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Water Management in Archaeological Sites and Sustainable Tourism

*Nicholas Kathijotes,
International Ocean Institute, Cyprus University of Technology*

Summary

The value of the archaeological sites is a huge asset for every country. They can boost tourism and eventually the economy if presented in an organized and scientific way. As an example to this the evolution of urban sewerage and storm water drainage systems in ancient Cyprus as well as water management systems is reviewed, based on the results of archeological studies of the 20th century. Cyprus, located at the crossroad of three continents, has assimilated various civilizations throughout its history. The effects of these influences are also present in the drainage systems. Particular attention is given to the systems from the Hellenistic and Roman periods (310BC - 330 AD) The technological advances and environmental consciousness exhibited in dealing with the hygienic and functional requirements of cities were so sophisticated that can only be compared to modern urban water systems and practices developed in the second half of the 19th century in Europe and North America. Such sustainable water management practices are relevant and their potential applications are evaluated.

Keywords: Wastewater management; sewer systems; ancient Cyprus; ancient water technologies; urban sanitation

INTRODUCTION

Throughout the years and since antiquity, Cyprus developed maintaining its own civilization, but assimilating various influences to which it has been exposed. Being in a strategic position at the crossroad between three Continents-Europe, Asia and Africa, Cyprus was exposed to their culture throughout the centuries. These influences can not only be detected in buildings and temples but also in the drainage systems found at various archaeological sites.

Archaeological studies have established that the basis for many modern technological achievements in water resources was established in ancient Greece with the most

advanced cultural developments taking place in semiarid areas with the lowest rainfall and the most limited water resources (Angelakis et al., 2005; Angelakis et al., 2013). Studies of climatic conditions in the Mediterranean carried out in the last 5000 years showed unstable conditions but there was never an abundance of water resources (Lionello, 2012; Angelakis et al., 2005). This applies to Cyprus as well. Since ancient times, Cypriots have disposed of their excreta and other wastes on site where wastes were generated. This paper outlines examples of water resources management throughout the ages, in Cyprus and the Hellenic Civilization on different aspects of the use and management of water, investigates technical issues and gives suggestions, thus promoting a new approach to archaeological heritage and sustainable tourism.

A BRIEF HISTORY OF PREHISTORIC CYPRUS

Archaeological evidence indicates that the first Cypriot settlers arrived on the island as early as the 9th or 10th millennium BC during the Neolithic Age (ca.8500-3900 BC). They traveled in primitive boats, probably coming from Anatolia to the northern part of the island, and from the Syrian shore to the east. They carried with them a wide variety of mainland plants and animals. Their daily life included farming, hunting, and animal husbandry.

The Chalcolithic Age (ca. 3900 – 2500 BC), although shorter in period, is known as the period of rapid population growth, the development of sophisticated art, and the advancement of religious beliefs and symbolisms, initiated some relations with neighboring countries. In the last phase of the Chalcolithic period small metal objects made of natural copper are introduced (Karageorghis, 2012). Storm water was collected in every house, carried through terracotta conduits (Fig. 1a) and stored in cisterns found in the house yard (Griva, 2008). A detailed section of one of these terracotta pipes is shown in Fig. 1b.



(a) (b)

Figure 1: (a) Round terracotta pipe installed under the floor possibly carrying storm-water and (b) Terracotta pipe with inspection aperture from Amathus.

HISTORICAL TIMES

In Amathus, a very important finding discovered was the underground Nymphaeum, an ancient tunnel of at least 120 m long together with a water spring. After the destruction of the Nymphaeum by the earthquakes of 15 BC and 76/77 AD, a reservoir and a fountain were constructed. Further excavations in Amathus have revealed a well preserved stone conduit (pipeline sculptured in stone) which was most probably used for the supply of freshwater from the water reservoir (Fig. 2a and b). It consists of carved stone pieces of variable length but consistent internal and external diameter. The variable length is probably a result of the stone pieces they had available to carve the conduits. The gradient is steady and relative to the ground elevation. Square stone pieces are present at given distances of about 2 m in order to support the conduits by preventing settlement (Fig. 2b). Apertures also exist on every piece of pipe covered by a flat stone and sealed with lime mortar for access in case of blockage or when ventilation was required.



(a) (b)

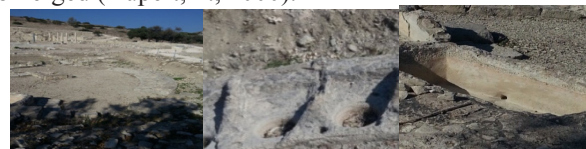
Figure 2: (a) Stone conduit (sculptured stone water pipeline), with equally spaced small apertures used as inspection holes and (b) Detailed stone conduit connection point found in Amathus.

During the Hellenistic Period (ca. 323-67 BC), and following the death of Alexander the Great, the Ptolemaic rule brought peace and prosperity to Cyprus. Culturally Cyprus is considered as part of the Greek world and is embellished with various public buildings (Karageorghis, 2012).

In Amathus excavations of the agora in the 1980s have revealed a public bath building (balaneion) consisting of an enclosed circular space and adjacent rooms and hallways (Figure 5a and b). A hall realized as a roofed palaestra (exercise room) or as a dromos (race course) is present. Patrons could come to this area for exercise and then proceed to the circular bathing area. In the center of the bathing area one can observe the foundations for the furnace and of the hot water reservoir (Fig. 5a). Two groups of eight

little baths (pueloi), which are narrow and lacking drain holes, are aligned against the east and west walls in the southern area (Fig. 5b). Here servants (parachytai) with buckets could rinse the patrons with cold or warm water. As no drains were found in the balaneion (baths), it can be assumed that grey water was removed by the servants possibly disposing it to the large drain system which runs westwards under the street collecting storm water and the runoff from the Nymphaeum and reservoir.

This circular room was partially remodeled in the second century BC when five of the little baths were replaced by larger plunge baths (Fig. 5c) in which the user could be submerged (Aupert, P., 2000).



(a) (b) (c)

Figure 5: (a) View of the Hellenistic Baths and (b) a detailed view of the 'Pueloi' (little baths) inside the Hellenistic Baths-in Amathus. On the right (c), plunge baths in Hellenistic Baths (balaneion) in Amathus.

SUSTAINABLE TOURISM

UNEP and UNWTO organisations defines 'sustainable tourism' as "Tourism that takes full account of its current and future economic, social and environmental impacts, addressing the needs of visitors, the industry, the environment and host communities". Thus, we should (i) make optimal use of environmental resources that constitute a key element in tourism development, maintaining essential ecological processes and helping to conserve natural heritage and biodiversity, (ii) respect the socio-cultural authenticity of host communities, conserve their built and living cultural heritage and traditional values, and contribute to inter-cultural understanding and tolerance., and (iii), Ensure viable, long-term economic operations, providing socio-economic benefits to all stakeholders that are fairly distributed, including stable employment and income-earning opportunities and social services to host communities, and contributing to poverty alleviation.

It is then expected that we maintain a high level of tourist satisfaction and ensure a meaningful experience to the tourists, raising their awareness about sustainability issues and promoting sustainable tourism practices amongst them. Our natural and cultural heritage then have a key role in achieving the above goals.

Suggested measures may include further studies on the state of the art for different aspects of the use of water in the past, thus promoting a new approach to archaeological heritage. The archaeological sites are there, but little is still known about their functional and technical issues regarding the management of water resources.

An effort in integrating new and existing knowledge and know-how in regional and national policy frameworks

can lead to developing instruments for water management inspired by archaeology of water, establishing networks that would pool different expertise to foster the definition of best practice for sustainable tourism and respectful use of water resources.

The development of efficient mechanism for transfer of knowledge to local operators, will empower stakeholders with new tools to orient the tourist offer, and promote the creation of new qualified jobs,

Participation of private sector (SMEs) and civil society by means of identifying thematic programmes and pilot activities for the selected areas, ensures an effective use of research outcomes.

Promoting the adoption by tourism operators of standards for a sustainable water use that would be inspired by our past should be a necessity.

Let us then design a replicable comprehensive strategy for facing the challenges of the present and of the future relying upon the extraordinary heritage of the shared Balkan and Mediterranean past.

EPILOGUE

It is evident that since antiquity various water management methods have been practised not only for rainwater harvesting but also for the sustainable use of grey water for cleaning latrines and other sewage fixtures proving that people had a working knowledge of basic hydraulics. This is further supported by the fact that later Greek and particularly Roman civilizations have used and perfected the existing technologies on a larger scale. Ancient people realised the benefits of mixed sewer system with stones at the bottom not only for economic reasons or easier completion, but also for reducing water flows and providing higher infiltration for groundwater recharge.

Mediterranean area in general will continue to have low water availability not only due to population growth but also due to climatic changes. The development of a sustainable water resource management system then is crucial, and will assist in the conservation and protection our precious resource from pollution and extinction.

The need of integrating the 'water issue' in the development of innovative strategies for reducing the impact of tourism on environmental and cultural heritage and to ease the pressure on water resources, suggests further capitalising existing knowledge and building upon the extraordinary archaeological heritage, that would release various interventions at different levels.

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