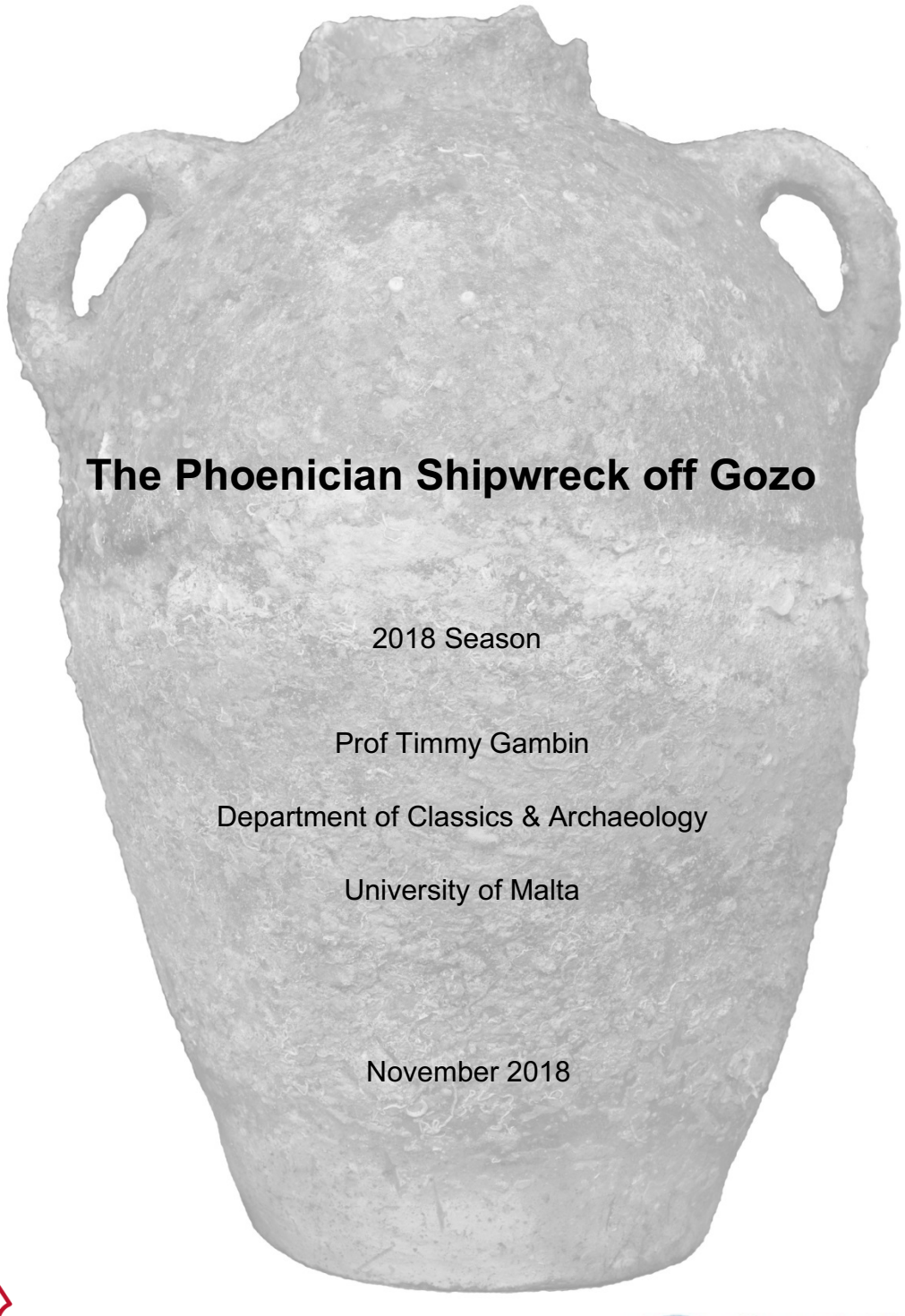

The Phoenician Shipwreck off Gozo

2018 Season

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University of Malta

November 2018

Supporting Maritime Archaeology in the Eastern Mediterranean

Preamble

Research on the Phoenician shipwreck has been ongoing since 2007. It started with the discovery of the site during a systematic side-scan sonar survey of the approaches to Xlendi Bay in Gozo. This survey is part of a long term broader research project aimed at creating a comprehensive archaeological map of the seabed off the islands of Malta and Gozo. Such a map will contribute to a more strategic approach to the management and protection of Malta`s underwater cultural heritage.

Site Location & Description

Located approximately 900 meters off the south-west coast of Gozo the shipwreck lies on a relatively flat seabed of coarse sand at a depth of 110 meters. The visible part of the site rises no more than one meter off the seabed. Except for some minor damage, probably caused by traditional bottom-fishing techniques practiced in the past, the site is very well preserved and retains a distinguishable outline. The dimensions of the shipwreck are approximately 12 meters long, by 5 meters wide, with a depth of 1.8 meters of archaeology buried under the sediments. The latter dimension was acquired during a sub-bottom profiler survey. In 2014, a Franco-Maltese team worked on the site using state-of-the-art technologies. The results of this project were the creation of a high-resolution 3D image of the shipwreck and the recovery of four objects. Since 2016, an international team of technical divers, led by the present author, has continued to conduct scientific research on the site.

Past Work on the Site

2007-2010: Various remote sensing surveys undertaken by high-resolution side-scan sonar, sub-bottom profiler and remotely operated vehicle.
2014: Site survey and object recovery through the use of a manned submersible.
2016: Site survey and object recovery by diving archaeologists.
2017: Preparation of site for subsequent seasons, site survey, samples and objects recovery.

Aim of the 2018 Project

1. To lay down six permanent control points around the site for the survey purposes.
2. To execute a detailed and accurate survey of the control points.
3. To set up an excavation test trench 4 x 2 meters at one of the extremities of the site.
4. To set up and excavation equipment based on a hydraulic submersible pump with two dredges.
5. To excavate an area of the shipwreck.

6. To continue surveying and recording the entire site and the excavation progress by through the use of advanced 3D photogrammetry.
7. To recover artifacts as the excavation in the trench progress.
8. To sample the sediments.
9. To conduct post excavation inter-disciplinary studies in order to better understand the broader archaeological significance of the site.
10. To raise public awareness, locally and internationally, of the archaeological significance of the Phoenician shipwreck.

Fieldwork Procedures and Methods

The overall aims of the project were clearly disseminated in long and detailed meetings before the commencement of the project in the form as the Project Manual and the Diving Project Plan, which were made available to all participants. Overall project objectives and procedures were delivered at the initial project briefing (**Figs 1 and 2**). During the duration of a project the Project Director would brief all divers and support personnel on the day`s objectives. This briefing was followed by a detailed briefing by the Dive Officer. The latter covered the dive plan, procedures and safety elements.

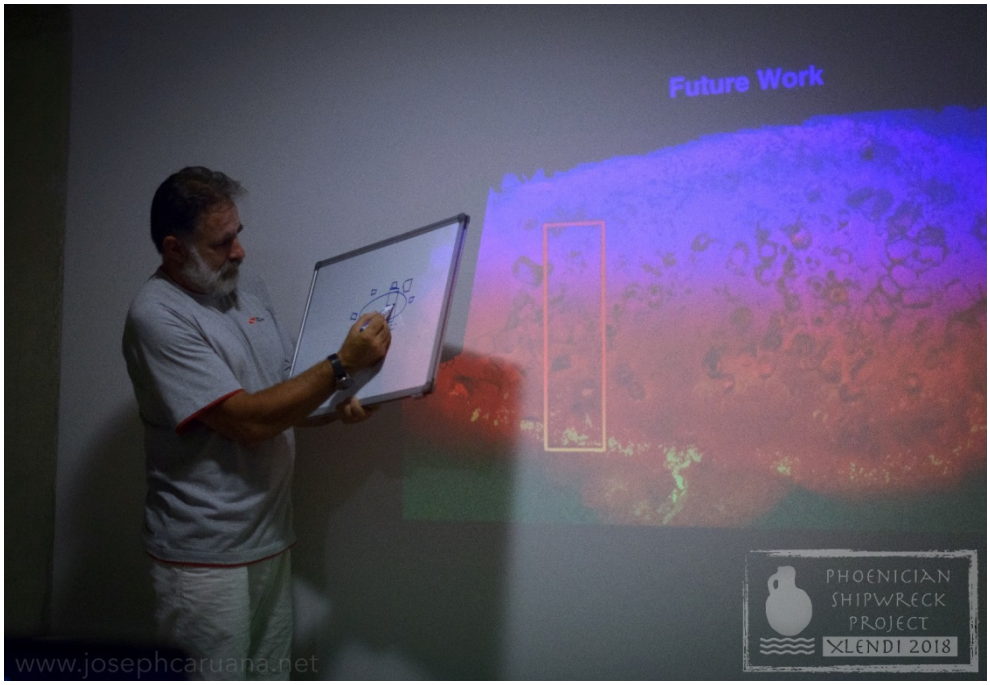

Fig 1. Presenting the site in the first project briefing (J. Caruana).

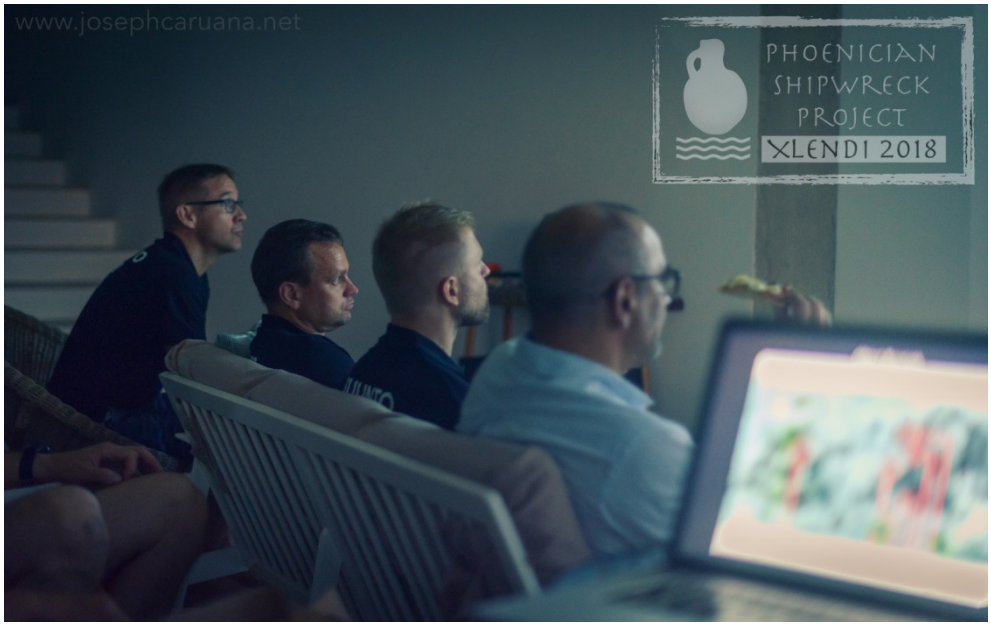

Fig 2. Some of the time during the first project briefing (J. Caruana).

Prior to the commencement of diving operations, a network of six permanent control points was established around the site in elliptical order. Each point had a target and scale so as to aid the photogrammetric process (**Fig 3**). This was accomplished from the RV Hercules that was made available by the RPM Foundation. One of the first diving tasks was to connect the main mooring/shot line to the mooring block that was positioned close to the site in 2017. This line provides the quickest and safest route for the divers to make it to and from the wreck. This is essential due to the limited bottom time. A specially developed right-angle scale with sides of 2 meters was positioned and levelled at the northwestern side - outside of the site - so as to enable the creation of an accurate local coordinate system for the 3D photogrammetric models (**Fig 4**). Once the scale was set, divers conducted a series of systematic swims over the entire site including the control points and the right-angle scale. For increased resolution of the 3D model, still images were used (as opposed to video in previous seasons). The model was then scaled and referenced in the local coordinate system.

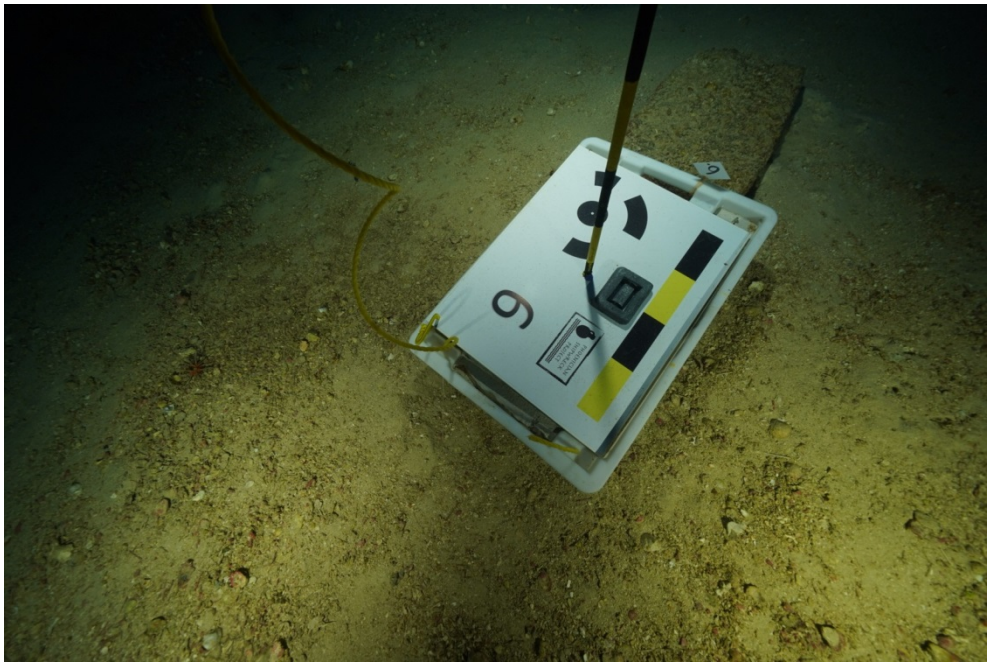

Fig 3. One of the control points in-situ. (K. Hyttinen).

Fig 4. Preparing the right-angle scale (J. Caruana).

A grid of 4 x 2 meters, divided into two 2 x 2 meter units with 1 x 1 meter subunits, was positioned at the western extremity of the shipwreck in an area where the grinding stones and amphorae meet. Following the positioning of the grid, the entire site was surveyed so as the grid could be placed within the local coordinate system (**Fig 5**).

Fig 5. Dredge equipment close to grid (J. Wood/K. Hyttinen).

For the purposes of this excavation, the surface pump (for the water dredge) was replaced with a hydraulic-powered submersible pump. The hydraulic machine was housed on the bow deck of the boat with one person responsible for its operation (**Fig 6**). The hydraulic hoses were lowered and secured along the shot line with the submersible pump positioned at 95 meters. Supply hoses connected the pumps to two dredges with long exhaust pipes. The dredges were positioned in the vicinity of the trench, each of them near one of the 2 x 2 meter units. In order to ensure that no evidence was lost, all excavated material was guided to two spoil bags located on the seabed close to the site. Sediments collected in this way are to be sieved and screened (**Fig 7**). A large 24,000 Lumens underwater light was fitted to a tripod so as to provide uniform light across the entire area of interest (**Fig 8**).

Fig 6. Surface hydraulic machine being manned by K. Vella (T. Gambin).

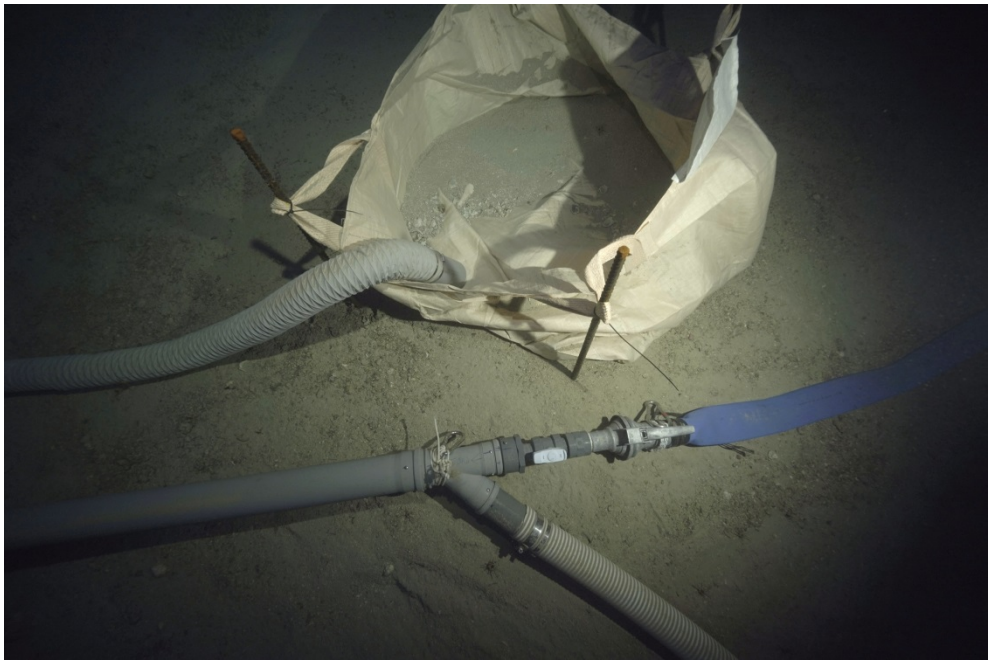

Fig 7. The spoil bags on the seabed (K. Hyttinen).

Fig 8. Dredge and main light (K. Hyttinen).

Excavations were conducted by teams of three divers. Two divers operated a dredge each in separate 2x2 m units, while the third acted as safety diver. The hand-fanning technique was used to dislodge sediments (**Fig 9**). This enabled the excavation to progress in a controlled manner with the gradual removal of sediments across subunits. Sherds and other archaeological materials were placed in mesh bags that were marked and designated for each of the grid`s subunits. The first dive of the day was always dedicated to data acquisition with the 3D Team recording the trench as left at the end of the previous day's operations (**Fig 10**). Progress was recorded on daily basis by comparing dense clouds produced from the 3D photogrammetry models. 3D models, orthophotos and DEMs were produced daily and used to plan and fine-tune excavation strategies (**Figs 11 & 12**). All data, including measurements, were inputted and stored in a data base using Site Recorder. Moreover, newly unearthed artefacts were digitally labeled and added to the Site Recorder data base (**Fig 13**).

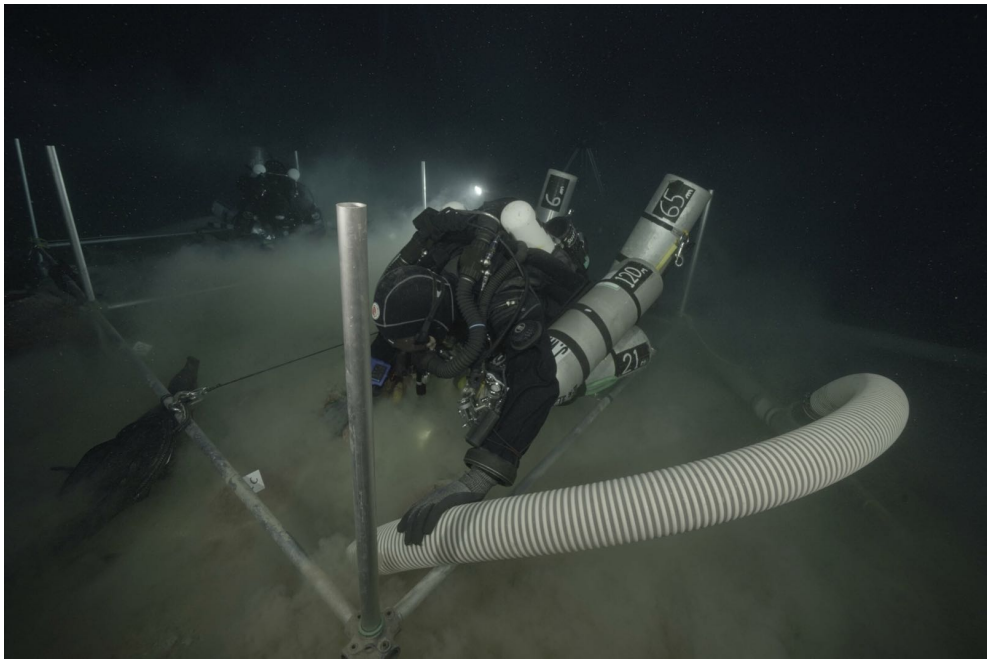

Fig 9. Divers excavating (K. Hyttinen).

Fig 10. Diver conducting systematic swim line over site to obtain data for 3D photogrammetric models (J. Wood).

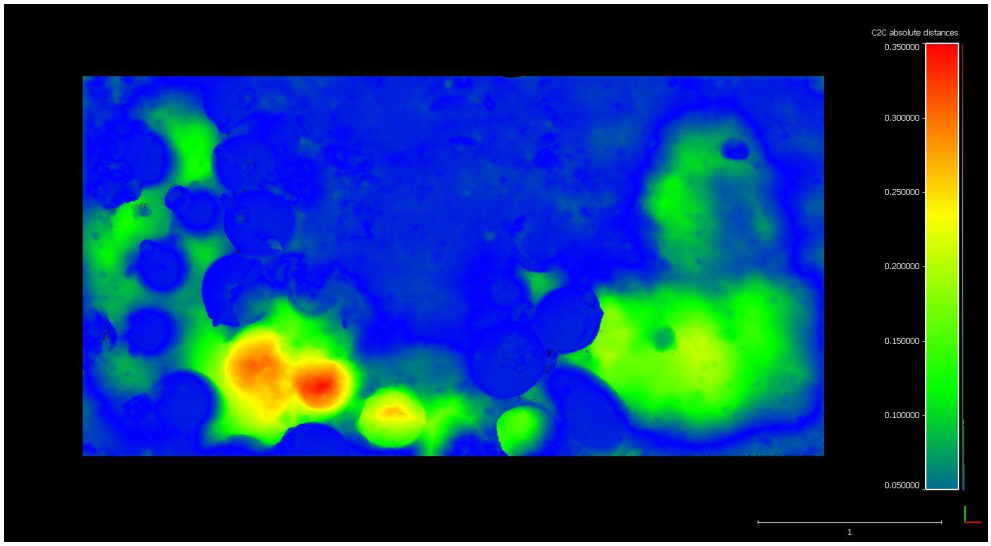

Fig 11. 'Heat map' showing depth extents of excavation (J. Wood).

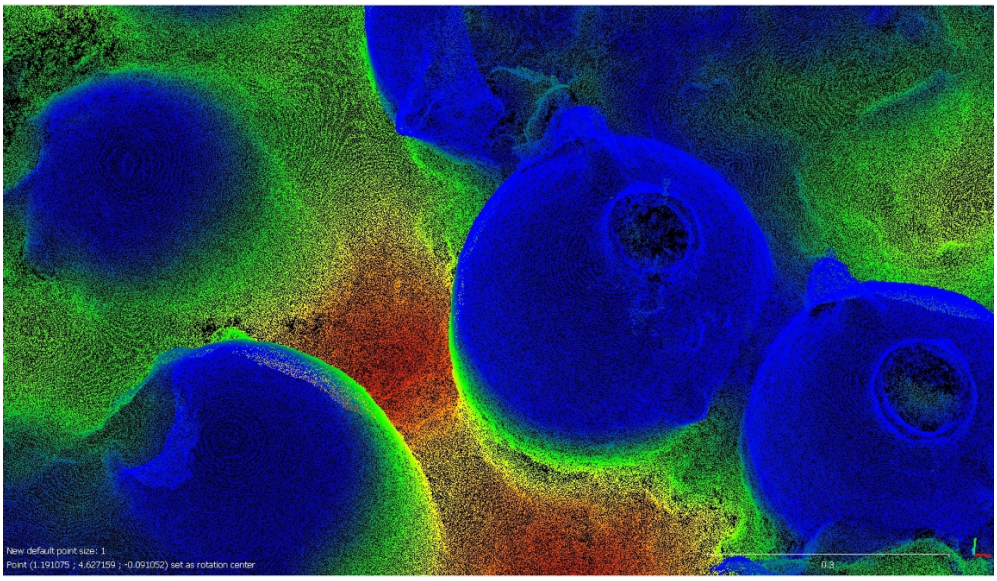

Fig 12. DEM of amphorae during excavation phase (J. Wood).

Fig 13. Typical data processing scene following a day of diving (J. Wood).

Sediment Samples were taken from close to all six control points. These were obtained so as to provide control samples for scientists studying lipids and DNA from the site.

The total number of dives conducted was over 120, most of which were to 110 meters. Total dive time was 306.01 hours. For the whole project the team used 103,503 Liters of Oxygen 75,489 liters of Helium and 14 Tubs (of 20kg) of 797 Sofnolime.

Towards the end of the excavation, three amphorae were recovered from the trench together with one grinding stone (from outside the site). Before its removal, the grid's position was marked by iron rods so as to facilitate its re-installation in 2019. A final 3D survey was conducted on the last day of operations prior to covering the excavated area with geotextile. (**Fig 14**)

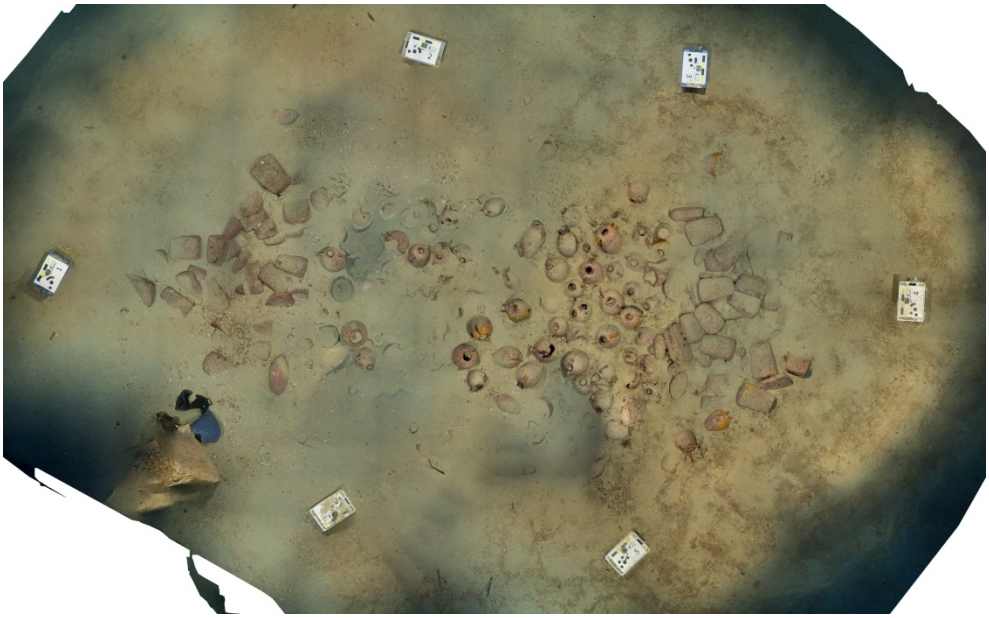

Fig 14. Final orthophoto produced prior to laying the geotextile (J. Wood/K. Hyttinen).

Diving Appraisal

All diving and emergency procedures as well as diving logistics and description of the environment were handed out to participants in a Diving Project Plan document before the start of the 2018 season. Due to the extreme depth of the shipwreck, dives are physically and mentally taxing and require divers to be not only experienced but also highly disciplined. All feasible safety precautions were carried out in order to ensure diver safety and those were repeated daily during the briefings and debriefings. Back-up cylinders were secured along the shot line and at the bottom in the vicinity of the site. Series of back-up cylinders were carried by divers in case their rebreathers failed. A fast RIB was placed on standby (just in case it was needed for emergency evacuations) and was always close to the deco trapeze and the shot line. Furthermore, the project dive protocol covered emergency procedures for a variety of situations. A number of pre-project meetings were also held with staff members from the hyperbaric chambers of Gozo and Malta. Besides being made aware of our operations and dive profiles, they were also on standby for any emergency that may have occurred.

Project Outcomes

The 2018 season may be considered as highly successful. The main objective of the season was to conduct the archaeological excavations at 110 meters of depth without compromising scientific standards. Despite the constraints and the lack of established approaches for work at this depth the

project was executed successfully and safely. The rest of the objectives were reached and these include the following achievements:

1) Six permanent survey control points were placed at permanent locations around the site.
2) Excavation equipment, hydraulic hoses, submersible pump, dredges and hoses were tested, lowered and installed at depth near the grid and connected to the pump.
3) Excavation to full scientific standards was successfully accomplished at a depth that, until September 2018, was considered to be beyond the depth of diving archaeologists.
4) A system was installed so as to collect spoil and thus reduce the risk of missing important archaeological evidence.
5) Photogrammetric surveys of the excavation trench were accomplished daily with data processed on the same day as data acquisition. In this way, 3D models, orthophotos and DEMs were used for daily planning and refinement of excavation strategies.
6) Digital records of excavation depths were produced to millimetric accuracy.
7) A Site Recorder data base was established and populated with data/information dating back to 2007. The database was subsequently updated on a daily basis.
8) Sediment samples were collected and made available to scientists as control samples.
9) Three amphorae and one grinding stone were recovered for further study.
10) A small (loose) fragment of wood was discovered in the upper levels of the sediment. This was recovered and sent to a laboratory in France for testing.
11) A public talk was organised by the Munxar Local Council in Xlendi square. One talk was delivered J. Wood, one of the Royal Navy divers who took part in the first ever Xlendi expedition in 1960. The other talk was by T. Gambin who spoke about the 2018 excavation. This event was well attended and enabled the team to share its work with the local community as to the progress of the project. (**Fig 15**).
12) A small but effective exhibition with artefacts recovered during previous campaigns was opened for the general public in the Citadel of Rabat, Gozo (**Fig 16**). Visitors to the exhibition between September 22nd and 10th November 2018 number over 7500.

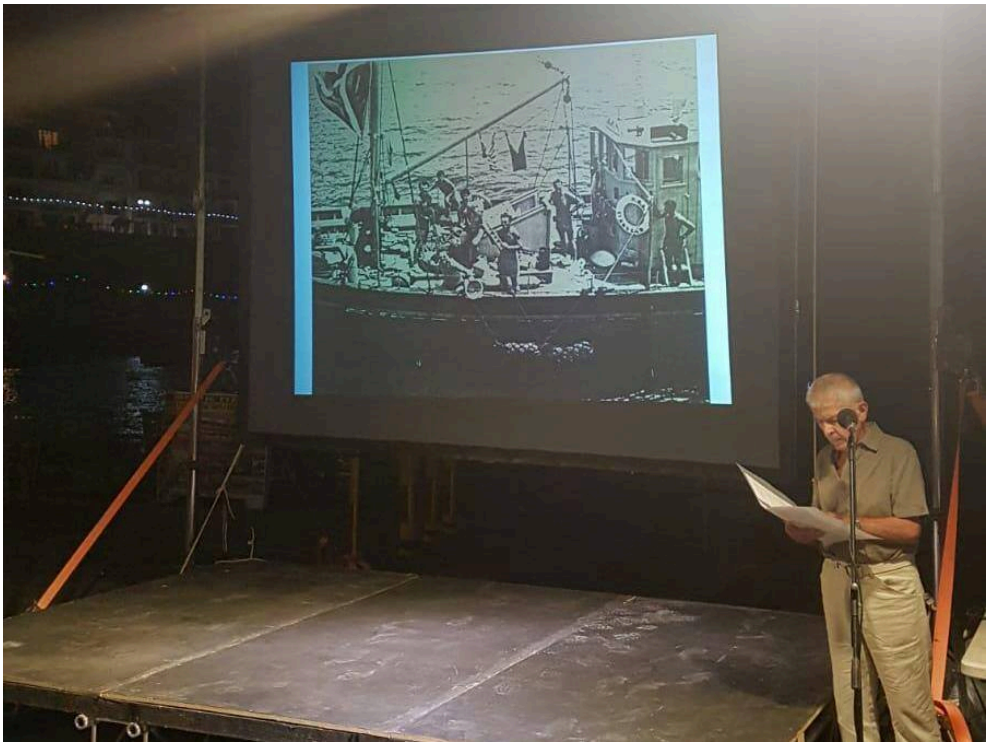

Fig 15. John Wood delivering his talk on the first project in Xlendi Bay (T. Gambin).

Fig 16. Part of the Phoenician Shipwreck Exhibition (T. Gambin).

Concluding Remarks

When assessing the project, it is imperative to keep in mind that no manual exists for manual archaeological excavations and work at such depths and the approaches used and described are a hybrid of established practices and experimental ones. However, this does not mean that the scientific approach was compromised in any way. The combination of factors (i.e. the depth, the lack of an established methodology for working at such depths, and the archeological frameworks within which one has to operate within) means that the rate of progress was slightly slower than was initially planned. This is especially true when one compares this work to more 'traditional' underwater excavation (which is not a fast procedure anyway). It is envisaged that in 2019 the team will continue to excavate in the area started this season. However, through the experiences garnered during the 2018 season it is envisaged that next year's excavations will be expedited more positive results will be forthcoming.

Appendix A

Collaborative Institutions

University of Malta

Heritage Malta

Universitaire Aix Marseille

Centre national de la recherche scientifique (CNRS) - Marseille

IMBE - Aix en Provence

University of Urbino

University of Tuibingen

Oxford University

Mediterranean Institute of Biodiversity and Marine and Continental Ecology (IMBE)

Offshore support provided by: RPM Nautical Foundation

Appendix B

Project Team

Technical Divers

T. Gambin (Malta)

D. Gration (UK)

K. Hyttinen (Finland)

I. Wallin (Finalnd)

J. Wood (Malta)

A. Castillo (Malta)

G. Iaria (Italy)

P. Vaittinen (Finland)

T. Nevalainen (Finland)

P. Lammi (Finland)

J. Smith (UK)

N. Taylor (UK)

P. Toomer (UK)

A. Lepine (UK)

Shallow Diver Support

D. Kovacevic (Serbia)

L. Briggs (USA)

S. Batrolo (Malta)

Boatmen

K. Vella (Malta)

R. Forace (Malta)

Archaeology and 3D (on land)

J. C. Sourrisseau (France)

P. Drap (France)

Appendix B

International Outreach related to Phoenician Shipwreck

January 2018

Talk delivered at Centre Camille Jullian, Aix en Provence, France.

February 2018

Talk delivered at the Finnish Heritage Agency, Helsinki, Finland.

May 2018

Talk delivered at Haifa University, Israel.

October 2018

5 talks on various aspects of the shipwreck delivered at the 9th International Congress on Punic and Phoenician Archaeology, Merida, Spain.

December 2018

Talk to be delivered at the EUROTEK Tech Diving conference, Birmingham, UK.