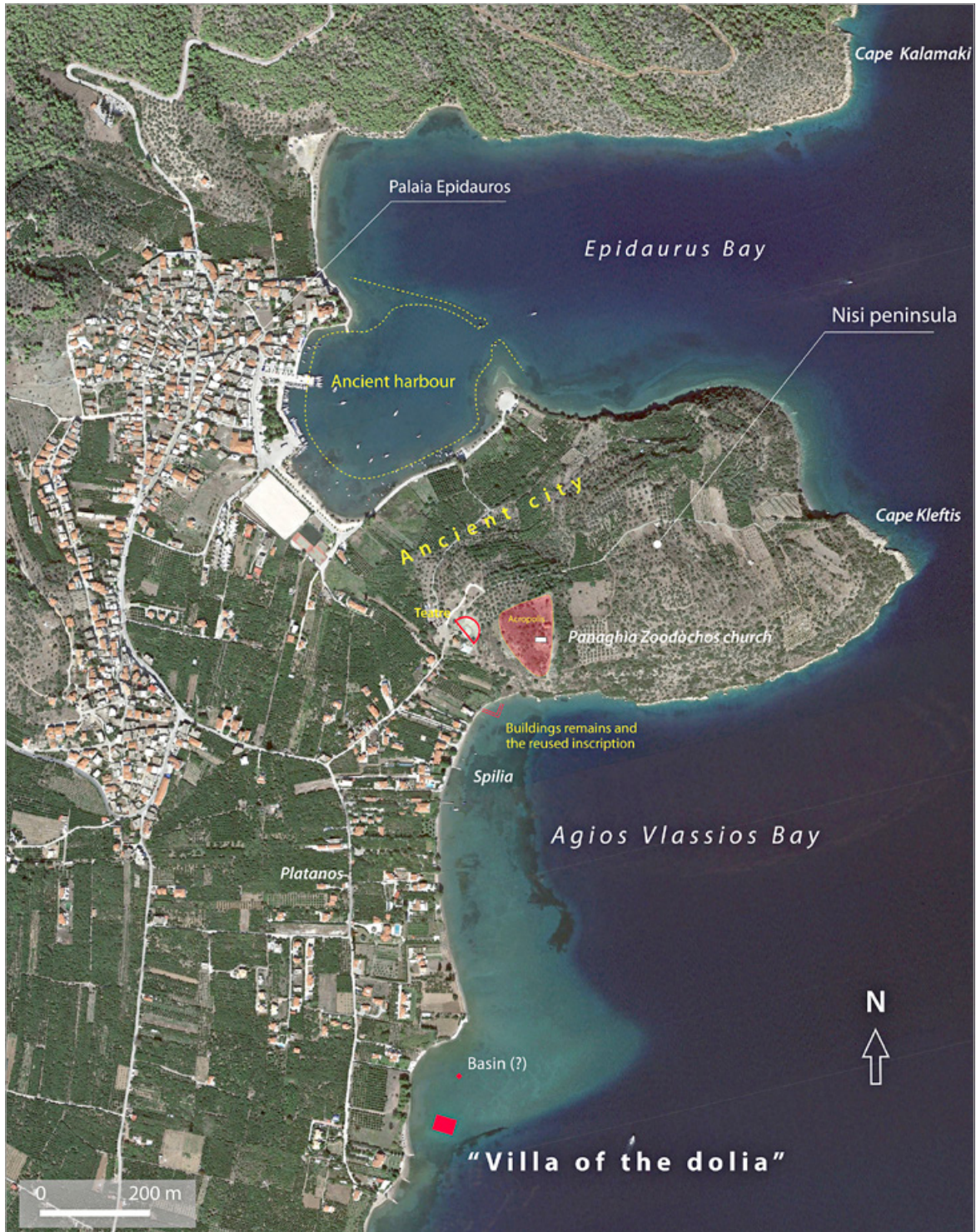


Fig. 1. Location of the villa and the Ancient Epidauros on zenithal aerial (photo ©ISCR).

square meters, at a distance of ca. 45 m from the shore, not far from a now drained small river; its axis runs along NW-SE, its greatest length being 40 m⁶. Until now, no archaeological excavation has been conducted, and after the first archaeological observations conducted by the archaeologist Ch. Kritzas⁷, the site was only studied and cited by geomorphologists interested in the study of the sea level changes⁸. The Villa is

⁶ LAMBECK, 1995; MOURTZAS-KOLAITI 2013.

⁷ ΠΑΠΑΧΑΤΖΗΣ 2004, 217-218, 220.

⁸ KOLAITI-MOURTZAS 2016.



Fig. 2. Drone oblique photo with the submerged remains of the villa and part of the current coastline (photo ©ISCR).

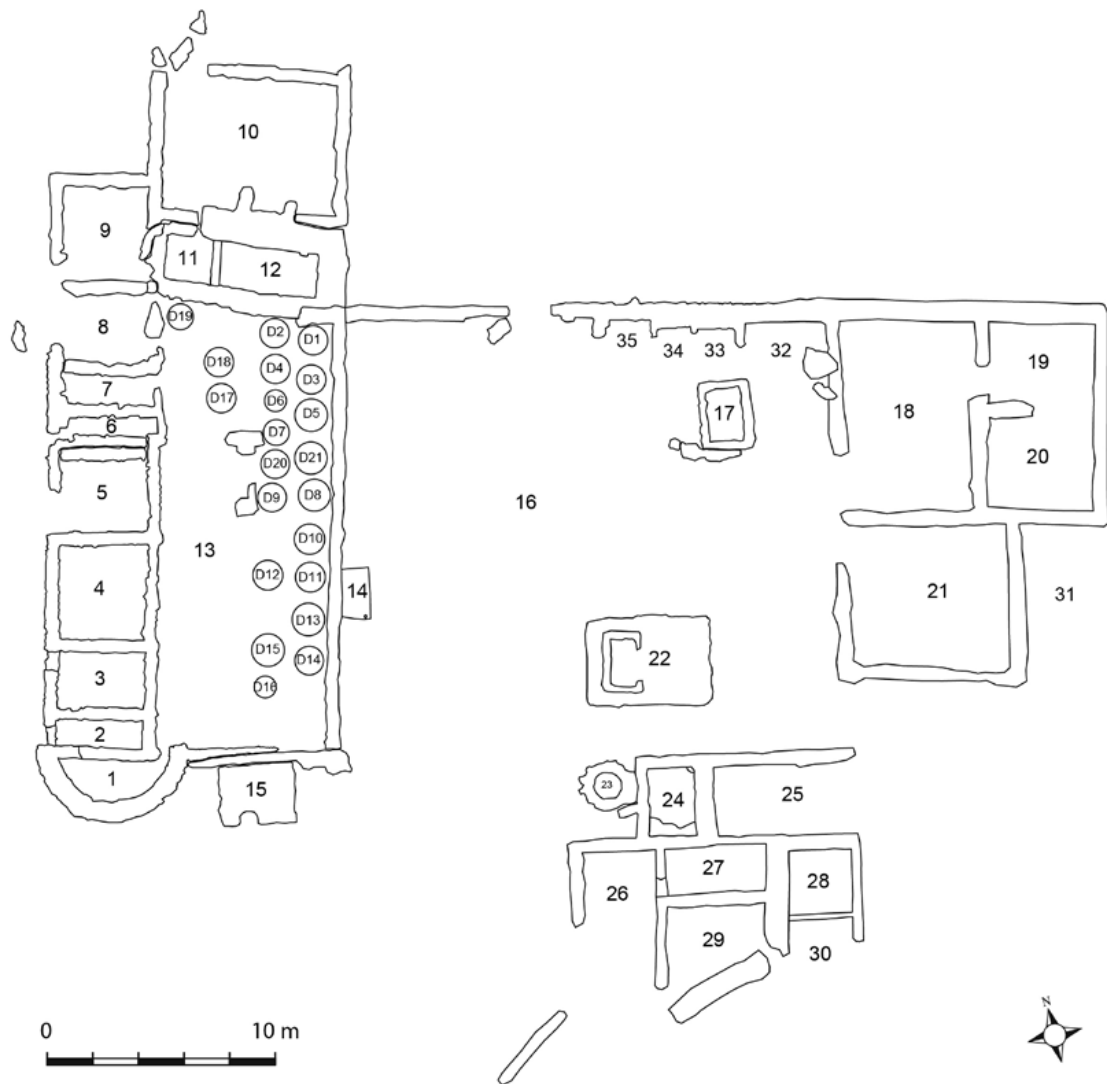


Fig. 3. Preliminary planimetric scheme of the complex (2018; el. M. Secci ©ISCR).



Fig. 4. Room No. 28 paved with *bessales* (photo ©ISCR).

well visible from above, thanks to the shallow water, and tourists can see their architectonic structures while snorkeling, without the need of scuba diving equipment (Fig. 2).

A first aerial photographing of the area that took place in the 1970s along with a first description and identification of the underwater architectural remains, indicated that the visible structures on the site were the remains of an extensive Roman villa⁹.

The surveys carried out in 2017 by ISCR and EEA have documented that the state of conservation of the archaeological remains was at risk of consistent damages, due to the long-term visiting of the area by swimmers and to the wave motion. Subsequent to this assessment, a major program of excavation and conservation was launched by ISCR, EEA and IASA, with the aim to investigate the origins of the Villa and its diachronic occupation, the relationship between it and its coastal landscape, and to preserve *in situ* this underwater archaeological monument. The presence of some *dolia* reveals the prevailing rural character of the complex (*Villa rustica*), that is why it has been decided to name it as the “Villa of the *dolia*”. After the 2018 campaign it was possible to identify 33 rooms/open spaces built with several different construction techniques (see *infra*, S. Medaglia, following), but remains of additional rooms are clearly visible under the pebbles and the small and medium sized stones (both worked and unprocessed) that are scattered on the sea bed, completely covering the archaeological remains (Fig. 3). The complex, on the basis of the currently observable evidence (2018), consists of three main bodies whose fulcrum is a courtyard, where the well No. 23 is present. The NW one consists of a large warehouse which is flanked by an array of small rooms; the second and third, positioned in the E area and in the deepest part towards the high sea, is composed of a series of large rooms reserved for the residential sector and for the services. The main archaeological structures now visible seem to belong to the productive sector of the Villa, while we suppose that the structures of the private sector had to be located in the SE area, even if at present we cannot define their extension and articulation (2018 campaign); here there is a room paved with a *bessales* floor (Fig. 4), probably belonging to an *hypocaustum*¹⁰.

⁹ ΚΡΙΤΖΑΣ 1972, 186-199; ΛΑΜΠΡΙΝΟΥΔΑΚΗΣ-ΚΑΤΑΚΗΣ 2012, 189-193: for a description of antiquities in the area of Ancient Epidaurus in general.

¹⁰ The *bessales* measure 22'22'2.5 cm (on 22'22 cm *bessales* in peloponnesian context see VITTI 2013, 89, from Troezen); *ibid.*, 250). In this room during the underwater excavation two circular *suspensurae* were

found, not in place. While we are writing the 2019 campaign is in progress and three identical elements were found with a portion of a new floor paved with bricks of 27.5 cm. This new floor it is mostly covered by sediment and requires a stratigraphic excavation to be studied. It will be covered by geotextile Terram 2000 and sand bags to be excavated and studied in a future campaign.

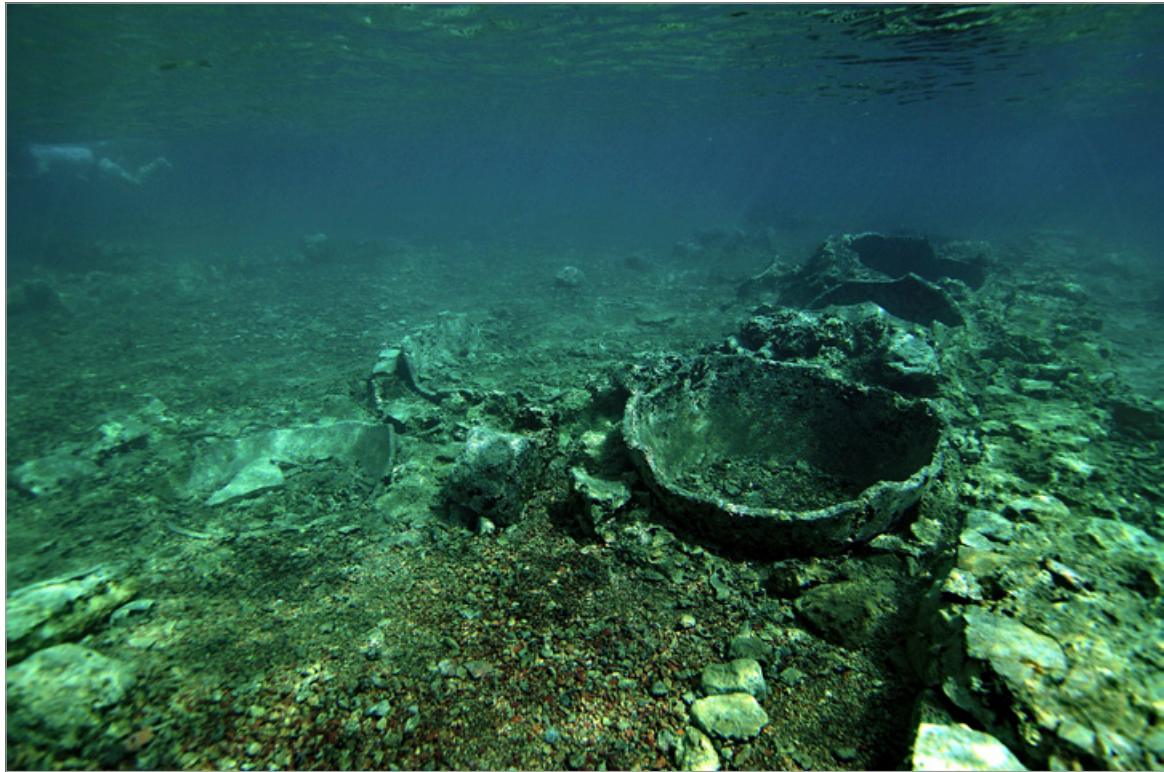


Fig. 5. The warehouse of the *dolia* (photo ©ISCR).

The central and NW areas of the Villa host the main productive sector, among which is the warehouse of the *dolia* (Fig. 5). It is characterised by the presence of four rows of twenty *dolia*¹¹ (Fig. 6) probably used for the storage of wine (*cella vinaria*)¹². The presence of lead staples occurred in antiquity in the specimens Nos. D01, D02, D03, D04 is also observed. In the eastern row, nine *dolia* are now visible, which on their exterior have been fastened on the floor with masonry walls composed by mortar, stones and pebbles; in the middle row are nine *dolia*, some of them are of smaller size; in the western row there are only two *dolia* that are not well preserved. The fourth row presents only one *dolium* preserved, positioned in the NW angle of the building. Although there are not clear evidences about the entrance of the warehouse, most probably it was located along the short S side, outside which is still visible today a floor pavement made of *opus figlinum* (Fig. 7), showing a circular hole that was housing an element now completely disappeared¹³. Regarding other rooms and areas that are part of the productive sector of the complex, at the moment we are not able to say anything more, and we can only describe their structural characteristics (see *infra*, S. Medaglia, following). Close to these spaces are some structures that can be interpreted as pools/basins (Fig. 3, Nos. 17, 22, 24; Fig. 8), and areas paved in bricks, in a similar way of the above mentioned floor in *opus figlinum* (Fig. 3, No. 15) and in *opus spicatum* (Fig. 3, Nos. 11, 24), where some activities connected with the processing of agricultural and fish products could take place (a number of millstones and grinding stones, entire or in fragments, and weights for fishing nets scattered on the bottom of the sea have been recovered).

Among these, in the courtyard, is a well from which water could be drawn for the needs of everyday life. The ceramic material recovered during the excavations, consisting of common kitchen pottery, *sigillata* ware and amphorae, is currently under study and at the moment it has been dated in a period covering the middle imperial age. In this paper we just want to present the fragment of a lip of an oil lamp nozzle type, with double spiral pattern motif (B.E.2018-10-24) dating back to the middle of third century AD¹⁴,

¹¹ KOLAITI-MOURTZAS 2016, 82 observed: «...thirteen large storage jars in two parallel rows embedded in the floor». This is a proof that in the years the strength of the sea carries out a strong action of uncovering of the archaeological remains.

¹² In the while we are writing this paper we are involved in the 2019 campaign and the discovery in the *dolium* No. 19 of remains of

vine shoot seems to confirm the content of the *dolia*, although we cannot eliminate the possibility that some of them could contain olive oil.

¹³ It cannot be excluded that the circular gap in the floor is to be related to the base of a *torcular* or another *dolium defossum*.

¹⁴ BRONEER 1930 (type XXVIII); DENEAUVE 1969 (Type 7c).



Fig. 6. Photogrammetry of the western sector of the villa with the cella vinaria (el. M. Collina, Unical; photo ©ISCR).

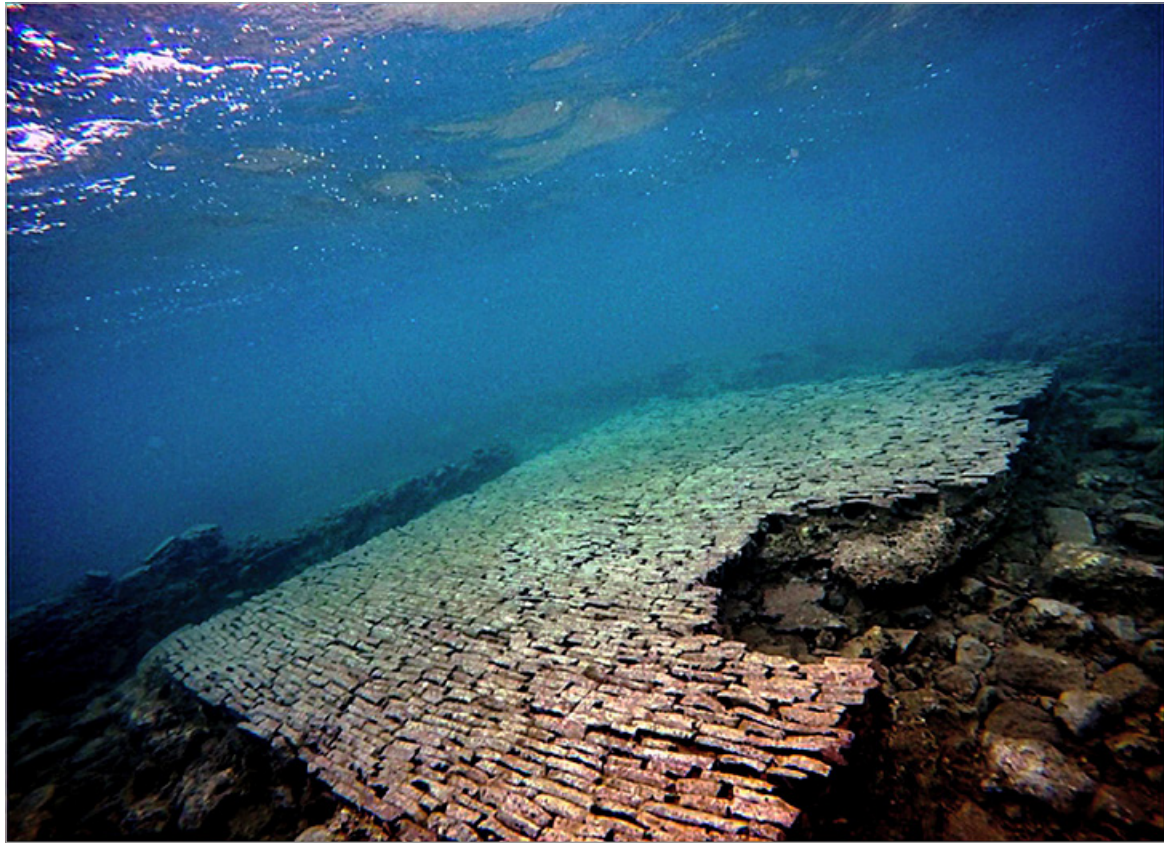


Fig. 7. The floor *opus figlinum* placed outside the short southern compartment of the *cella vinaria* (photo ©ISCR).

recovered during the stratigraphic excavation of the well (Fig. 9). Closely observing a floor near this so-called well, it seems that similar floors, constructed with bricks laid in a mortar layer (*opus figlinum*) are commonplace in country houses of Roman times in the Hellenic area and they are quite widespread in buildings which have been identified as *lenoi* (wine presses), due to their nonslip nature¹⁵; on the other hand, the co-existence of a rectangular area with this circular construction, the presence of pipes and the agricultural character of the complex, could be an indication for the use of this area as a *lenos*¹⁶ and in this case the circular structure could be regarded as a receptacle (*hypolenion*). Such structures are widespread in country houses of the Late Roman period¹⁷. Moreover, to the S of the “well” there is a floor paved with rectangular clay tiles, which supports the identification with a *lenos*, as such floors were used for the waterproofing of *lenoi* in country houses of the Hellenic region¹⁸. A future excavation of the area might contribute to a safer identification, which still remains fully hypothetical. Our “well” or hypolenion can be compared with a find discovered in Arcadia region¹⁹. Specifically, this well, dated in Late Roman age (3rd-4th century AD), was discovered in Manari (Assea, Tripoli) during the excavation of a country villa for wine production²⁰.

After the first analysis of the surviving structures of the Villa, these do not seem to belong, as it can be imagined, to a single construction phase. For example, the remains of an apsidal room (Fig. 3 n. 1) seem to be occupied by a series of small rooms (Fig. 3, Nos. 2-11) and by the *dolia* warehouse (Fig. 3 n. 13) and seem to suggest an earlier phase. Only future excavation campaigns will be able to fully answer these questions.

I want to close this paragraph by reporting the discovery, around 80 meters away from the Villa in the NNE direction, of a very fragmented and currently isolated architectural structure, consisting of a

¹⁵ Cf. a wine press in Ancient Akraiphia of Boiotia, which had a long period of use, from the 1st century B.C. to the 4th century AD: ΒΛΑΧΟΓΙΑΝΝΗ 2013, 491-492, figs. 6, 8, fn. 14, where further bibliography on similar floors of Boiotia. In the 3rd century AD, a tank on its NE corner was constructed: *ibid.*, 505. A similar floor also exists in a wine press of a farm house in Elaiostasi of Naupaktos, whose movable finds date to the 2nd-3rd century AD: ΣΑΡΑΝΤΗ-ΣΤΑΪΚΟΥ 2013, 724-725, fig. 1.

¹⁶ ΠΕΤΡΟΠΟΥΛΟΣ 2001, 37-51, tabs. 7-24; 2005, 33-45, tabs. 7-20;

ΜΗΤΣΟΠΟΥΛΟΥ-ΛΕΟΝ 2007, 39-50.

¹⁷ Cf. a larger and deeper built receptacle in a wine press in Manari of Assea, which belonged to a farm house that has not yet been located: ΠΕΤΡΟΠΟΥΛΟΣ *et alii* 2012, 125.

¹⁸ ΓΙΑΛΟΥΡΗ 2009, 1249-1250; also cf. a floor in a farm house in Ancient Locris, in the periphery of Kyparissia, Palaigianni site: ΔΑΚΟΡΩΝΙΑ-ΜΠΟΥΓΙΑ 2013, 565, 569, fig. 5.

¹⁹ ΠΕΤΡΟΠΟΥΛΟΣ 2013b, 304, fig. 9.

²⁰ ΣΟΥΧΛΕΡΗΣ 2013, 346, fig. 1.



Fig. 8. Pool/basin No. 22 with the diver focused on documentation activities (photo ©ISCR).



Fig. 9. Excavation activities through the waterpumping of the well No. 23 (photo ©ISCR).



Fig. 10. Ruins in concrete with *opus testaceum* facing (photo ©ISCR).

cocciopesto basin on two overlapping floors. Portions of its walls (for their construction building see below) are collapsed around it (Fig. 10). During the 2019 excavation campaign, the area will be the subject to a photogrammetric 3D recording and to more detailed investigations. It is clear that the coastline between the Villa of the Dolia and the ancient port of Epidaurus needs further investigation and explorations, and it will certainly provide interesting insights for the reconstruction of the ancient coastal landscape.

B.D.P.

4. BUILDING TECHNIQUES

During the first investigation campaign in 2018, a preliminary interpretation of the wall structures was started. The typological classification of construction techniques and building materials used was performed with the aim to reconstruct, where possible and in a diachronic key, the architectural history of the whole complex.

The current state of the villa shows a very articulated architectural configuration belonging to a series of construction phases that have changed its aspect after extensions, additions and renovations. The analysis of the construction techniques is made problematic by the state of preservation of the masonry, which often showed limited heights to a few tens of centimeters. Sometimes, in cases where the walls are better preserved, most of them refer not to the upper part of the grading plan but to the foundations that the hydrodynamism and wave movements exposed by digging deep into the seabed.

The villa shows a remarkable variety of construction techniques that cannot always be grouped and associated to standardized models and techniques. The construction of the walls is evidently linked to utilitarian aims with the use of the material available in the surroundings. This multiformity, emphasized by the frequent use of heterogeneous materials, often reused, is certainly connected to the simplicity of the complex whose main function was typically agricultural and productive.

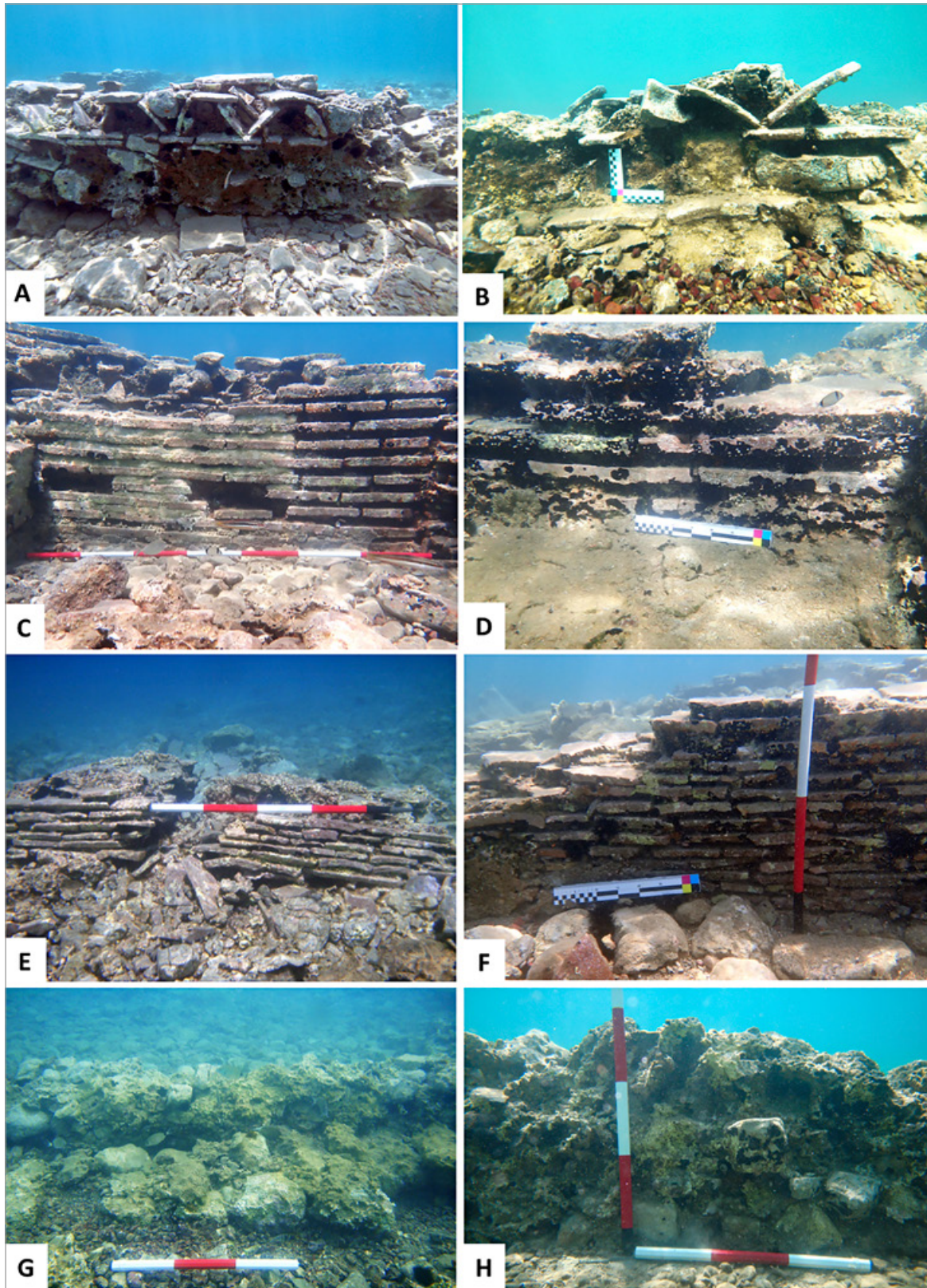


Fig. 11. Some of the masonry techniques observed in the archaeological complex (photo ©ISCR).

A large part of the walls – perhaps those pertaining to the oldest phase of the villa – are made of *opus mixtum* in which the rough stone is used together with the brick. In this case, these masonries provide for the alternation of bands of *opus incertum* consisting of small-medium-sized pebbles bonded with mortar and bands composed of two double brickworks interposed with small niches of isosceles trapezoid shape (Fig. 11, A). The niches are made by juxtaposing specially fragmented bricks; a pebble is placed inside the

niche and in the space standing between one and the other. At the base, in correspondence of the grading plan, these walls often show a masonry base composed of a row of large-sized lithic blocks roughly roughened. This building technique is found, for example, in the dense array of rooms that follow one another on the western side of the *cella vinaria* (Fig. 3, rooms 1 and 4), on the northern face of the wall bordering the villa and in some areas of the southern archeological complex (Fig. 3, rooms 22, 24, 25). The presence of large blocks rows related to walls of poorly preserved rooms suggest that many other areas of the villa may have been built using this mixed-technique.

A variant of the latter was found in the room No. 3 in which bands composed of single lines of bricks interposed to panels in *opus incertum* and similar niches to the previous ones are visible (Fig. 11, B).

A second technique in *opus mixtum* was isolated in the NE sector of the complex and involves the walls of rooms 18, 19, 20 and 21 (Fig. 3). These are poorly preserved cement walls in which rows of a line of bricks and just rough-hewn blocks of stone are alternated.

The divider between rooms 11 and 12 is also constructed in *opus mixtum*, where a register in *opus testaceum* composed of three rows of rectangular bricks (41/42×30×2 cm ca.) is alternated with panels made of *opus incertum*.

The *opus incertum* characterizes also some rooms placed on the NW side of the *dolia* warehouse in which the use of different medium-small lithic elements immersed in abundant mortar is recorded; in these walls frequent fills of brick fragments are observed (Fig. 11, H). In the room No. 6 the *opus incertum* is different and characterized by walls built with unfaced concrete and irregular quarry limestones aligned in pseudo-horizontal rows (Fig. 11, G). Smaller stones are present, and, sometimes pottery fragments. In some cases, big squared stones enforce the angle.

The back wall of the complex deserves a separate discussion as it is observed in the section that involves rooms Nos. 18, 19, 20 and 31 (Fig. 3). It is a mighty wall built with blocks of medium-large dimensions bonded with mortar and in which finished and well squared blocks sometimes are used, probably taken from the ruins of older monumental buildings.

The other techniques present in the complex include the use of bricks bonded to concrete cores (*opus testaceum*). The first, with a very accurate execution, has uniform and perfectly horizontal laying surfaces in which the mortar beds have the same height as the bricks. In these walls bricks of different sizes were used. In the pool/basin 22 (Fig. 3), for example, there are bricks measuring 29/30×41.5/42×4 cm (Fig. 11, D; Fig. 8), while in the back wall of room 33 there are rectangular bricks of 16.5×29×3 cm. In the walls of this last section, bricks cut into rectangles are also inserted (Fig. 11, C).

In *opus testaceum*, with a much less accurate texture than the previous one, are constructed the walls of the ruins placed closely outside the complex northwards, perhaps pertaining to basins (Fig. 10; Fig. 11, E). In these constructions are used big curved tiles cut irregularly into pieces of different sizes. The laying surfaces are neither uniform nor perfectly horizontal²¹.

Finally, the use of fragments of curved tiles, with a further deterioration in the texture and a chaotic thickening of the bricks, is recorded in the back wall of the room 33 and in the walls of room/basin No. 17 (Fig. 11, F).

S.M.

5. THE FARM AND THE ROMAN PRODUCTIVE LANDSCAPE IN THE REGION OF EPIDAUROS

The ancient submerged complex was located in a suburban area only a few hundred meters away from the ancient city. On the basis of the currently visible remains, it must have been a coastal villa with a predominantly rural and productive vocation²². These villas may have served as both the owner's, his family's and workers' place of residence and as a center of managing the agricultural produce. More often than not, there were further buildings to accommodate farmers who worked at the farm, to stable

²¹ In the *dolia* warehouse the presence of rectangular bricks measuring 20×40×4 cm and square bricks of 28×28×2.5/2.8 cm, not in place, was observed. On the use of brick in the Peloponnese in roman times see VITTI 2015 and 2016.

²² MARZANO 2013, 8-19; RIZAKIS 2013, 35-40. The term "*villae*

maritimae" is not appropriate for the villa of Epidaurus as in ancient sources and modern historians this term applies to villas whose common characteristic was luxury, in contrast to the frugality of "*villae rusticae*": MARZANO 2007, 15.

animals and store rural products. Most of these villas were located in accessible sites, near cities, street networks, rivers, lakes and the sea, as is the case of Ancient Epidaurus. In regions such as the Peloponnese, Attica and central Greece, there was the potential of intensive farming, the most important products being grain, olive oil and wine. The excavation data from the area of the SE Peloponnese²³, where Ancient Epidaurus belongs, indicate that in this area there was probably intensified and specialized agricultural production²⁴. As Plutarch mentions²⁵, most inhabitants of Epidaurus lived and worked in the fields. The city was characterized as *αμπελόεσσα/αμπελόεντος* (vineyard) by both Homer²⁶ and Strabo²⁷, while there was also the adjective *λειμηρής*, which is mentioned by Stephanus Byzantius²⁸, as there were many fields in the area.

It seems that in the Hellenic area farm houses do not consist of only one house but of several buildings, each of which had a different function²⁹. The design of the *villa rustica* differentiated according to the architect but basically consisted of three parts: the urbana or main residence, the agricultural center and the farming area³⁰. The view that big estates (*latifundia*) were quite common in almost all rural areas of the Hellenic region has not been confirmed by recent excavation data, as the majority of Roman farms that have come to light are villas of a medium scale³¹. The main target of these Roman type villas was not autarky in manufacture but the production of surplus which would become a tradable commodity and would be profitable³².

Unfortunately, few publications of Roman villas in Greece have been released so far. According to recent discussion on Greek villas³³, Roman villas in Greece were either located on the outskirts of towns or cities (*suburbanae*), along coastal areas (*maritimae*) or inland (*urbanae/rusticatae*) where agricultural activities and farming were the main works that took place. Even fewer are the publications concerning Roman villas in the Argolis area: a short description of the underwater villa in P. Epidaurus is included in an article on agricultural buildings of Roman times in Argolis which was published in 2013³⁴.

In general, it seems that the owners of Roman country villas that were located around the cities had particularly close bonds with the owners of luxurious mansions in the cities themselves, as both belonged to the same urban elite, whose identity is known only in few cases³⁵. On the contrary, the precise relation between wealthy land owners and the rural population is a bit obscure, and so is the way in which the exploitation of land was organized. The term *Roman villa* corresponds to the basic features of this Roman type of building, which can be summarized as follows: it is a rural house which is located in the countryside, frequently belonging to a wider complex in the center of a farm³⁶. These complexes were found in the most fertile pieces of land, which were connected to the road network and extended in an area of ten to more than 1000 hectares.

Regarding to the features of the main building of the complex, which in our case could be the oblong building with the *dolia* and the rows of rooms, these can be summarized as follows: a design of the complex in harmony with the landscape, a clear central axis, symmetry in the design of the main building of the villa and a pre-selected arrangement of the relation between the villa and the surrounding buildings³⁷. It is characteristic that different complexes developed through time and differed from one province to another. It was, thus, usual, in a pre-existing local settlement for a Roman plan to be applied, incorporating Roman architectural elements to the local features³⁸. Other features of the farm-house estates were the existence of a second floor and the presence of a great number of vases, such as amphorae etc. for storing as well as transporting products to several markets³⁹.

P.G.

²³ For a historical outline of the Argolis area, see: ΜΠΑΝΑΚΑ 2012.

²⁴ STEWART 2010, 225; RICHMOND 1970, 51; MCKAY 1975, 1-25; PERCIVAL 1988, 5-13; JOHNSTON 1994, 6-8; MULVIN 2002, 1; ZARMAKOUPH 2013, 752-761.

²⁵ PLU. *Moralia*, 291.

²⁶ HOM. *Il.* 2.559.

²⁷ STR. 372.10.

²⁸ ST.BYZ. 153.92

²⁹ ΒΛΑΧΟΓΙΑΝΝΗ 2013, 508.

³⁰ RIZAKIS 2013, 35.

³¹ 200-600 m²: CATO *Agr.* I.7.12-13; MARTIN 1971, 89-90; DUNCAN-JONES 1974, 325-326; MARZANO 2007, 107, fn. 21; RIZAKIS

2013, 36.

³² BROCKMEYER 1975, 213-228; ΚΕΡΦΟΕ 2007, 553-557; RIZAKIS 2013, 37.

³³ ΠΑΠΑΠΑΙΟΑΝΝΟΥ 2018, 328.

³⁴ ΣΑΡΡΗ 2013.

³⁵ RIZAKIS 2013, 47; SEG 45.418, s.v. «Patrai».

³⁶ RICHMOND 1970, 51; MCKAY 1975, 1-25; PERCIVAL 1988, 5-13; JOHNSTON 1994, 6-8; MULVIN 2002, 1; MARZANO 2013, 8-19; ZARMAKOUPH 2013, 752-761.

³⁷ SMITH 1978a, 149-173.

³⁸ For further definition of villas, see PERCIVAL 1988, No. 1, 13.

³⁹ ΠΕΤΡΟΠΟΥΛΟΣ 1994, 413-414; 2013a, 185.

6. THE IN SITU CONSERVATION ACTIVITIES

6.1 The project restoring underwater

The conservation activities carried out during this campaign were designed by R. Petriaggi and B. Davidde in the frame of the *Restoring Underwater* Project launched and conducted by the Underwater Archaeology Operations Unit of the ISCR in 2001. The project started with the restoration of the *vivaria* of the Roman villa of Torre Astura (Nettuno, Rome)⁴⁰. Its aim was to achieve the techniques to work underwater to restore the submerged structures, as is done for the artifacts on land, through the study and planning of new instruments, materials, methodologies, and techniques for conservation and *in situ* display of ancient submerged artefacts. Then, since 2003, most of the project's work and experimentation experiences took place in the submerged archaeological site of *Baiiae* (Naples, Italy)⁴¹.

Therefore, in Epidaurus, the main conservation activities have begun with the preliminary study of the state of preservation of the site, by documenting the biological degradation phenomena and architectonic decay of the floors and wall structures. Moreover, cleaning and consolidation of the *dolia* warehouse have been the focus of our tasks.

R.P.

6.2 Biological aspects

The submerged structures of the Roman Villa of Epidaurus, characterized by microenvironmental conditions with high solar radiation and moderate or high water temperatures during the summer, are affected by a peculiar biological colonization and bioerosion phenomena. The shallow depth subjects the remains to the mechanical action of the wave movements and, consequently, to the phenomena of sand covering and movement of the pebbles in the seabed that have caused, over time, structural degradation phenomena causing fractures and losses of constituent elements. The wall structure is quite heterogeneous, combining brick elements (masonry and *dolia*), natural stone elements (calcarenes) and mortars used for the construction. The bricks and the *dolia* are affected exclusively by epilithic encrusting colonizers (zoobenthic and phytobenthic organisms) which did not cause a real degradation of the material. The surfaces of the *dolia* showed a widespread growth of epilithic organisms consisting in large part of Coralline algae, bryozoan colonies, small algal felts forming delicate tufts, spirorbid sedentary polychaetes, crustaceans represented by barnacles and encrusting sponges.

The major degradation phenomenon, observed mainly near and between the mortars, is represented by perforations of the endolithic bivalve *Lithophaga lithophaga* Linnaeus, 1758 (known as date mussel) (Fig. 12, A-B). This bivalve is able to actively penetrate inside the rock, solubilizing the calcium carbonate composing the lapideous material and to bore it irreversibly⁴². The presence of this organism is closely connected to the anthropic impact on the archaeological structures because of the destructive harvesting of date mussel. The anthropic action has been hypothesized on the basis of the observations of numerous fragments of mortar and blocks near the walls whose characteristics well correspond to fragments obtained by mechanical breaking for collecting the specimens.

The second bioerosive phenomenon observed on the mortars is due to the action of endolithic sponges belonging to the genus *Cliona*. The action of these sponges is visible thanks to the exposed chambers formed inside the rock (Fig. 12, C). The same action was also observed on the carbonatic fragments in the close proximity of the archaeological structures.

Other bioerosion phenomena related to the presence on the surfaces of numerous specimens of echnoderms of the species *Paracentrosus lividus* Lamarck, 1816 were observed (Fig. 12, D). Their bioerosive action (known as *grazing*) occurs by means of their mouth apparatus, the Aristotle's lantern, used by the animal to feed on the biofilm present on the surface. It is also known that these organisms are also able to dig and bioerode small sub-circular cavities⁴³ in which they settle more or less permanently. The grazing

⁴⁰ PETRIAGGI-MANCINELLI 2004.

⁴¹ PETRIAGGI 2005; PETRIAGGI-DAVIDDE 2005; 2012; PETRIAGGI-DAVIDDE PETRIAGGI 2015; DAVIDDE PETRIAGGI-GOMEZ DE

AYALA 2015; DAVIDDE PETRIAGGI *et alii* 2016.

⁴² RICCI *et alii* 2015, 89-100.

⁴³ BAK 1994, 99-103.

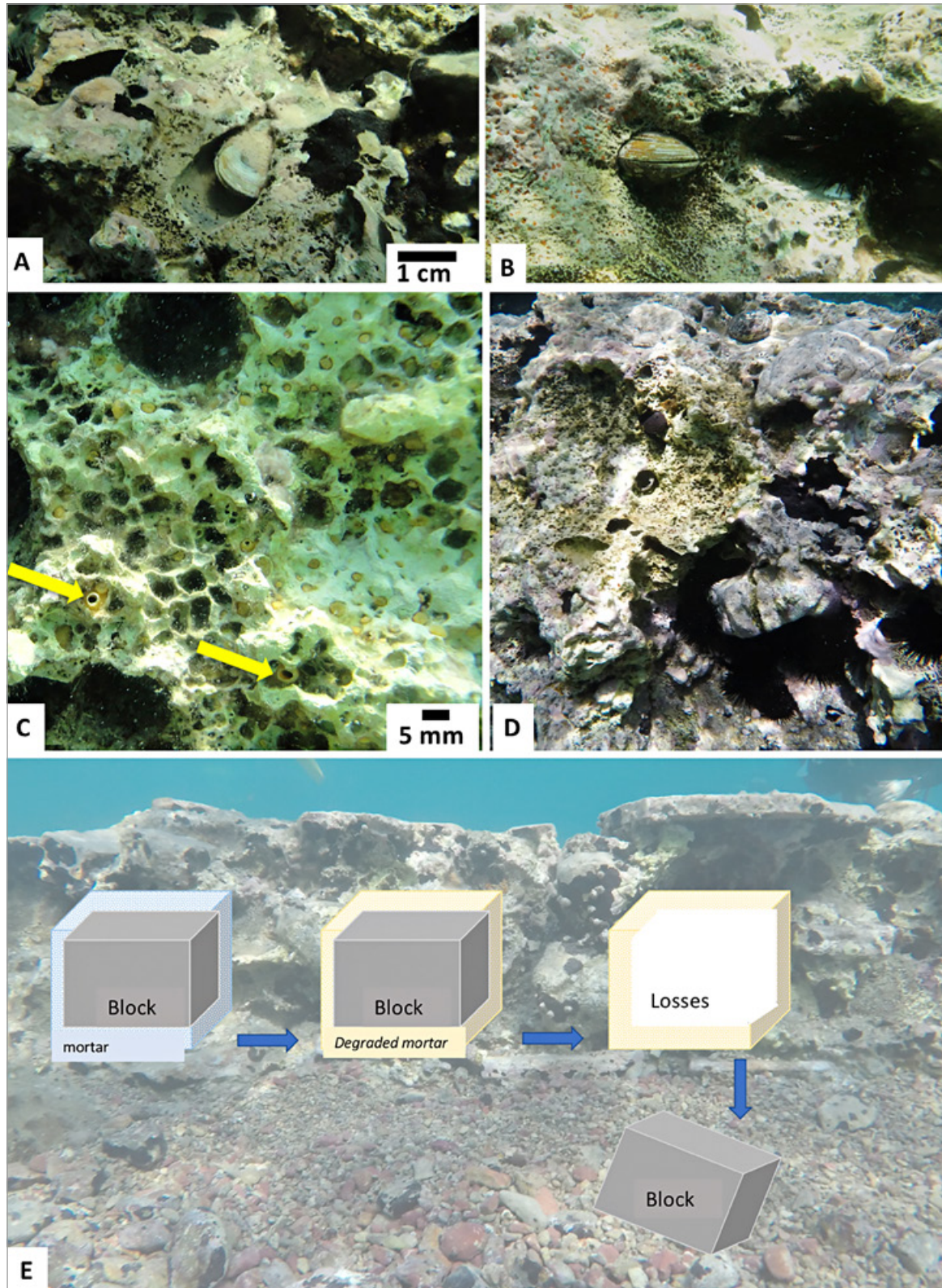


Fig. 12. Bioerosion of the submerged structures. A-B: specimens of *Lithophaga lithophaga* inside the holes. C: perforations caused by boring sponges (yellow arrows: *oscula* of the alive sponge inside the cavities). D: sea urchins in the cavities of the wall structures. E: hypothetical reconstruction of the biological and mechanical degradation causes of the wall structures (photo ©ISCR).

action provides a plausible explanation of the scarce presence of erect algal colonizations on the horizontal surfaces. In fact, sea urchins are not able to feed on encrusting red algae (Corallinales), characterized by a calcified thallus, which densely colonized the surfaces. The significant loss of the masonry building blocks, visible from the numerous gaps in the structure, was probably caused by the weakening of the mortars

which have undergone a degradation of a physical-chemical nature by the abovementioned endolithic organisms, having lost much of their strength, followed by an important fragility caused by the depletion of the carbonate matrix. This phenomenon, together with the hydrodynamism and anthropic damage, has led to the detachment and collapse of stone blocks (Fig. 12, E).

C.S.P., S.R.

6.3 The state of preservation and possible causes of degradation before the restoration works

Human impact on the site can be distinguished in two periods, with different characteristics, intensities and effects on the submerged structures. The first one is from when the site was abandoned until its full submersion under the sea.

During the first period it seems that building materials have been removed from the site in order to be reused. The practice of reusing building materials from earlier constructions has been very common over time in the Hellenic region. Examples of this practice can be observed in the later phases of the Villa of *dolia*. Apart from the large number of ceramic roofing tiles that have been reused in the walls and flooring, processed stones from the earlier construction seem to have been used in the outer layer of the eastern corner of the southern wall of room 10 (Fig. 3). After the abandonment of the building there must have been an extensive collection of stones. Larger and better processed ones were preferred in order to be used elsewhere. This practice is more distinctive at the northern wall of room 13 (Fig. 3).

The second period of human intervention begins with the full submersion of the site under the sea and intensifies in the 1960s and 1970s with the development of tourism until today. The well-known submerged roman Villa, also visible from satellite imagery, shallow and accessible to anyone, has become a tourist attraction (Fig. 13). As cited in the previous paragraph, some problems are connected to the presence of the date mussel *Lithophaga lithophaga* and its extraction that requires dismantling of the rock where the mollusks live. This action has become illegal in the last decades (ΑΔΑ: Ψ62Ν4653ΠΙΓ-ΤΝΔ).

The clumsy stepping on the walls and the *dolia* in the shallows, add mechanical stresses to the already weakened structure, further degrading the site by unintentional detachment of the stones and mortar. The deterioration of the *dolia* is more extensive; the area inside room 13 is full of *dolia* sherds, many of them with recent breaks. It has to be mentioned here that the site is unguarded; but also that during our presence at the site and whilst having restricted a part of the site – with ropes, buoys and informative signs, stating work in progress, as well as the continuous warnings from the research team, nothing could be done to keep the tourists outside the archaeological site.

Occasional anchorage, mainly in the deeper part of the site, is also responsible for its degradation. The condition of two parts of ceramic flooring which were found detached and inverted west of the northwest wall of room 18 could have been caused by such an action.

From the twenty destroyed *dolia*, none of them preserve their rim or part of it. Unprecedented is also the absence of these inside the site. Before the cleaning process and the removal of the loose stones within room 13, neither inside nor out where any of these parts detected. After the cleaning in July but also during the work done in December only two parts of *dolia* rims were found, both small with a rim radius of 10 to 1 cm; together they barely make up 1/8-1/6 of the total rim of a *dolia*. Also, two intact tiles with good adhesion to the mortar which were revealed during the excavation in July, in December were absent and could not be found in the surrounding area ⁴⁴.

A.T., E.M.B.

6.4. The restoration methodology and tools

The mechanical removal of encrusting biodeteriogens on the architectural surfaces was carried out using the same instruments normally employed in the dry environment, such as drills, mills, hammers, chisels and

⁴⁴ In the while we are writing, the 2019 Campaign is ongoing and the rim of the *dolium* No. D19 has been just recovered in it.



Fig. 13. The human impact on the site (photo ©ISCR).



Fig. 14. The cleaning of the *opus figlinum* floors using the innovative battery-powered electromechanical tools provided by UNICAL (photo ©ISCR).

spatulas. Some structures, such as the *opus figlinum* floors, were cleaned using the innovative battery-powered electromechanical tools provided by UNICAL: a cleaning brush useful to remove the loosely deposit and the marine organisms that reside on the surface of the artefacts; a small electrical chisel that helps the restorers to remove carbonatic encrustations and an electrical hand-held grinding tool that allows restorers to reduce the carbonatic incrustations thickness too hard to be removed by the small electrical chisel (Fig. 14)⁴⁵.

⁴⁵ BRUNO *et alii* 2015.

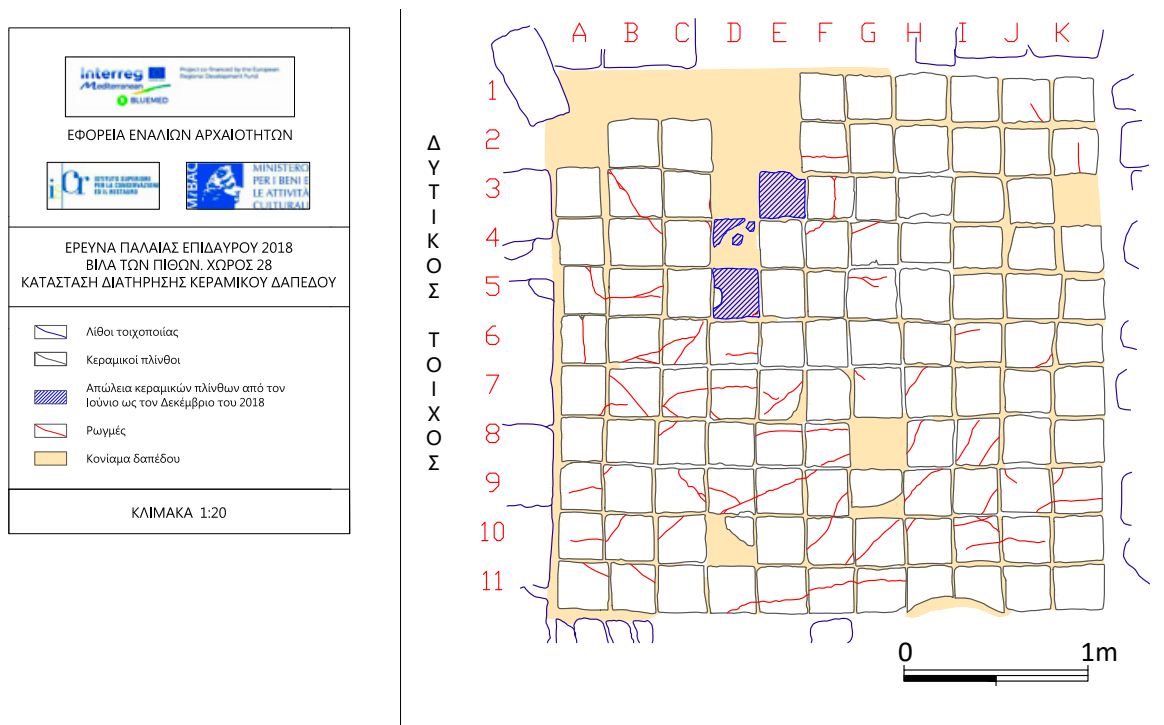


Fig. 15. The state of preservation of the ceramic floor in the room No. 28 (photo ©EEA).



Fig. 16. The filling on the upper masonry surfaces carried out using the supply pockets made of a waterproof fabric (photo ©ISCR).

The in-depth consolidation of the submerged walls and floors was carried out on rooms 13 (*dolia* warehouse) and the documentation of the state of preservation was carried out for the ceramic floor 28 by the team of the Ephorate (Fig. 15). The grouting (filling of cracks and lacunae) of the wall structures was carried out using mortars for injections (Volteco Lime Gel) carefully designed for the purpose, ensuring the maximum compatibility with the walls under both the physical and chemical point of view, and granting a complete hydraulic grip, necessary in the underwater environment. The viscosity of the mortar must avoid its dispersion in the water (not too liquid) and at the same time allow a constant supply and a regular



Fig. 17. A phase of the wall consolidation (photo ©ISCR).



Fig. 18. A wall of the storehouse (*cella vinaria*) after the restoration (photo ©ISCR).

flow rate (not too dry), without blocking the grouting channel too early. The grouting operations were performed manually, through waterproof supply pockets (very low pressure or sole gravity), by exerting gentle pressure on the sack, ensuring perfect adherence at the edges of the cracks or lacunae and excellent hardening properties.

The repair of wall joints, where loss of the original mortar has occurred, and the filling on the upper masonry surfaces, was carried out using the same abovementioned supply pockets made of a waterproof fabric (Fig. 16).

The wall consolidation was carried out by using the mortar by filling the losses and by positioning erratic pebbles, selected for dimension and shape from the sea bottom, pertinent to the masonry, to integrate the losses of the wall. At the end the mortar was also inserted between the perimeter of the lacuna and the pebble (Figs. 17-18).

R.P., R.M.

6.5 Management, conservation program and monitoring activities

The site has been officially declared as an underwater archaeological site protected by Law (ΦΕΚ 1236/B/08.12.1998) and according to Law 3028/2002 fishing, mooring and underwater activities with the use of breathing devices are forbidden.

At the end of the campaign, the Ephorate of Underwater Antiquities has planned a maintenance program of the site by periodicals surveys carried out in winter 2018 to prevent the abovementioned damages. The first survey was carried out by restorers and archaeologists of the Ephorate by covering interventions of the *dolia* and the floor with Geotextile sheets Terram® 2000 and Terram® 4000, in order to protect the structures against the biological growth.

P.G., A.T.

7. PERSPECTIVES

The second campaign of excavation and restoration conducted by ISCR with the Greek Ephorate will be planned in the summer 2019 with the aim to continue to preserve and study this very important underwater archaeological site. In 2019 the students of the ISCR MA High School and selected students from Roma Tre University will participate in the works and they will learn methods and techniques for the *in situ* excavation and conservation of archaeological structures. This underwater site is an ideal site to train underwater restorers and archaeologists. The Ephorate has planned a pioneering project including Autonomous guided and narrated tour over the sunken city of Epidaurus it has already been approved for European funding. The object of this project is the identification, conservation, documentation and dissemination of the sunken city with the use of advanced technological practices. The project is materialized by the collaboration between the Ephorate of Underwater Antiquities, the Scientific Centre «Athena» and the Marinco Ltd. The total duration of the project is estimated to 24 months. Finally, the Ephorate of Underwater Antiquities has applied for funding for a study on the protection and elevation of coastline sunken settlements on the coasts of the Peloponnese, the aim of which, in Epidaurus, will be easier access to the site through the coast or the sea area, information on the uses that are permitted in the area, coastal and underwater signs etc. This shall be part of the European Funding for the period 2021-2027.

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