Malta's prehistoric temples: conservation issues

J. Cassar

Abstract

Malta's prehistoric megalithic temples, which are World Heritage sites, are currently suffering from problems associated with the deterioration of materials as well as structural problems. These problems have been studied for many years. A Scientific Committee set up by the Government of Malta in 2000, identified those elements in the surrounding environment causing deterioration of the site. It was recommended that the sites should be protected by temporary shelters, which would provide additional time for research into the long-term preservation of these sites. The sheltering project should kick off late in 2007. In preparation, Heritage Malta has been since 2005, and is still currently, intensively studying the temples as well as conditions in and around the site. Much of this information has already been fed into the final detailing of the shelters. The data obtained from the environmental monitoring in particular will also constitute important baseline information which will then be used to compare with the altered conditions under the shelters.

Introduction

Malta's prehistoric megalithic temples, dating to the period ca 3600 2400 BC are World Heritage sites. The temples include those of Mnajdra and Hagar Qim (Figure 1), Tarxien, Skorba and Ta' Hagrat on the island of Malta, and Ggantija, on the island of Gozo. Since 2003, Malta's prehistoric temples have been managed by Heritage Malta, a Government Agency whose principal mission, as defined in the Cultural Heritage Act 2002, is to ensure that those elements of Malta's cultural heritage entrusted to it are protected and made accessible to the public. These sites were formerly under the care of the Museums Department. Both of the two locally available limestones, the Globigerina Limestone and

Figure 1: Temple complex of Hagar Qim (Heritage Malta).

the Coralline Limestone, were used in the construction of the megalithic temples. Hagar Qim and Tarxien are built entirely of Globigerina Limestone. At Ggantija, on the other hand, very little use was made of Globigerina Limestone, and practically the entire complex is built of Coralline Limestone outcropping nearby. In the case of Mnajdra, Coralline Limestone was used for the construction of some of the external walls whereas Globigerina Limestone was used for the internal walls. Decorative elements occur in most of these sites and include altars, animal reliefs and spiral motifs; these are also carved out of the soft Globigerina Limestone. All of these temples are currently suffering, to a greater or lesser extent, from a number of problems, including those associated with the deterioration of materials as well as structural problems, including a number of serious

collapses which occurred in recent years. Studies have been ongoing for many years to understand the state of conservation of these temples, and the nature and extent of deterioration, as well as to identify the causes of these problems.

Past studies

Within the framework of a multi-disciplinary joint project between the (then) Museums Department, Malta, and the University of Florence, Italy, the megalithic monuments of Ggantija, Hagar Qim and Tarxien were studied over a period of 7 years (1985 to 1991). Studies of the materials were carried out on approximately 100 samples, judiciously obtained from the stone surfaces and a few by core drilling. The majority of the samples were Globigerina Limestone, but some Coralline Limestone megaliths were also studied. Analyses included mineralogy (identification of main minerals, insoluble residues and clay fractions), petrography (preparation and examination of thin sections), chemical composition (including soluble salts), physical properties (evaluation of total porosity, pore size distribution and water absorption) and micro-structural studies.

Structural problems affecting these ancient structures were documented and assessed by means of planimetric and structural surveys, both direct and by photogrammetry. Also included were detailed mapping of the façade of the temple of Ggantija, as well as plans and elevations of all the temples under study, i.e. Ggantija, Hagar Qim and Tarxien.

Action

The first concrete steps taken towards the preservation of these temples included the setting up of a Scientific Committee by the Government of Malta in 2000. This followed from the recommendations of an International Experts Group

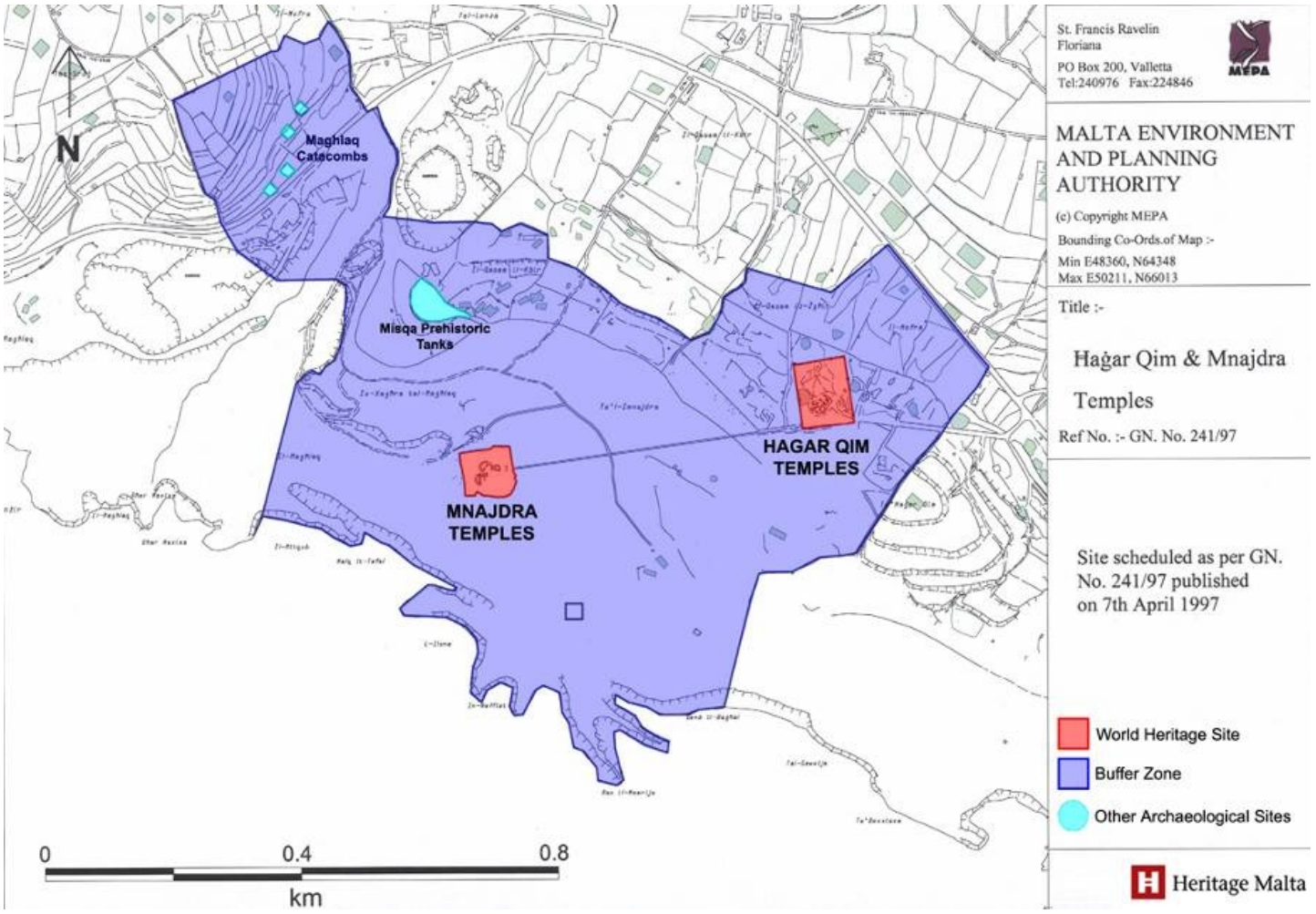


Figure 2: The two temple sites of Hagar Qim and Mnajdra (Heritage Malta).

meeting in Malta on the Conservation of Malta's Megalithic Temples, held in May 1999. The remit of this Scientific Committee was to study and give advice on possible conservation solutions for the preservation of the temples.

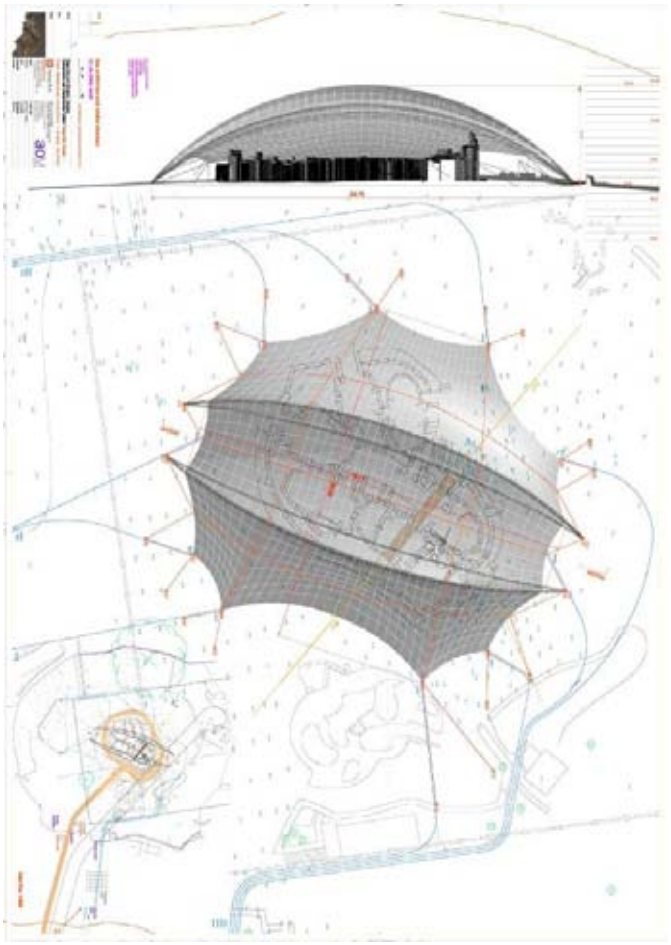


Figure 3: Model of the shelter to be constructed over the Hagar Qim temple (Walter Hunziker / Michael Kiefer).

The remit of this Scientific Committee was to study and give advice on possible conservation solutions for the preservation of the temples. The Committee identified elements in the surrounding environment as the main causes of deterioration of the site. These were acknowledged as being rain, wind (speed and direction), air temperature and relative humidity, solar radiation, and pollution, including also sea salt aerosol, Sahara dust, SO_2, NO_x and volcanic emissions, as well as biological organisms.

It was then recommended that the sites should be protected as far as possible from the effects of these adverse conditions. Shelters were proposed as being the most suitable, reversible but temporary means of protecting these ancient and fragile sites from these harsh external influences. These temporary shelters would moreover provide additional time for a deeper understanding of the effects the combination of these factors has on the temples, and will gain time to allow for research into the long-term preservation of these sites.

Following a Cabinet decision in August 2000, an international competition for the design of shelters for the sites Hagar Qim and Mnajdra (Figures 2 and 3), considered to be amongst the most fragile of the temple sites, was launched, under the auspices of the International Union of Architects (IUA) in 2003. 3.5 million Euros of funding was secured through the European Regional Development Fund, and the endorsement of the UNESCO World Heritage Committee was gained. The sheltering project should kick off late in 2007 and aims at protecting these sites for a period of between 25 -30 years. These shelters are intended as an interim measure while research continues in order to identify less visually intrusive alternatives.

In preparation for the building of these shelters, Heritage Malta has been since 2005, and is still currently, intensively studying the temples as well as conditions in and around the site. These studies include environmental monitoring, thermographic measurements, further stone sampling and analysis, measurements of water runoff, sampling and analyses of biological aerosol and atmospheric

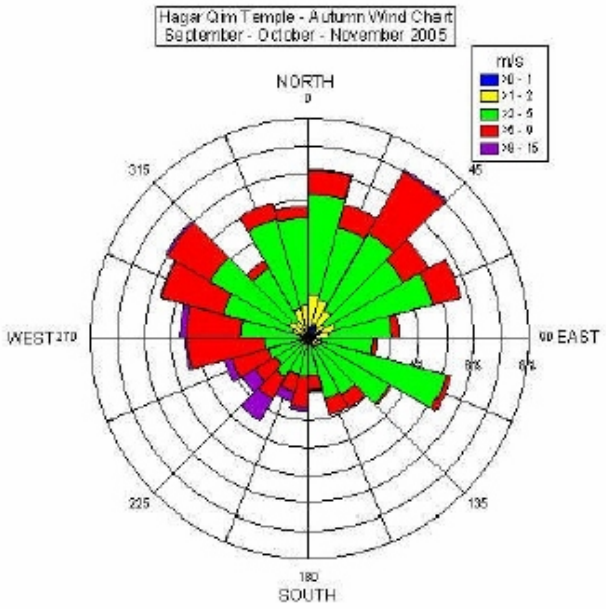


Figure 4: Hagar Qim temple autumn-winter wind chart, 2005 (Heritage Malta).

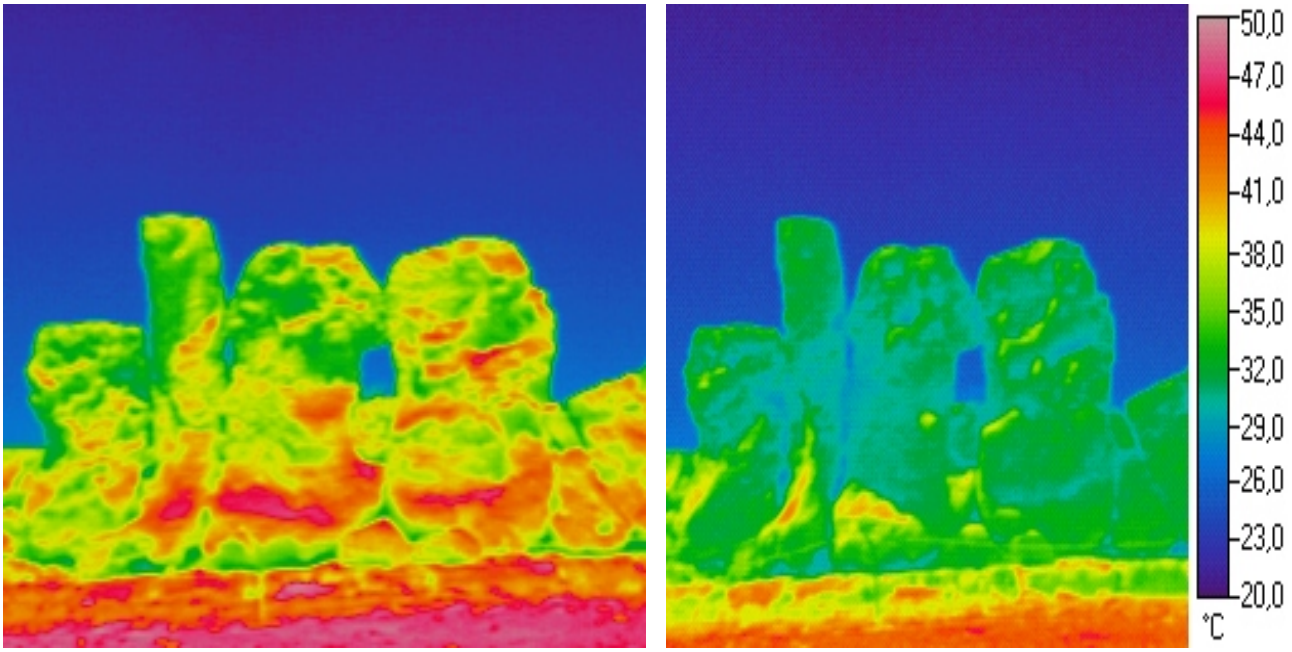
aerosol, and 3-D scanning of both sites and the surrounding terrain. much of this information has already been fed into the final detailing of the shelters. The data obtained from the environmental monitoring in particular will also constitute important baseline information which will then be used to compare with the altered conditions under the shelters. This continuous monitoring is to be shortly intensified, with additional information to be collected from inside the temples, and will continue even after the shelters have been installed. Post-sheltering data will then be comparable with data gathered before, the interpretation of which should give a deeper understanding of the complex deterioration mechanisms brought about by a combination of the factors as already mentioned above.

Environmental monitoring is being carried out by Heritage Malta staff, in collaboration with the Istituto di Scienza dell'Atmosfera e del Clima CNR ISAC Bologna Italy, and is being funded by the 2003 EU Pre-Accession funding programme. This monitoring is being achieved by means of a meteorological automatic station operating at Hagar Qim, recording air temperature, relative humidity, solar radiation, wind direction (Figure 4) and speed and rainfall.

Micrometeorological measurements are also being collected by means of two automatic stations also installed at Hagar Qim and Mnajdra. Surface monitoring includes air and surface temperatures, relative and specific humidity and time of wetness as well as dew point of the air.

Thermal Infrared measurements (Figure 5) have also been performed on the surfaces of the megaliths, using a thermal camera to monitor the heating of the stone surface. Thermographic measurements also allow for the evaluation of whether the surface conditions are subject to water condensation or evaporation.

Sampling of the stone surface has also been carried out to confirm and supplement previous studies on damage evaluation and the identification of natural and anthropogenic causes of deterioration. This is being done once again by analyses of soluble salts. Other parameters are also being measured. These include water runoff, to measure liquid and solid runoff in specific vulnerable areas; an evaluation of surfaces exposed to erosion or deposition of soil; and water level measurements, since in some areas of the temples flooding occurs after heavy or continuous precipitation. These studies are being supplemented



Thermal image
29th June 2005 at 11.30 am

Thermal image
29th June 2005 at 3.30 pm

Figure 5: Thermal images of part of the Hagar Qim external wall (Heritage Malta).

by short environmental campaigns which include the sampling and analyses of biological and atmospheric aerosols; morphological investigations of aerosol particles are also being made.

3-D scanning and modeling of both sites has been carried out by A.B.C. Appalti Bonifiche Costruzioni of Firenze Italy. The principal objective has been to carry out high-definition 3-D documentation of the sites, and the end product was a 3-D digital model of each of the two temple complexes and the surrounding terrain. This has now created a high-quality base-line record of the present state of the megalithic structures.

Conclusion

The decision to shelter these unique but fragile World Heritage sites is a bold step which, however, was not taken lightly. It is bases on previous studies, deep background knowledge and also grave concern following a perceived acceleration in the deterioration of these sites. In full knowledge of Malta's international responsibilities, prolonged studies and continuous monitoring of the sites and their environment is being carried out in collaboration with respected international experts in the field. These should ensure that the shelters fulfil their aims of protecting these ancient structures whilst at the same time buying time to carry out the necessary research for the long term preservation of these unique sites.

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References

1993. Pieri Nerli P., and Zetti I. “I templi preistorici megalitici maltesi. Studi e proposte di intervento conservativo per i complessi di Ggantija e Hagar Qim. Tesi di Laurea in Architettura” (unpublished). Facolta' di Architettura, Dipartimento di Storia dell'Architettura e Restauro delle Strutture Architettoniche, Universita' degli Studi di Firenze, Italy.

1994. Tampone G., Vannucci S., Ferri W., Cassar J., Fiorito S., Pieri-Nerli P., Sausa P., and Zetti I. "I templi megalitici preistorici delleisole maltesi: la rilevazione architettonica". In: Proceedings of the 3 rd International Symposium, The Conservation of Monuments in the Mediterranean Basin, Venice, Italy, 443 453.

1994. Vannucci S., Alessandrini G., Cassar J., Tampone G., and Vannucci M.L. "I templi megalitici preistorici delle isole maltesi: cause e processi di degradazione del Globigerina Limestone". In: Proceedings of the 3 rd International Symposium, The Conservation of Monuments in the Mediterranean Basin, Venice, Italy, 555 565.

1996. Vannucci M.L. “Studio mineralogico-petrografico delle “pietre” dei templi preistorici dell'arcipelago maltese e relativi prblemi conservativi. Tesi di Laurea” (unpublished), Facolta' di Scienze Matematiche, Fisiche e Naturali, Universita' degli Studi di Firenze, Italy. Corso di Laurea in Scienze Geologiche.

2001. Cassar J., and Vannucci S. “Petrographical and chemical research on the stone of the megalithic temples.” In: Malta Archaeological Review, Issue 5, 40- 45.

2003. Stroud K. "The Conservation of the Temples of Hagar Qim and Mnajdra", unpublished M.A. dissertation, University of Malta.

2003. Hunziker W. “Hagar Qim und Mnajdra Heritage Park, Malta”. Specifier, Issue no. 59.

2004. Hunziker W. “Hagar Qim und Mnajdra Heritage Park, Malta”. The Architect, Issue no. 29.

2005 2006. CNR-ISAC. Environmental Monitoring at Hagar Qim and Mnajdra Temples. Four Quarterly Reports and Interim Report. Unpublished reports.

2006. CNR-ISAC. Environmental Monitoring at Hagar Qim and Mnajdra Temples. Results and Recommendations on the microenvironmental impact of the shelters for the Temples. Unpublished report.

2007. Dietsche D. “Formfindung fûr eine membrane”. Tec-21, Nr 1-2.

J. Cassar: joann.cassar@um.edu.mt