

## Introduction

‘And I should raise in the east  
A glass of water  
Where any angled light  
Would congregate endlessly.’

(Philip Larkin, 1964, *Water*, *The Whitsun Weddings*, London)

Water is one of the most benign, and destructive powers, in the lives of all people. In semi-arid and arid zones such as the Near East, the presence or absence of water holds the fate of people in the balance. Water must be controlled, not only so that there is enough to sustain human life, animals and crops, but also to prevent the destruction of land by flooding or salinization.

### Research aims and parameters

The aim of this thesis is to assess critically in technological and sociological terms the water supply and management of the Near East from 63 BC to AD 636. I will look at water from rain, springs, rivers, wadis, lakes and aquifers and how it was accessed, transported, stored and used (for drinking by humans and animals, washing, agriculture, water power, industry and display). I will not include the use of waterways for transporting goods as this is a distinct subject area. By ‘Near East’ or ‘East’ I am referring to the area that broadly corresponds to the Roman provinces of Syria, Palestine and Arabia (in modern terms: south-eastern Turkey, Syria, Lebanon, the Palestinian territories, Israel, Jordan and parts of Iraq) [Fig. 1]. ‘Middle East’ is used when referring to the modern area and boundaries. The dates chosen cover the period of Roman and late Roman occupation in the area, from Pompey’s annexation of the Seleucid Empire in 63 BC to the Battle of Yarmouk in AD 636 when the region was lost. The term ‘Roman’ here means the period between 63 BC and AD 284 (the accession of Diocletian) and the term ‘late Roman’ refers to the subsequent centuries.<sup>1</sup>

The broad agenda of assessing water supply and management in technological and sociological terms may be split into several smaller research aims. While much work has

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<sup>1</sup> This follows Ball 2000, 6; Butcher 2003, 9.

been undertaken on individual sites and water supply and management elements in the Near East, a region-wide, synthetic study of all the systems has been lacking. I aim to characterise the methods for the access, transport, storage and use of water across the study area. This avenue of research will provide a usable dataset for those interested in the history of water technology. As part of this I will look at the relationship of the pre- and post-Roman technologies to those employed in the Roman and late Roman periods. In addition to these observations of broad chronological changes, I will also undertake diachronic analyses of changes in technology in the Roman and late Roman periods. In both cases, several questions arise. Do we see, for example, significant differences between and in periods and if so, what was the motivation for these changes? What stimulated, or inhibited, any advances or shifts: technological development, cultural shifts in attitudes to water supply and management, economics, political instability, social pressures, administrative changes? Did changes in the late Roman army have an effect on water management techniques? Did the rise of Christianity have an impact on water supply?

I will also consider pertinent questions in water supply studies. Research into aqueducts across the empire has often focussed on a supposed dichotomy between productive rural aqueducts and consumptive urban aqueducts.<sup>2</sup> In recent years, evidence primarily from the western provinces and North Africa has suggested that this view needs to be adjusted and that there was a symbiotic relationship between the rural and urban water supply.<sup>3</sup> This topic has ramifications beyond water supply and can contribute to discussions on the relationships between urban centres and their hinterlands, which is important in studies of the Roman economy. This debate, centring on branch lines from urban aqueducts serving rural settlements, is discussed in Chapter 6 where additional evidence is presented from the Near Eastern provinces. The results from this study begin to expose the complexities of this relationship.

Another subject that has seen increasing debate in recent years is the constant-offtake principle. This is a frequently-cited theory in which Roman water supply systems worked on the basis that water flowed constantly through the system and was not stored in significant

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<sup>2</sup> Ellis 1997, 149. Also see: Shaw 1984; Leveau 1987, 96, 98, 104; Corbier 1991; Shaw 1991.

<sup>3</sup> Wilson 1999, 328-9; Gazonbeek 2000. See also Piras 2000, 248 on a branch line from the Aspendos aqueduct. Also Wilson 1997, Intro.

quantities at any point in the management system.<sup>4</sup> This debate is important because the principle suggests either technological underdevelopment or a wasteful and ostentatious approach to limited water resources. This strengthens the view of urban, consumptive, aqueducts as non-functional luxuries. The question of technological underdevelopment will be discussed specifically with respect to watermills and water-powered installations in Chapter 10. Until the 1980s, it was commonly thought such installations were not used regularly in the Roman world, which represented technological stagnation in the ancient world; recently this view has come under increasing revision.<sup>5</sup>

The applicability of this principle will be considered in discussions of dams and reservoirs (Chapters 4 and 7). In chapter 7, I attempt to answer some of the questions posed by Bruun concerning water shortage and surplus in the Roman world.<sup>6</sup> These include whether there was a system to provide buffer reservoirs, as has been argued for North Africa, or whether it was possible to turn off the water supply, whether there was a conscious policy for these matters and whether the use of aqueducts led to the neglect of rainwater cisterns and wells. The research into aqueducts and urban storage and distribution here point strongly to the need for a revision of prevalent theories about urban water consumption and storage. It will be shown, for example, that the eastern provinces responded differently to issues of water management than North Africa. At the outset of this research it was assumed that, due to similarities in climate and environment, patterns in water supply and management found in North Africa would be mirrored in the Near East. So, if differences are found from North Africa, is this, for example, evidence for a cultural difference between these two areas of the empire?

As well as differences from other areas of the empire, patterns will be sought within the area under consideration. Did approaches used in Syria vary from those in Arabia, or did different parts of the same province use different methods? How far were those variations governed by landscape, climate and geology? Did culture, history and religion play roles in determining how water was used and controlled? Answers to these questions will be sought

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<sup>4</sup> Hodge has been one of the most influential proponents of this theory: for example Hodge 1992, 3, 79, 89, 279, 280, 296, 303, 322. Also see Forbes 1964, 172; Leveau and Paillet 1976; Shaw 1984; Cotterell and Kamminga 1990, 51.

<sup>5</sup> See Finley 1965 on the primitivist viewpoint. On more recent developments see: Lewis 1997; Wikander 1979; Wikander 1981; Wikander 1984; Wikander 1985; Wikander 1990; Wilson 2002b.

<sup>6</sup> Bruun 2000. On buffer reservoirs in North Africa see Wilson 2001a.

from various areas of water supply, for example the influence of geography and geology on irrigation techniques (Chapter 5) and the role of religion in the diffusion of latrines (Chapter 8). In Chapter 8 I will also analyse some of the attitudes towards Roman water use as shown from the evidence of bathhouses and latrines. This will also be explored in Chapter 9, when looking at the use of water for display in private, domestic contexts.

A persistent theme throughout this work is Rome and its influence on the Near East, which must necessarily tackle the issue of ‘Romanization’. This has become an increasingly thorny topic with an ever-expanding bibliography.<sup>7</sup> ‘Romanization’ can be defined broadly as the process by which a native population, recognising the cultural superiority of Rome, took on aspects of Roman life, in particular its language, religion and material culture. The efficacy of this terminology, in particular the notion of the superiority of Rome, has come under attack from several angles recently. Many scholars justifiably have flagged up the fact that such a unilateral approach cannot encompass the multiplicity of ways in which Rome settled areas and was received by the native populations. It would be neither useful nor appropriate to assess all the contributions to this debate here, but two recent works are felt to be very pertinent for the ensuing discussion.

Ball is the most notable assailant of one-sided ‘Romanization’ in studies of the eastern empire and vigorously reacts to the commonly-peddled idea of the superiority of Rome.<sup>8</sup> He contends that this euro-centric view is anachronistic, reflecting our own biases against the East, and argues instead that the East viewed Rome as a precocious upstart and that Rome looked to the East for inspiration. This is not the place to make a detailed assessment of Ball’s work, some parts of which are more controversial than others, but his general premise that we need to look in the other direction is very thought-provoking and must form a starting point for any new research into the impact of Rome in the East.

Gosden writes about colonial ‘middle ground’, in which all groups have some, though not equal, agency in colonial meetings and participate in the creation of culture.<sup>9</sup> It is under these circumstances that colonialism can be seen as ‘a source of creativity’ that gives rise to ‘new ways of doing things in a material and social sense.’<sup>10</sup> Within this model, the

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<sup>7</sup> See for example articles in Mattingly 1997a; Alcock 1997; Fentress 2000. Also Woolf 1994; Mattingly 2004.

<sup>8</sup> Ball 2000. Also see Said 1978 on modern, post-colonial attitudes to Orientalism.

<sup>9</sup> Gosden 2004, esp. 82-113.

<sup>10</sup> *Ibid.* 25.

Roman Empire becomes one of ‘strategic action and calculation, in which cultural forms are raw material for creating oneself as an individual, a group of a new type, inventing a new tradition or maintaining the old ways.’<sup>11</sup>

With these approaches in mind, this thesis will attempt to evaluate how the East fits into the rest of the empire by analysing whether Rome had any influence on water management in the Near East and *vice versa*. Does such influence, if present, manifest itself in new technologies and approaches or adaptations to indigenous techniques? Does this answer vary in different areas of water management? What role did different agents, such as powerful individuals (for example Herod), the military, the Church and the indigenous population, play in the dissemination of technology and ideas? How did a person’s or a group’s identity influence their use of and attitudes towards water? In addition, did the history and background of an area or site have any effect on methods and attitudes to water supply?

### **Thesis Structure**

The thesis is divided into 11 chapters. Chapters 1 and 2 provide the necessary background for the thesis. Chapter 1 looks at the geography, geology and climate of the Near East in order to provide an understanding of why certain techniques may have been employed over others. In particular, it will become clear that one of the problems was not the amount of water available in the area, but rather its uneven distribution across time and space. In Chapter 2 an account of the water technologies and management solutions employed in the pre-Roman periods is given, so that the reader may understand the levels of technology already present in the region thus giving the potential to see and interpret innovations during the Roman and late Roman periods. A thematic approach is taken that reflects the thesis structure. A table displaying the diachronic developments is provided for readers unfamiliar with the pre-Roman history of the Near East. A survey of the post-Roman evidence has been integrated into Chapter 11. This assessment of pre- and post-Roman technologies should provide the framework to illustrate any continuity or discontinuity in water supply methods.

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<sup>11</sup> *Ibid.* 112.

Chapters 3-10 investigate types of water management techniques or installations (water-lifting, dams, irrigation and aqueducts) or zones of water supply and management (in towns and cities, in bathhouses and latrines, in the domestic sphere and in industrial processes). The aim of these chapters is to synthesise the large and disparate datasets available on the various installations. Synthesised technical information (for example dimensions, capacities and construction techniques) has been presented insofar as it allows the general reader and researchers of Roman water supply to gain a detailed knowledge of the installations and techniques being discussed. Discussion of the broader issues, both technological and sociological, follows and builds upon this technical analysis. While this work is synthetic, specific cases, for example bathhouses, are discussed in detail when their (re-)interpretation is relevant to the main arguments. Gazetteers, ordered alphabetically by site, have been provided for each of these chapters.<sup>12</sup> These gazetteers present the basic data for each of the installations included in the study, as well as the necessary bibliographic references for a reader who wishes to pursue a particular case further.

The final chapter presents the main conclusions of this study. One of the aims of this chapter is to attempt to bring together a picture that has been discussed in its separate parts in the preceding chapters and to trace any overarching patterns that have appeared throughout the work. This will review some of the issues and themes with direct relevance to water supply studies, such as the constant-offtake principle, as well as considering the reasons behind any temporal or spatial changes that occurred or, equally, did not occur.

### **Nature of the Evidence**

The evidence upon which this work is based is primarily archaeological, drawn from publications and personal observations made on fieldtrips to Syria, Jordan and south-eastern Turkey between 2001 and 2004.<sup>13</sup> Where possible the archaeological evidence has been supplemented by supporting epigraphic and literary material, which presents few difficulties other than an unsurprising emphasis on the monumental aspects of towns and cities, in particular Antioch.

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<sup>12</sup> A brief note on the transliteration of place names: I have tried to use the name and spelling that is most commonly recognised. Overall, in the Arabic names ‘al’ has been preferred to ‘el’ and the Arabic conventions for ‘sun’ and ‘moon’ letters has been followed.

<sup>13</sup> Due to political circumstances, I was not able to travel to Iraq, Israel and the Palestinian territories.

In general, the material from Israel and the Palestinian territories has been more extensively published than the rest of the region; interim reports on most archaeological investigations are available easily in the journal series *Excavations and Surveys in Israel/Hadashot Arkheologiyot*. Additionally, two publications focussing on water supply have been published in recent years: *The Aqueducts of Israel* and *Cura Aquarum in Israel*.<sup>14</sup> This work hopes to temper this bias towards Israel and the Palestinian territories by including the evidence from the rest of the region and so to overcome any false divisions that may have arisen out of the unfortunate modern political circumstances; for example one of the drawbacks of *The Aqueducts of Israel* publication is that it does not, to a large extent, integrate its evidence with the remainder of the Near East.

In addition, some classes of technology or types of installation have received more attention in the literature than others, in particular dams, aqueducts and irrigation. Work in the Near East has focussed heavily on individual aqueducts, particularly in Israel, as noted above. Little has been attempted, however, on the relationship between the urban centres and their hinterlands, especially in terms of the effect of large urban water supply projects on traditional agricultural water supply techniques. I hope that this research will go some way to remedy this.

An explanation for the concentration on dam technology lies in modern water supply concerns in the region. In the recent past, Turkey, Syria and Iraq have undertaken large-scale dam construction and irrigation projects. The impact of such projects appears to have prompted a preoccupation with the history of dam technology because of the modern cultural implications. Also as a consequence of these large-scale dam projects and their effect on landscape and agricultural production, irrigation has become one of the most popular topics for discussion and research in water supply studies in the region.<sup>15</sup>

Another reason for this concentration on irrigation systems derives from the type of archaeology prompted by these dam construction projects: field survey. Since the modern dams flood and destroy large tracts of archaeologically important land, there has been a need for field survey in order to maximise the amount of data that can be recorded before sites are lost under the floodwaters. This need has been coupled with a general trend in the region for

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<sup>14</sup> Amit *et al.* 2002; Ohlig *et al.* 2002.

<sup>15</sup> For example, Geyer 1990: publication of conference papers devoted to the subject.

archaeological investigation via field survey, for example the Homs Landscape and Settlement Project, Syria; the Wadi Faynan Landscape Survey, Jordan and the Balikh Valley Landscape Survey, Syria.<sup>16</sup> Inevitably, these surveys have focussed on hinterlands, field systems and their accompanying water management systems.

In addition, this thesis provides a regional focus for synthetic studies that have been carried out on particular classes of water supply installations, for example water-lifting devices, watermills, latrines and baths.<sup>17</sup> The work undertaken on baths is noteworthy in two aspects. Firstly, there has been little work on the actual water supply of baths; a problem to which Manderscheid is going some way to remedy.<sup>18</sup> Secondly, both Nielsen and Yegül's synthetic treatments of Roman baths pay minimal attention to baths in the Near Eastern provinces.<sup>19</sup> Work on baths in the Near East either focuses on the late antique baths or on baths located in modern Israel and the Palestinian territories.<sup>20</sup> Also the lack of archaeological evidence for the Hellenistic period in Syria means that it is difficult to understand the continuity, if any such existed, between Roman bathhouses and their Hellenistic predecessors.<sup>21</sup>

Dating these structures and installations presents several challenges. In general, water supply and drainage facilities are difficult to date on archaeological evidence alone and in most cases epigraphic or literary evidence provides the most reliable proof.<sup>22</sup> There are several reasons for this, including lack of pottery or other dateable material in primary, undisturbed contexts, the unchanging methods of construction over time and the longevity of the structures. Some technologies are affected by these factors more than others, in particular qanats, field systems and irrigation channels. Where it is felt that there are specific issues connected with dating that may affect wider conclusions and arguments, these are discussed in the main text; a particularly interesting case study on dating is provided by the dam evidence in Chapter 4.<sup>23</sup>

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<sup>16</sup> Philip *et al.* 2002; Barker *et al.* 1997, 1998, 1999, 2000; Newson 2002; Wilkinson 1998.

<sup>17</sup> Water-lifting devices: Oleson 1984. Water mills: Wikander 1984 and 1985. Latrines: Neudecker 1994; Baths: Yegül, 1992 and Nielsen 1993.

<sup>18</sup> See for example Manderscheid 2000.

<sup>19</sup> Nielsen 1990 and Yegül 1992.

<sup>20</sup> On late antique and Islamic baths, see Yegül 1992, 326–349. On baths in Israel, see for example Dvoretjetski 1999 and Netzer 1999.

<sup>21</sup> On the problem of Hellenistic Syria see Millar 1990.

<sup>22</sup> On dating aqueducts, for example, see Wilson 1996, 6-18.

<sup>23</sup> Also see Kamash forthcoming.

Several dating methods have been tried with varying degrees of success, including dating a structure on the basis of a presumed association with a nearby settlement, radiocarbon dating and plaster dating. The first method is one of the most regularly employed in the Near East. This method is restricted to occasions where there is only one viable, single-period site in the vicinity, but cannot be useful when multiple candidates of different periods exist (see Chapter 4.4). One adaptation of this ‘settlement data technique’ that has been used to date irrigation channels around Damascus is to use toponyms as an indicator of date. In two cases, the Mezzawi and Derani (Adaya) channels, the names of the channels seem to be associated with villages of those names known from the Diocletianic era and have therefore been attributed to this period.<sup>24</sup> Unless we can prove, however, that the village could not exist without the channel, this might only provide a *terminus post quem* for the date of the irrigation channels. I view such dating techniques with an air of caution, while recognising that some attempt at dating is better than a defeatist approach.

Radiocarbon dating of lime mortars in water-related facilities presents two problems: if the sample was contaminated by coming into contact with water and water-borne carbonates, this can skew the date and the carbonates in mortars from limestone areas can also push the date back.<sup>25</sup> These factors have cast doubt on the reliability of, for example, the so-called turbine mill at Caesarea [#591; Gazetteer 17] that has been published as being radiocarbon dated to AD 345-80.<sup>26</sup> Another problem here includes inadequate presentation of both radiocarbon-dating results and the nature of samples and unjustifiable interpretation of the results. The results are rarely given in the conventional format, but more usually a date range is given with no reference to calibration or confidence level ( $\sigma$ ).<sup>27</sup> There is often insufficient information given about the sample taken, the context of the sample and its suitability for dating using radiocarbon-dating techniques; only single samples seem to have been taken in the majority of cases, which also reduces the reliability of the result.<sup>28</sup> Several

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<sup>24</sup> Tresse 1929, 471; Decker 2001, 106f.

<sup>25</sup> McQuitty 1995, 746, fn. 3.

<sup>26</sup> Atrzy and Schiøler 1984-6; Schiøler 1989.

<sup>27</sup> On radiocarbon conventions: Bowman 1990, 49. Examples of inadequate presentation of results include: Sagiv *et al.* 2002, 181; Tsuk 2002a, 294; Tsuk *et al.* 2002, 209.

<sup>28</sup> Taylor 1987, 105.

scholars have also been tempted to attribute a specific date in the date range, which is not possible in radiocarbon dating.<sup>29</sup>

Porath has made an attempt to create a new dating method using plaster as a chronological indicator.<sup>30</sup> His arguments are quite convincing in some aspects, but there are two drawbacks: some of the dates for the plaster types are based on supposedly known dates for several aqueducts, which are arguably quite insecure and there is a gap in independent data for the period between Hadrian and AD385.<sup>31</sup> In addition, very few people who base their chronology on Porath's scheme seem to use his plaster classification correctly or closely.<sup>32</sup> This last problem is particularly disappointing since one of the strengths of Porath's work is a drive towards a more objective and stringent technique of recording and description of plaster types. Porath should be applauded for at least attempting to provide a new scheme for dating aqueducts.

Finally, another bias emerges from looking at an interesting dichotomy in archaeological work undertaken in the Near East. In general, scholars research either the Roman and late Roman periods or periods that preceded or followed. The Roman and late Roman periods have been detached almost from the rest of Near Eastern history. It is difficult to understand why this dislocation has occurred, but it may be that Ball and Dalley have struck the answer by comparing work done by Classical archaeologists with that done by Near Eastern archaeologists. They both assert that almost all works on the Roman Near East, which are usually written by Classicists, take an overly western cultural, or 'Eurocentric', standpoint.<sup>33</sup> With this bias strongly implanted, it becomes very difficult to match one account to another. In particular, works on Roman water supply techniques in the Near East make only superficial glances back to the past traditions and usually only as far back as the Hellenistic period, with the exception of Wilkinson's excellent study on the water supply of the Balikh Valley.<sup>34</sup> Wikander's recent handbook has gone some way to improving this situation, but its very broad geographical range (from Iran to the Atlantic)

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<sup>29</sup> For example Tsuk *et al.* 2002, 209: 'Carbon 14 analyses of the charcoal from the mortar of the stone pipeline yielded a date of 50 BC – AD 240. It allows us to suggest a date as early as the 1<sup>st</sup> century AD.'

<sup>30</sup> Porath 2002a.

<sup>31</sup> The gap in independent data is recognised by Porath himself and by the editors of the book: Frumkin 2002, 277, editor's note; Porath 2002a, 35.

<sup>32</sup> See, for example: Frumkin 2002b, 274-5; Tsuk *et al.* 2002, 209.

<sup>33</sup> Ball 2000, 2; Dalley 2001-2; Dalley and Oleson 2003.

<sup>34</sup> Wilkinson 1998.

has meant that no single region was analysed for and in itself.<sup>35</sup> The reluctance of some to acknowledge the pre- and post-Roman periods has led to a further bias.<sup>36</sup> By omitting study of these periods, an implicit assumption is made concerning the supremacy of the Romans and their total control over the management of the water supply.

I hope that the following chapters will show that, in spite of these issues, there is great potential in the data from the Near East. The methods and aims of the work should help to further our understanding of the cultural processes involved in the transfer of technology, for example what triggers these transfers and what influences their movement? In addition, it is hoped that the study of one of the most vital resources for life in the region will have elucidated the dynamics behind the acceptance of or the refusal to accept an existing culture and tradition.

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<sup>35</sup> Wikander 2000a.

<sup>36</sup> This can be contrasted with studies on North Africa, for example Shaw 1984, where some work has been done on the pre-Roman water supply in an effort to understand the Roman situation more clearly.