

Jonas Berking

## Water Management in Ancient Civilizations: Editorial

### Summary

This volume brings together papers on Water Management in Ancient Civilizations. It envelops a great variety of ancient means to harvest, supply, distribute, and dispute water in all its forms. Contributions range in time period from the early means of water management in Mesopotamia and Egypt, to the Epochs of Hellenistic and Roman Eras, into medieval times and beyond. The fascinating momentum of ancient water management include not only the great solutions and applications that were already at hand thousands of years ago, but its implications and importance for present and future problems, since water is, was, and will continue to be the most precious resource for human wellbeing.

Keywords: water availability; water technology; social organization; irrigation strategies; water lifting devices; water economy; water legislation

Dieser Sammelband vereint Beiträge zum Wassermanagement antiker Zivilisationen. Er umfasst dabei die große Bandbreite antiker Methoden zum Wasser sammeln, zur Wasserversorgung, zur Verteilung oder zu Verteilungsproblemen. Die Beiträge reichen von den Anfängen des Wassermanagements in Mesopotamien und Ägypten, über die Hellenistische und Römische Epoche, bis hinein in das Mittelalter und die Neuzeit. Das Faszinierende am antiken Wassermanagement sind dabei nicht nur die frühen Lösungen und Anwendungen, sondern insbesondere auch ihre Wirkung und Wichtigkeit bis in die Gegenwart und Zukunft, denn Wasser ist und bleibt die wichtigste Ressource für menschliches Wohlergehen.

Keywords: Wasserverfügbarkeit; Wassertechnologie; soziale Organisation; Bewässerungsstrategien; Wasser-Hebe-Systeme; Wasserwirtschaft; Wasserrecht

This study is part of the Key Topic *Watermanagement* within the Excellence Cluster 264 *Topoi – The Formation and Transformation of Space and Knowledge in Ancient Civilizations*. It brings together papers presented at the 2016 workshop on *Water Management in Ancient Civilizations*. The workshop further developed the topic of ancient and historical water management within the Excellence Cluster *Topoi*, after a first workshop on this topic in 2014 at the Freie Universität Berlin, Germany.

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## I Scope of the volume

Water is one of the most important ingredients in nature and daily life, and the study of this very common substance is a subject of many different disciplines.<sup>1</sup> The majority of modern water studies are concerned with issues of water management, including: water quality and quantity, the broad agenda of human agency, and institutions of water distribution and sanitation. This volume brings together papers presented at the 2016 workshop on *Water Management in Ancient Civilizations*. The workshop further developed the topic of ancient and historical water management within the Excellence Cluster *Topoi*, after a first workshop on this topic in 2014 at the Freie Universität Berlin, Germany.<sup>2</sup> The workshop in 2016 only encompassed part of this broad field of water studies and disciplines. The idea of the workshop was to bring together approaches from different disciplines that contextualize water management within a historical perspective. The outcome of this fruitful and multidisciplinary workshop is a compilation of contributions from geosciences, classical archaeology, ancient oriental studies, history, history of science, and legal studies in this volume.

Within much of the research in water management, there is a growing interest in how to bridge water research from different disciplines, since water has been a topic high on the political and scientific agenda for several decades now.<sup>3</sup> Increasing effort is being put into the incorporation of different academic disciplines, so that their knowledge can help solve a diverse range of global water problems.

However, in historical, and especially archaeological approaches, water research has a long tradition that predates the popular discussion by several decades. The often claimed “hydraulic hypothesis” put forward by Karl Wittfogel in the 1950s,<sup>4</sup> was one of these earlier approaches that combined the social and political consequences of controlling and managing water. Although the hydraulic hypothesis has been critiqued and rejected by many scholars since, it still forms the basis for many modern discussions.<sup>5</sup> One of the main aspects of this hypothesis is that extensive water distribution for irrigation purposes produces the need for regulation (an institution), which in turn formulates a major aspect of cultural and social dimensions. As a far-reaching consequence of this, irrigation endeavors could have been a major aspect in the first marked transition in human history (the transition from hunter-gatherer to state-urban cultures), and maybe also in the establishment of social stratifications.<sup>6</sup>

Hence, any single deterministic view of water solely as a resource is misleading for water studies, especially when set against the background of this workshop about water

1 Mays 2010b.

2 Berking 2016.

3 Weisz et al. 2001.

4 Wittfogel 1957, 2–3.

5 Harrower 2009.

6 Hunt et al. 1976.

management in ancient civilizations. Such a view would eclipse the great variety of water in all its forms. That is to say, water management can be approached in several ways and thought about on a number of different levels.

## 2 Water management: aspects and approaches

However, since water management is such a broad term, there is no simple approach to it. The great variety of disciplines and agendas which deal with water management issues describe complex relations between natural environmental conditions and social, technical, governmental, and legal structures. A straightforward definition, according to Scarborough is: “[...] water management is the human interruption of the natural water cycle undertaken by a society”.<sup>7</sup> This definition covers the three important aspects of water management, including: (a) the natural movement of water (water availability), (b) the redirection and collection of water (water technology), and (c) the social organization, displayed, e.g. in governance or legal structures.<sup>8</sup>

More generally, this means that:

(a) Water availability refers to natural water sources. The primary source is precipitation and the subsequently generated surface, or groundwater, run-off. It is important to note that the specific climatic conditions, hydrological regime, and landscape or catchment characteristics make water availability a dynamically changing and manifold process.

(b) Water technology refers to all technical measures of water management. Specifically these are: (i) wells and springs, (ii) open and closed canals, (iii) open and closed reservoirs, (iv) temporal and permanent dams, as well as (v) water lifting devices.

(c) The social organization with respect to water management refers to the way in which water is shared, provided, and used among individuals or groups. Often societies develop(ed) special governance structures to regulate water as a resource.

Water and water management have various other dimensions; for example, water can be classified and analyzed in terms of its function and purpose. Water is used as fresh water (domestic, drinking, tap, and portable water); for food production (water for irrigation and animal husbandry); fishery; navigation (transport); cult practices; energy (hydropower); status (political power); hygiene; and for the purpose of entertainment, protection, cooling, and recreation.<sup>9</sup>

Water management can also be seen through the lens of the prevailing climatic or hydrologic conditions and the chronological time period of a particular study. The pre-

7 Scarborough 1991, 1.

8 Berking et al. 2016.

9 Berking et al. 2016.

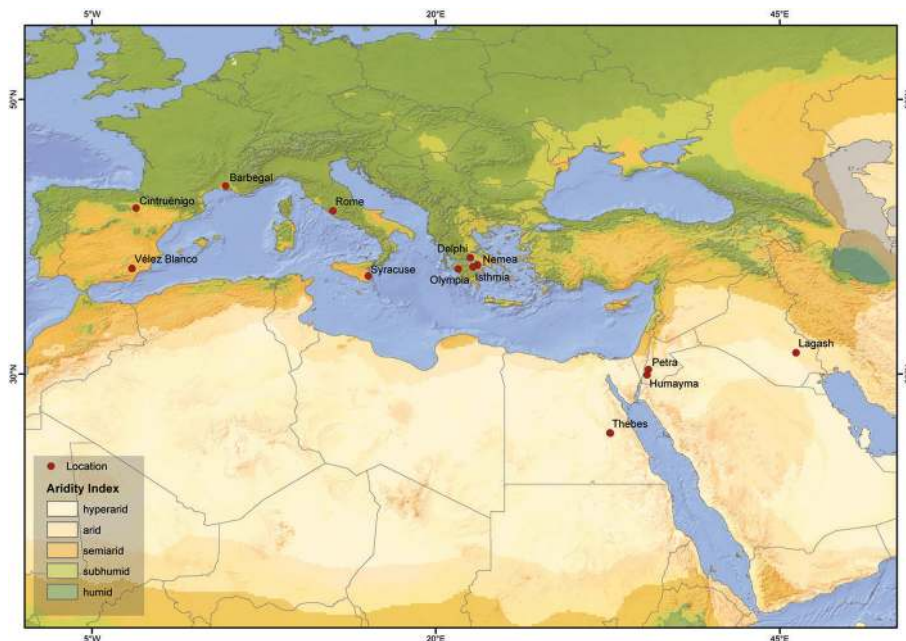


Fig. 1 Distribution of the main locations presented in this volume. Background colors represent the UNEP Aridity Index, indicating the climatic setting of the specific sites.

vailing landscape and climatic setting of a specific study site concerns the type of water management strategies applied in a particular case. For this volume, the geographic distribution and climatic classification of the contributions presented here are shown in Fig. 1.

The most common means with which to group historical studies is to classify them according to their chronology. The chronological framework for the contributions in this volume are illustrated in Fig. 2. Due to the very long timeframes of several of the studies, this chronological classification isn't used to organize this volume.

### 3 Organization of the Volume

The original thematic concept of the workshop is used to organize this volume, and, thus, the papers are grouped into four sections: (i) Water, Climate, and Society; (ii) Water Techniques and Legislation; (iii) Water and Economy; and (iv) Water Management in the Classical era. These present different aspects of ancient water management. It is not the claim of this volume, however, that it presents a comprehensive book about ancient

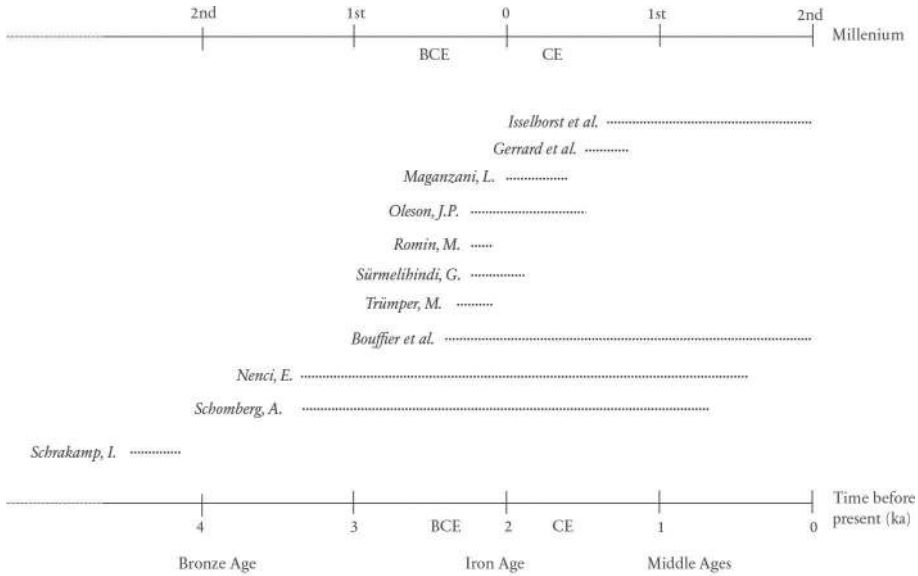


Fig. 2 Chronological order of the main periods presented in this volume.

water management, but it brings together single case studies with new and original research.

## 4 Sections

### 4.1 Water, climate, and society

Especially in arid and water scarce regions, water management is a fundamental need for humans and societies. These regions are prone to drought and are prime examples of the interactions between of water, climate, and society. One important aspect of coping with low water availability is presented by J. Oleson, namely the provision of a well-organized water distribution and storage system built on advanced technological knowledge. The climatic conditions, as well as the technical knowledge, are very well represented in the arid mountainous region of western Jordan, where the Nabateans evolved in the first centuries BCE, with their capital of Petra. As J. Oleson points out, satellite settlements, such as Harara (Humayma) to the south of Petra, were also characterized by a well-organized water distribution and storage system. The technical realizations in water technology from the Nabatean and later Roman times are still famous today.

## 4.2 Water techniques and legislation

As mentioned above, most types of water technology can be grouped into five categories. Whilst most of these technologies and techniques are well understood, it is sometimes difficult to be sure of their origin or where and when they first appeared.

It seems that many techniques evolved during the first millennia BCE in Mesopotamia, as well as in Egypt, especially in Alexandria in the first millennium BCE. G. Sürmelihindi, herein, undertakes a comprehensive overview of water technology throughout antiquity. The special focus of this contribution is on water-lifting devices, which sometimes were highly sophisticated machines. For example, the Roman *force pumps* and the *water mills* were milestones of antique water lifting techniques, often not contextualized with such a profound geoscientific background. Also, what is probably the oldest water-lifting device, the *shādūf*, plays a role in G. Sürmelihindi's paper, and is analyzed in much more detail by E. Nenci in his contribution. E. Nenci describes the *shādūf* from its first appearance in Egypt and follows its fast spread into different regions. The sophisticated technical details of this practical and easily recognizable technique are often neglected and it is only possible to date such devices by examining all existing records and sources as presented here.

The other major aspects of this chapter include water rights and water law, and their legislation. Here questions arise such as: Who owns the water? Is water a public or private good? What societal structures – states, cities, communities, or organizations – are in charge of this legislation? The best known example of a highly sophisticated system from antiquity presented in this volume, is the Roman water law. L. Maganzani presents excellent examples in her contribution, focusing on local irrigation systems organized by villages and communities in the Roman world and jurisprudential sources belonging to Justinian's Digest on the topic. The fact that joint water use generated disputes that were then addressed by jurisprudence, allows a perfect evaluation of the relationships between communities and their respective members concerning their water and irrigation needs. In a similar way, M. Ronin analyzes the problems Roman jurists had to cope with when facing problems related to water sharing and irrigation in the periphery of Rome. She argues that Roman jurists applied legal solutions that were directly linked with the development of the city of Rome itself, including the increasing competition for water resources due to economic and environmental reasons.

## 4.3 Water and economy

Water is vital for agriculture, and in most cases agricultural prosperity grows with the availability of fresh water. Hence, the economic value of water is often very high, especially in agricultural regions with hot and dry climates or a pronounced seasonality in

water availability.

A prime example of such a region is Middle and Lower Mesopotamia, where the hot and dry climate makes rain-fed irrigation nearly impossible. From here, I. Schrakamp introduces the oldest water management system presented in this volume. He focusses on the information provided by cuneiform inscriptions on the socio-economic and water management issues from the 3rd millennium BCE, focusing on the arid area around the Euphrates at Lagash.

In contrast to the riverine societies of Mesopotamia, which had little rain throughout the year, the Mediterranean regions typically have a rainy season in winter and hot, dry summers. Here, different techniques of groundwater tapping and distribution systems evolved that were especially important to provide water throughout the growing seasons during the summers months. Some especially well known and prominent examples of water distribution and irrigation strategies developed in the Iberian Peninsula at the end of the Classical era and with the beginning of medieval times. The *mélange* of Roman and Arabic influences at the time led to the development of special water management systems and irrigation techniques and communities, some of which are still in use today. One such technique is presented by C. Gerrard and A. Gutiérrez, providing new insight into the *qanat* technology in northern Spain, while Isselhorst et al. focus on water management strategies from Andalusia, of southern Spain, that partly still function today (Fig. 2).

#### 4.4 Water management in the Classical era

During the Hellenistic and later Classical era, water management and water techniques flourished in a formerly unprecedented way. The societies that have flourished in the Greek territory since the last millennium BCE developed several sophisticated technical works.<sup>10</sup> Some of these structures were related to water use. The application of hydraulic technology in combination with knowledge of processes, allowed the ancient Greeks to set up water supply and drainage systems, as well as flood protection, sanitary systems, and, maybe for the first time, recreational and sport facilities with water, such as pools or bath houses. This is the focus of the comprehensive study on Greek baths by M. Trümper, focusing mostly on the Peloponnese, but setting them into the context of the whole era of Greek baths throughout the Mediterranean.

When Rome later became the dominant power of the Mediterranean, they influenced vast regions through their large scale building projects and logistics. Roman construction and management of cities and settlements, and their way of exploiting and interacting with natural environments, especially water, was extensive and uncontested.

<sup>10</sup> Mamassis and Koutsoyiannis 2010.

One aspect of water supply in Roman settlements that was probably rather new at the time was to provide large quantities of water with high quality. This was only possible through the usage of regularly available, relatively pure groundwater sources, which were tapped and canalized and often transported over long distances via aqueducts.<sup>11</sup> From the classical area, Bouffier et al. present the famous aqueduct of Syracuse, the Aqueduct of Galermi, which is still in good shape and restored.

Finally, the contribution of A. Schomberg opens up the field of water application and technology, which is important to a rather new area of research into the invention, distribution, and functioning of ancient water clocks. She evaluates how and when time measurement began to take place in antiquity; the important role of the complicated but practical water clock, starting with its origin in the 2nd millennium BCE in Egypt; and how they later spread during Roman times, until the era of the water clock ended with the invention of the mechanical clock during the Middle Ages.

11 Cf. Mays 2010a.



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## Illustration credits

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