

# The Phoenician Shipwreck off Gozo

THE 2021 SEASON  
T. GAMBIN



L-Università  
ta' Malta

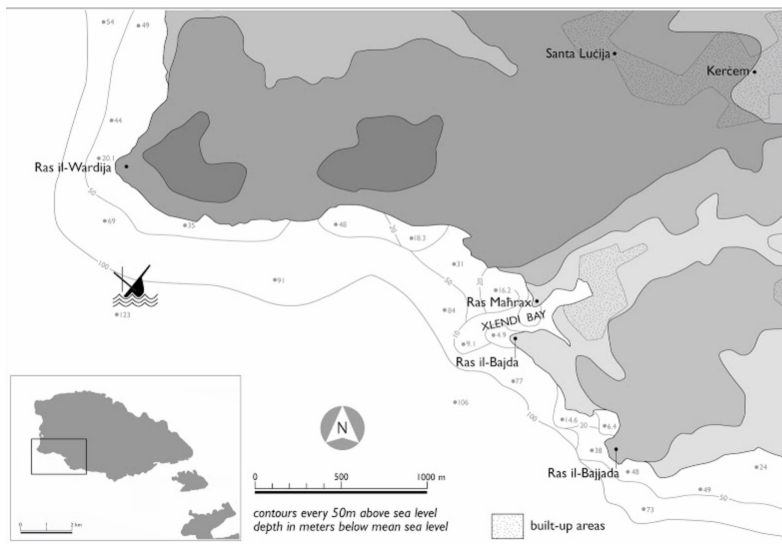


## Preamble

Research on the Phoenician shipwreck has been ongoing since its discovery in 2007. The site was discovered 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 surrounding the islands of Malta and Gozo. Such a map is a key feature of the strategic approach to managing and protecting the underwater cultural heritage of the Maltese Islands.

## 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 (**Fig. 1**). The visible part of the site rises no more than one meter off the seabed. It is possible to discern minor damage caused by traditional bottom-fishing techniques practiced in the past. However, the site is very well preserved and retains a distinguishable outline.



**Figure 1:** Map of the southeast coast of Gozo indicating the approximate location of the Phoenician wreck site marked by the ship symbol (M. Anastasi)

The dimensions of the shipwreck are 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 with systematic recovery of objects conducted in 2017, the excavation by a team of divers executed in 2018 and 2019.

### **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 (ROV).

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.

2018: Start of excavation of a 4x2 meter test trench.

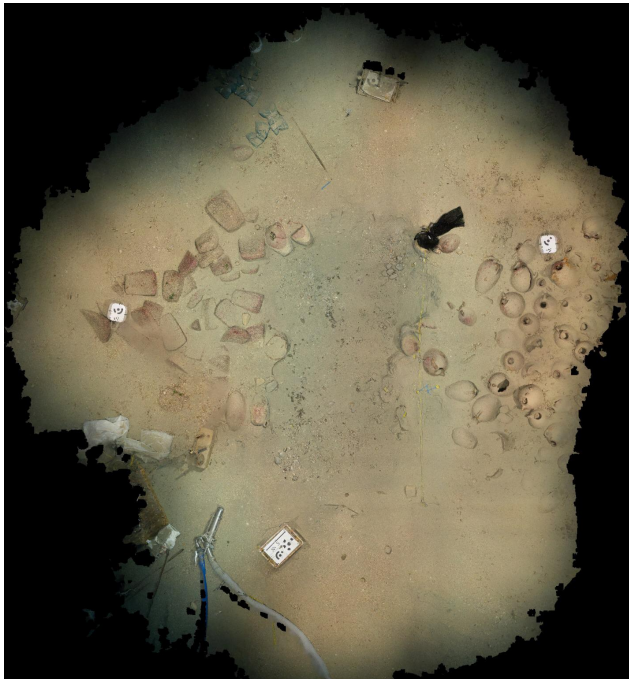
2019: Continuation of excavation of a 4x2 meter test trench.

2020: recovery of objects and continuation of excavation of a 4x2 meter test trench.

### **Aim of the 2021 Project**

1. To continue surveying and recording the entire site and the excavation progress through the use of advanced 3D photogrammetry.
2. To finish the excavation of the 4 x 2-meter test trench started in 2018, located at one extremity of the site (**fig. 2**).
3. To recover remaining objects from trench
4. To expose and record ballast in situ

5. To expose and record timbers in situ
6. To cover the trench with geo-textile so as to close off excavation.
7. To promote interdisciplinary studies through objects and samples recovered during the excavation.
8. To raise public awareness, locally and internationally, of the archaeological significance of the Phoenician shipwreck.



**Figure 2:** Trench as left at the end of the 2020 season.

### **Fieldwork Procedures and Methods**

The overall aims of the project were clearly laid out in the Project Manual and the Project Diving Plan. These documents were disseminated to all participants before the commencement of the project. An overview of planned activities was presented in the initial briefing sessions.

For the duration of the project, a brief was delivered by the Project Director (PD) and Dive Safety Officer (DSO) the night before each working day (**fig. 3**). Objectives and roles were allocated, feedback taken into account and observations shared to consolidate knowledge of the site and facilitate the next day's work. Each main diving team member was allocated a specific task including excavation, 3D modelling or video imagery, or in a

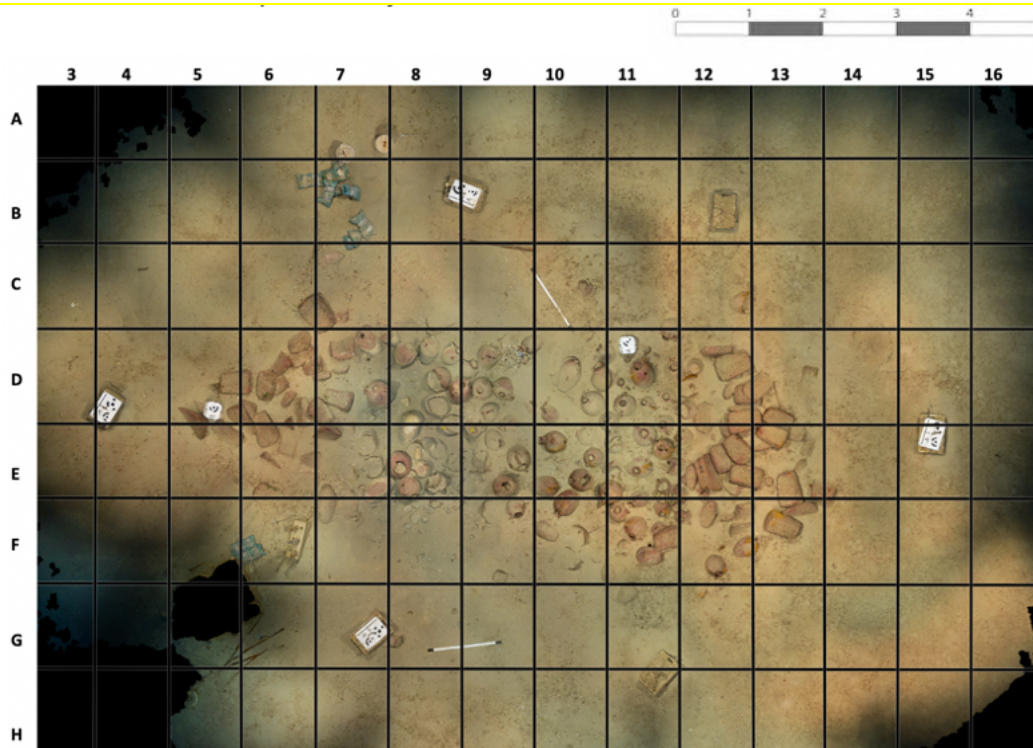
safety role. The DSO covered the dive plan, procedures and safety elements. Dive teams would subsequently meet to discuss the specificities of their role in order to fulfill their role efficiently. The plan was posted in a shared group message for reference. Due to Covid-19, most team members participated for the majority of the project. Divers arriving at different stages of the project were briefed individually.



**Figure 3:** Briefings by Project Director (J. Caruana).

The first diving task was to connect the main 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 move to and from the wreck and is essential due to the limited bottom. Subsequent preparatory dives included the placing of scales needed for photogrammetric recording and the complete removal of the geotextile.

**Figure 4** shows the extent of the virtual grid over the entire site. Excavation of the test trench was continued systematically in an area covering 4x 2 m. The quadrants excavated were 7F to 7D and 8C to 8F (**Fig. 4**).



**Figure 4.** Site with grid reference (M. Kassulke).

Following the successful use of the technique during the 2018-2020 excavations, the excavation team used a hydraulic-powered submersible pump with a hydraulic machine housed on the bow deck of the boat (**fig. 5**). When possible, excavations were conducted by teams of three divers. The hand-fanning technique was used to dislodge sediments although the lower levels of the archaeological deposit necessitated the use of trowels. Systematic excavation ensured progress in a controlled manner. Sherds and other archaeological materials were placed in mesh bags that were marked and designated for each of the grid's subunits.

The ROV was deployed during diving operations. The ROV provided a line of communication with the surface and footage of how the excavation progressed on that particular day (**fig. 6**).



**Figure 5:** Surface team being briefed on the hydraulic machine (T. Gambin)



**Fig 6.** Divers being observed from the surface with the ROV (C. Gauci).

The safety divers were responsible for recovering the shot line, deploying the decompression trapeze, assisting divers into the water, and relieving the rebreather divers from bailouts, cameras, and artefacts brought up by the deep divers. They also assisted with setting the flotation drums on the shot line as well as the hydraulic hoses (**figs 7 and 8**).



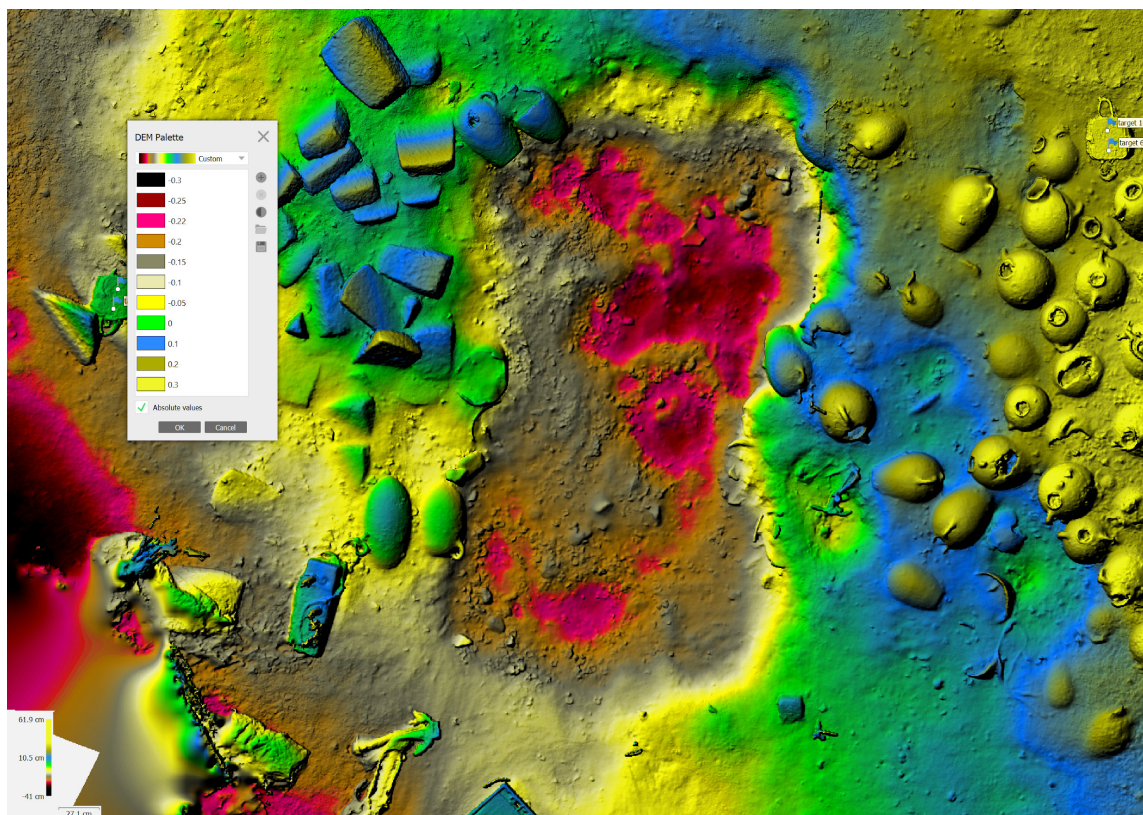
**Figure 7:** Safety divers setting up the flotation drums on the main shot line (K. Goovaerts)



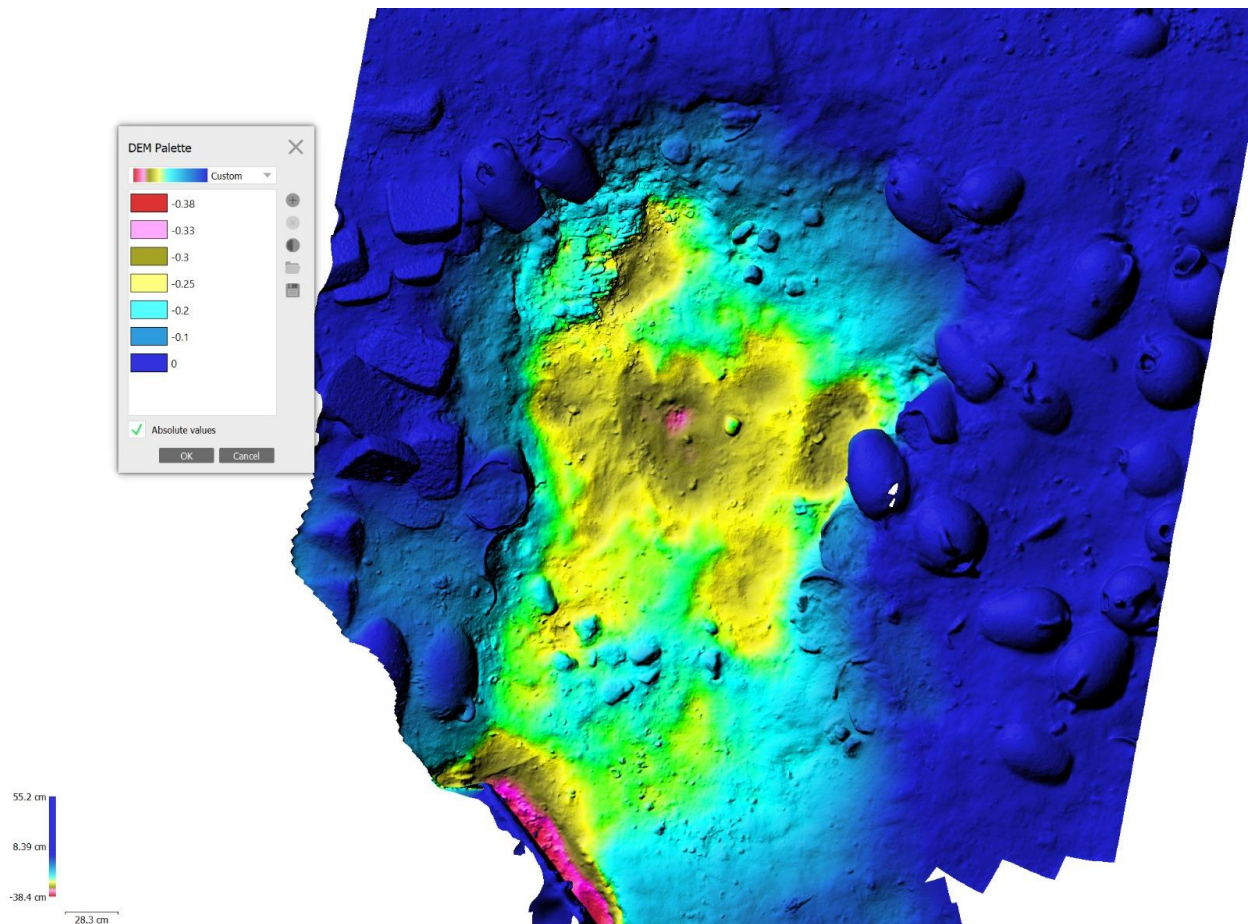
**Figure 8:** Safety diver relieving a rebreather diver from bailouts (K. Goovaerts)



The first dive of the day was dedicated to data acquisition with the 3D Team recording the trench as left at the end of the previous day's operations. Progress was recorded on a daily basis by comparing dense clouds produced from the 3D photogrammetry models, orthophotos and DEMs (Figs. 9 and 10). All data, including measurements, were inputted and stored into the Site Recorder database started in 2018. Before its removal, the grid's position was marked by iron rods so as to facilitate its re-installation in 2021. A final 3D survey was conducted on the last day of operations prior to covering the excavated area with two layers of geotextile held down by sandbags to preserve the site in-situ.



**Figure 9:** DEM showing levels in trench after conclusion of 2020 season (K. Hyttinen).



**Figure 10:** DEM showings levels in trench after conclusion of 2021 season (K. Hyttinen)

Small objects such as ceramic sherds and organic material including wood fragments and molluscs which came loose during excavation were put in a mesh bag. This was either clipped to the diver's equipment and passed to the safety diver during decompression or placed in the lifting basket. The lifting basket was used once to recover grinding and rubbing stones (**fig. 11**). The divers would roll or lift the assigned objects into the basket, then indicate to surface support that the basket would break the surface using a pink SMB. Once the lifting bag broke the surface, a free diver secured the basket to the winch line while keeping clear of the lifting bags. The basket was raised to the lift, the lift bags emptied, the basket brought onboard, and the objects moved to secure positions onboard.



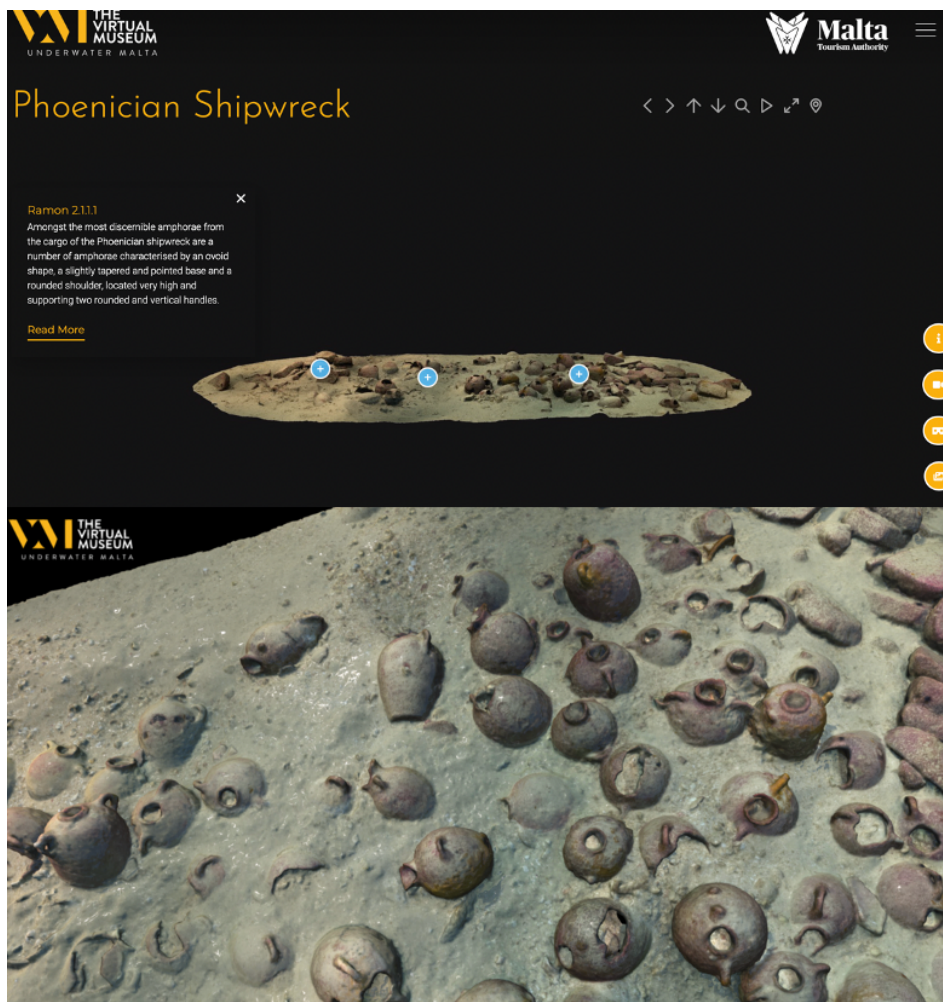
**Figure 11:** Basket loaded with rubbing stones (J.Wood)

The collected material, brought back to base in mesh bags, was sorted once back at base. These mainly constituted: (1) ceramics, (2) wood, (3) carbon, (4) metal, (5) bone, and (6) concretions (**figs. 12 and 13**). The artefacts were transferred to the University of Malta to continue the process of desalination.



**Figures 12 and 13:** Sorting of recovered material (C. Gauci)

Due to Covid-19, aspects of public outreach strategy had to be adapted. The Open Day at Xlendi Bay organized in collaboration with the Munxar Local Council, as well as the stall at Science in the City showcasing amphorae and 3D models of the wreck, were both cancelled. However, the increased focus on online education and outreach over the past years proved timely and invaluable. The Phoenician Wreck was one of the first 10 sites included on the launch of the Virtual Museum- Underwater Malta (**figs. 14 and 15**). The aim of the online platform is to use 3D, Virtual Reality, video and photography to provide access to and share Malta's unique underwater cultural heritage with all members of the public. The Phoenician Shipwreck website was launched in Spring of 2020 and is dedicated specifically to news and progress about the site. This has also seen significant interest (**Appendix D**).



**Figure 14 and 15:** Screenshots from the Phoenician Shipwreck interactive page of the Virtual Museum.

### Artefacts Recovered

The objects raised are of a mixed typology and material makeup.

Date	Area	Find No.	Organic ?	Find type	Special find No.	Description
03.09.21	F7-D7	1	yes	Teredos navalis		large shipworm

31.08.21	F7-D7	2		Pottery		sherds
02.09.21	F7-D7	3	yes	wood		fragments
02.09.21	F7-D7	4	yes	carbon		fragments/same container as find no.3
01.09.21	F7-D7	5	yes	wood		fragments
31.08.21	F7-D7	6		concretion		small/medium concretions, material unknown
06.09.21	F7-D7	7	yes	wood		small/medium fragments
06.09.21	F7-D7	8	yes	carbon		small fragments/ same container as find no. 7
03.09.21	F7-D7	9	yes	wood		small fragments
03.09.21	F7-D7	10	yes	carbon		small fragments/same container as find no. 9
07.09.21	F7-D7	11	yes	shells		sample of shells/loose trench material
08.09.21	E8/F8	12		Pottery		large sherds
09.09.21	E8/F8	13	yes	shell		single shell sample
15.09.21	E8/F8	14		pottery		sherds
08.09.21	F7-D7	15	yes	wood		small fragments
08.09.21	F7-D7	16	yes	carbon		small fragments/ same container as find no.15
01.09.21	F7-D7	17		concretion		medium-sized concretions, material unknown

02.09.21	F7-D7	18		concretion		small-sized concretions, material unknown
31.08.21	F7-D7	19		concretion		small/medium concretions, material unknown
03.09.21	F7-D7	20		concretion		small-sized concretions, material unknown
02.09.21	F7-D7	21		Pottery		fragments, rim sherd
07.09.21	F7-D7	22		Pottery		fragments
06.09.21	F7-D7	23		Concretion		small/medium concretions, material unknown
03.09.21	F7-D7	24		Pottery		sherds
08.09.21	C8-F8	25		Pottery		sherds
31.08.21	F7-D7	26	yes	wood		fragments
01.09.21	F7-D7	27		Pottery		sherds
07.09.21	F7-D7	28		concretion		small-sized concretions, material unknown
06.09.21	F7-D7	29		Pottery		small sherds
06.09.21	F7-D7	30		metal	1	possible metal, same container as find no.29
07.09.21	F7-D7	31	yes	wood		fragments
07.09.21	F7-D7	32	yes	carbon		small fragments, same container as find no. 31
09.09.21	E8/F8	33	yes	wood		small fragments

08.09.21	F7-D7	34	yes	shells		shells samples
09.09.21	C8-F8	35		Pottery		sherds
09.09.21	E8/F8	36	yes	wood		fragments
09.09.21	E8/F8	37		metal	2	possible metal, same container as finds no. 35,36, 37
09.09.21	F8	38	yes	tooth	3	single tooth
09.09.21	C8-F8	39		Pottery		small sherds
09.09.21	E8/F8	40	yes	carbon		single fragment, same container as find no. 39
09.09.21	E8/F8	41	yes	wood		small fragments
08.09.21	F7-D7	42		metal	4	possible metal
09.09.21	C8-F8	43	yes	wood	5	large fragment of wood
08.09.21	E7	44	yes	wood	6	large fragment of wood
08.09.21	E7	45	yes	wood	7	large fragment of wood
11.09.21	F8	46		Pottery		sherds
11.09.21	E8	47		Pottery		sherds
16.09.21	Sandbag 2020	48		Pottery		sherds
13.09.21	E8	49		Pottery		medium-sized sherds



11.09.21	E8	50		Pottery		sherds
16.09.21	Sandbag 2020	51		Pottery		sherds
13.09.21	E8	52	yes	wood		small fragments
13.09.21	E8	53	yes	wood		small fragments
14.09.21	E8/F8	54		concretion		concretions, material unknown
11.09.21	E8	55	yes	carbon		carbon fragment
11.09.21	E8	56	yes	bone	8	bone fragment
11.09.21	F8	57	yes	wood		small fragments
11.09.21	E8	58	yes	wood		small fragments
11.09.21	F8	59	yes	carbon		carbon fragment
11.09.21	F8	60		concretion		material unknown
11.09.21	E8	61		concretion		material unknown
08.09.21	E7	62		Pottery	9	rim or handle?
15.09.21	E8/F8	63	yes	wood		small fragments
14.09.21	E8/F8	64		Pottery		sherds
14.09.21	E8/F8	65	yes	bone?	10	possible worked bone

14.09.21	E8/F8	66		metal?	11	possible metal - bead-like shape
14.09.21	E8/F8	67		metal	12	possible metal - tubular shape/ hollow centre?
14.09.21	E8/F8	68	yes	bone?	13	possible bone fragments
14.09.21	E8/F8	69	yes	wood		small fragments
14.09.21	E8/F8	70	yes	bone?	14	possible bone fragments
14.09.21	E8/F8	71	yes	wood		small fragments
14.09.21	E8/F8	72	yes	wood		single fragment
14.09.21	E8/F8	73	yes	wood		small fragments
31.08.21	F7-D7	74		metal	15	small fragments of possible metal
15.09.21	E8/F8	75	yes	wood	16	large wood fragment
15.09.21		76	yes	wood		Wooden debris, small pieces
11.09.21	E8	77		Pottery		sherds
13.09.21	E8	78		Pottery		sherds, handle?
13.09.21	E8	79	yes	wood	17	Medium-sized fragment of wood and some smaller pieces
14.09.21		80		pottery	18	Large sherds of pottery
15.09.21	D6	81	yes	fibre	19	a piece of cloth-like fibre

15.09.21		82	yes	Carbon	20	A piece of carbon
16.09.21	Mix	83		metal?	21	small fragments of possibly metal. General Sandbag 2020
16.09.21	mix	84	yes	wood	22	small fragments of wood
16.09.21	mix	85	yes	bone?	23	piece of bone
16.09.21	mix	86	yes	carbon	24	small fragments of carbon
14.09.21		87		concretion		concretions, material unknown
14.09.21		88		Ballast Stone		
09.09.21	C8.F8	89		Ballast Stone?		
14.09.21		90	yes	Shell		two shells
11.09.21	E8	91		concretion		concretion of unknown material
07.09.21	F7-D7	92		stone (possible ballast stone)		stone (possible ballast stone)
31.08.21-08.09.21	F7-D7	93	yes	Shells		General trench, set of shells
31.08.21-08.09.22	F7-D7	94	yes	Bone	25	Pieces of bone

31.08.21-08.09.23	F7-D7	95		Misc. Concretions		bits of concretions
31.08.21-08.09.24	F7-D7	96		concretions and possibly metal		concretions and possibly metal (to identify)
31.08.21-08.09.25	F7-D7	97	yes	Seed	26	one seed (to check)
31.08.21-08.09.26	F7-D7	98	yes	carbon		small pieces of carbon
31.08.21-08.09.27	F7-D7	99		metal?		multiple pieces of material possibly metal.
31.08.21-08.09.28	F7-D7	100		pottery		multiple sherds of pottery

**Table 1: Recovered material in 2021**

### Special Finds

The recovery of a human tooth is a unique find. A lower, right, first molar, is the first human remains found on the shipwreck site. The tooth was located in the lower sediments of grid reference **F8 (figs. 16 and 17)**. The tooth will undergo further testing including carbon dating and DNA analysis. The results from these tests will provide important genetic insights.



**Figure 16:** Human tooth recovered.



**Figure 17:** bottom-up angle of human tooth highlighting the large internal pulp chamber

Organic artefacts were also recovered. Pieces of wood that came loose during excavation that may be hull fragments were collected (**figs. 18 and 19**). Scientific testing will include Carbon 14 dating and determining the species. A significant find of the 2021 season was the discovery of six timber planks in situ. The timber was carefully exposed with a combination of hand fanning and dredging, and recorded in millimetric detail using 3D photogrammetry. Ballast stones were also recorded in situ, revealing the relationship between the cargo and the ship's ballast and hull (**fig. 20**). This relationship will provide important information on shipbuilding techniques and hull construction. The planks were left in situ and covered in several layers of geotextile and spoil with the aim of continued long-term preservation. Bone fragments were also recovered, however, whether these are human or animal bone can only be conclusively determined through further testing (**fig. 21**). A significant ceramic find was that of a complete urn with four lugs. A possible etching on the urn can also be discerned, but requires further analysis (**fig. 22**). Similar urns have been recovered in previous seasons, however, this one differs due to circular perforations in the lugs (**fig. 23**).



**Figure 18 and 19:** Wooden fragments loosened during excavation (M. Sausmekat)



**Figure 20:** Orthophoto recording the relationship between cargo, ballast and timber planks exposed in situ (K.Hyttinen)



**Figure 21:** Bone fragment recovered during excavation (K. Hyttinen)



**Figure 22:** Recovered urn with possible etching (M. Sausmekat)



**Figure 23:** Top-down perspective of the urn highlighting the four perforated lugs (M. Sausmekat)

## **Diving Appraisal**



All updated 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 2021 season. In addition, participants were required to sign both the Dive Plan and the Excavation Manual as a confirmation. 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 in place so as to ensure diver safety. Individual diver checks were executed on a daily basis by a member of the surface support team. Further back-up cylinders were carried by divers in case their rebreathers failed.

The Heritage Malta RIB acted as the fast boat and was placed on standby and remained close to the decompression trapeze and shot line. The role of the fast boat was to keep the area clear of boat traffic, to act as backup for emergency evacuation procedures, to deploy the emergency bailout line if needed, as well as transporting divers quickly to shore in medical emergencies. VHF contact was maintained between the two vessels (**fig. 24**).



**Figure 24:** Heritage Malta fast RIB on position next to the decompression station (K. Tretheway)

Furthermore, the project dive protocol covered emergency procedures for a variety of situations. Staff members from the hyperbaric chambers of Gozo and Malta were briefed and informed before diving operations commenced. This meant that they were aware of the project's

operations and team dive profiles, and were also on standby for any emergency that may have occurred.

## **Project Outcomes**

The main objectives of the season was the conclusion of the excavation of the ‘test trench’ started in 2018. Lessons learned over the past diving seasons were taken into consideration and procedures were adapted to ensure that the project was executed as efficiently and safely as possible. The objectives reached include the following achievements:

- 1) Photogrammetric surveys of the excavation trench were accomplished daily. The data was 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.
- 2) Digital records of excavation depths were produced to millimetric accuracy.
- 3) Multiple fragments of loose wood were discovered in the lower levels of the sediment.
- 4) Lower levels of site were reached with the ballast layer and timber planks being observed, exposed, and recorded in situ.
- 5) Archaeological objects from the 4x2m grid were recovered
- 6) The site was covered with layers of geo-textile, sandbags and spoil material as part of a long-term preservation strategy.
- 7) Any tools that were used throughout the project were recovered in order to leave the site as undisturbed as possible post-excavation.

## **Concluding Remarks**

The 2021 season marks the end of fieldwork for the Phoenician Shipwreck Project. The aims and objectives of the season were achieved, and a number of ceramic and organic materials were recovered. Research produced by this project is ongoing and is consistently bringing forth more evidence and results which, through publications and outreach, will help disseminate the project to academic communities and the general public alike. All the objectives set out for the four-year excavation have been fulfilled - successfully and safely.

**Appendix A**  
**Collaborative Institutions**

University of Malta

Heritage Malta

Superintendence of Cultural Heritage

Universitaire Aix Marseille

Centre national de la recherche scientifique (CNRS) - Marseille

University of Urbino

University of Tuibingen

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

## **Appendix B**

### **2021 Project Participants**

Project Director: T. Gambin

Co-Director (archaeology): J. C. Sourisseau

Surface Operations Director: M. Sausmekat

Dive Safety Officer: D. Gration

Medical Officer (and support diver): Dr C. Gauci

3D Team: J. Wood and K. Hyttinen

Videographer: GM. Iaria

Rebreather Divers: N. Taylor; K. Haegens; M. Vertommen P. Lammi; P. Vaittinen; T. Nevalainen; PJ Prinsloo; P. Toomer; R. Bartolo; A. Sant; D. Bianco; C. Vella;

Support Divers: N. Sanchez Lopez; K. Goovaerts; K. Tretheway

Surface Support: M. Vella; J. Mifsud; M. Kassulke, and J. North

Boat Skippers: H. Borg; K. Azzopardi

## **Appendix C**

### **Outreach related to the Phoenician Shipwreck**

#### **May 2020:**

Paper delivered for the Conessioni mediterranee, una prospettiva da Tas-Silg organized by the Istituto Culturale Italiano. (Virtual seminar due to COVID 19)

#### **October 2020:**

Talk delivered for the Archaeological Society Malta (Virtual seminar due to COVID 19)

#### **April 2021**

Museo di Cabras – Alla scoperta del relitto fenicio

#### **October 2021**

Paper delivered at Naxos Conference, Sicily

## Appendix D

### 2021 Dive Statistics

Over a 26-day period over 150 dives to 110m were completed.

Time in water:

Over 400 hours. Less than 10% of this total was spent at 110m.

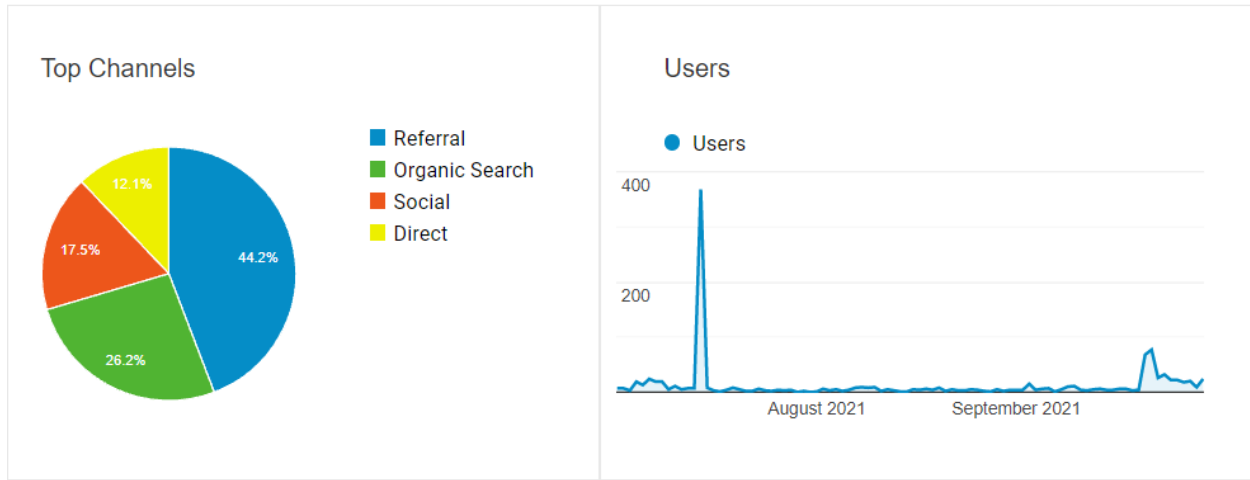
Open circuit divers completed over 200 dives to ensure the safety of the deep divers during decompression stops. These dives were also essential for the smooth running of the operations.

<b>Phoenician Expedition September 2021</b>					
<b>Gases Used</b>					
<b>Gas Mix</b>	<b>Tank Size</b>	<b>No. of Fills</b>	<b>Litres of O<sub>2</sub></b>	<b>Litres of He</b>	<b>Litres of Air</b>
O <sub>2</sub>	3L	191	126,060		
7/75	3L	175	8,085	86,625	20,790
13/60	11.1L	2	635	2,931	1,318
18/45	11.1L	9	3,956	9,890	8,132
50/20	11.1L	6	7,326	2,930	4,396
16/45	3L	6	634	1,782	1,544
12/55	3L	2	158	726	436
Air	0.8	180			31,680
Air	3L	17			11,220
Air	15L	80			264,000
O <sub>2</sub>	5.7L 160 bar	11	10,032		
<b>Total</b>			<b>156,886</b>	<b>104,884</b>	<b>343,516</b>

## Appendix E

### Phoenician Shipwreck Website Traffic Statistics 1 July-30 September 2021

<https://phoenicianshipwreck.org/>



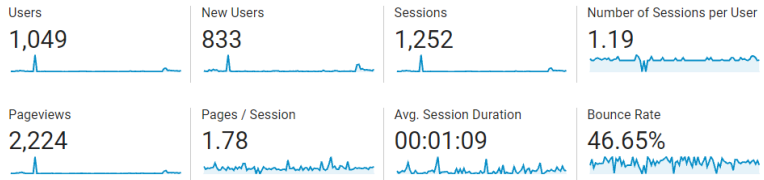
	Acquisition			Behavior		
	Users	New Users	Sessions	Bounce Rate	Pages / Session	Avg. Session Duration
	1,049	833	1,252	46.65%	1.78	00:01:09
1 ■ Referral	472	<div style="width: 47.2%;"></div>		19.53%	<div style="width: 19.53%;"></div>	
2 ■ Organic Search	280	<div style="width: 28.0%;"></div>		64.66%	<div style="width: 64.66%;"></div>	
3 ■ Social	187	<div style="width: 18.7%;"></div>		70.26%	<div style="width: 70.26%;"></div>	
4 ■ Direct	129	<div style="width: 12.9%;"></div>		73.08%	<div style="width: 73.08%;"></div>	



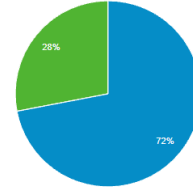
Overview

Users vs. Select a metric

Hourly Day Week Month



■ New Visitor ■ Returning Visitor



Country	Users	% Users
1. 🇲🇹 Malta	228	21.61%
2. 🇺🇸 United States	169	16.02%
3. 🇬🇧 United Kingdom	96	9.10%
4. 🇦🇺 Australia	31	2.94%
5. 🇮🇹 Italy	31	2.94%
6. 🇨🇳 China	23	2.18%
7. 🇫🇷 France	23	2.18%
8. 🇨🇦 Canada	19	1.80%
9. 🇩🇪 Germany	19	1.80%
10. 🇪🇸 Spain	19	1.80%

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