

Mapping ancient water management systems

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Upon the mention of underwater archaeology one's mind drifts to shipwrecks and sunken cargo lying on the seafloor. There are however other underwater sites besides shipwrecks and some of these sites are not necessarily in the sea. Since 2006, the Department of Classics and Archaeology of the University of Malta together with California Polytechnic (CALPOLY) University from the USA have conducted an innovative project exploring wells, cisterns and water galleries in both Malta and Gozo. This project has a number of aims. Primarily, the intention of this survey is to create a record of the various systems and features used for water management in the past. The second aim (but no less important) is to train computer engineering students in robotics and control engineering. The project co-directors are Dr Timmy Gambin from the University of Malta and Professor Chris Clark from CALPOLY.

In order to achieve these aims the project team organized a number of fieldwork sessions with the intention of allowing the students to learn by doing. Prior to travelling to Malta, participating students were lectured on the islands' history and culture as well on the various technical facets of the project that they would be handling. Local logistics such as access to sites, lodging and transport were taken care of by the Maltese members of team which includes Keith Buhagiar, Malta's leading researcher on ancient water management systems. Such preparations enabled the team to hit the ground running once in Malta. Initially, the main areas of focus were the wells of the ancient walled towns of Mdina and the Citadel in Gozo. The rationale behind the decision to start within the confines of these towns was guided by the possibility of discovering ancient wells and cisterns currently situated in the Baroque palaces, churches and monasteries that are visible today. Guided by the theory that people would have been

reluctant to excavate new wells and cisterns the team set out to discover how the past inhabitants would have reutilized extant water features. It was also important to distinguish and document the various ways in which people harvested such a precious resource.

In order to achieve these aims, the team deployed small remotely operated vehicles (ROVs) with an array of sensors including cameras and sonar heads. The former were used to capture visual images of the sites whereas the latter were used to acquire data that could be used in conjunction with mapping software to create site maps and plans. In order to function properly the ROVs needed at least 50 cm of

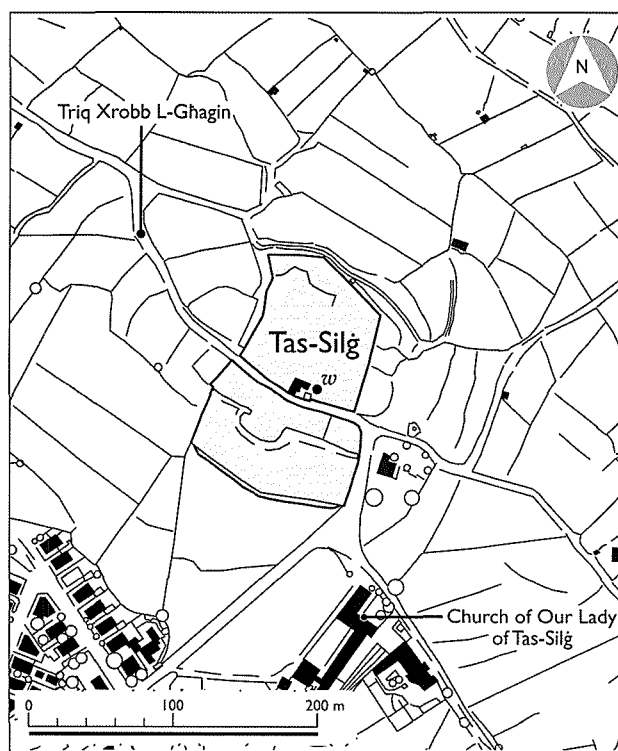


Figure 1. The site of Tas-Silg. The well explored in the northern enclosure is marked "w" (drawn by Maxine Anastasi).

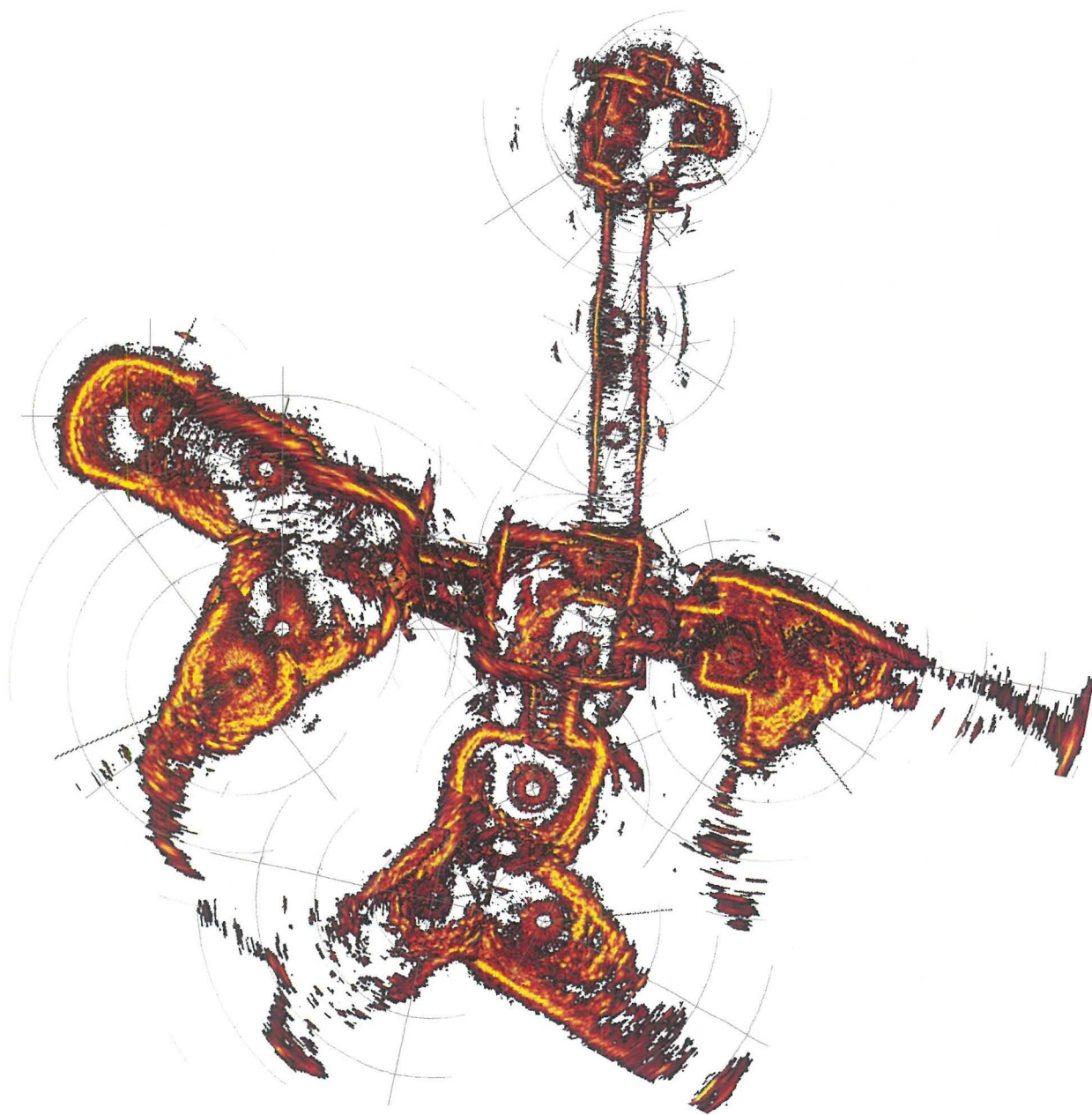


Figure 2. Sonar mosaic of cistern complex under the sanctuary of Tas-Silġ, northern enclosure. Distance between lines = 1m.

water. These small ROVs were best suited for this type of project due to the limited access available through small wellheads. Furthermore, by using robots rather than divers, the risk to humans was limited. Most of the wells and cisterns explored were found to have water and a number of different typologies were recorded. Many traditional bell-shaped cisterns were recorded with some of these connected to others by a series of tunnels. Other premises had deeper wells cut into the rock penetrating the water-table. Of interest is the noticeable way in which shafts have been extended over time, confirming the notion that these water management systems were reutilized by the various occupants of the site.

Apart from Mdina and the Citadel, the team also explored other historic sites, including two in Birgu, where the team surveyed the wells situated inside the Inquisitor's Palace and those of the upper part of Fort St Angelo. Over the past two seasons, we have taken this concept of exploration away from urban centres to include rural sites as well as natural freshwater galleries. Various rural water galleries have been explored and mapped including that at the Carmelite monastery at Tal-Lunzjata in the limits of Rabat whereas in Gozo, the water gallery at Ghar Ilma was also mapped and surveyed.

For the first time since the start of this project, the team undertook the survey of a large natural feature. L-Ghar ta' Harq Hamiem in Pembroke is a large cave filled with freshwater. Here the team faced new challenges such as the inaccessibility of some parts of the cave. With some good planning and piloting we managed to penetrate deep into this cave and gather essential data for the project. Unfortunately, this unique site is heavily polluted with numerous objects dumped into the main pool.

The last site visited in 2011 provided some of the most interesting results. The sanctuary of Tas-Siġ in Marsaxlokk needs little introduction and the wells of this multi-period site provided an excellent opportunity to use the knowledge we have garnered over the past years. Two wellheads are present and accessible in the northern part of the site (Fig. 1) and an entire day was spent collecting data of the various

passages – many of which are intact and still carry water. By stitching sonar images from the various tunnels that could be explored we were able to create a mosaic of what must be one of the best preserved ancient water management systems on the island (Fig. 2).

Over the next two years it is envisioned that the experience and methodologies gained and developed in Malta and Gozo will be 'exported' to Spain and Italy where we will be conducting similar surveys.

A number of public institutions have helped to make this project a success. These include The Superintendence of Cultural heritage, Heritage Malta, The Cathedral Museum (Mdina), The Collegiate of St Paul, and the Water Services Corporation to which the team's gratitude is extended. We are also indebted to the numerous individuals who unselfishly allowed us to 'invade' their homes, businesses and land so as to access the sites. On a personal note, I would like to thank Professors C. Clark, Z. Wood and J. Lehr for their invaluable input into this project. Financial support from the National Science Foundation has ensured the continued success of this project.

Sites can be explored via: <http://users.csc.calpoly.edu/~cmclark/MaltaMapping/index.html>

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