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Ships of the Desert and Ships of the Sea

Palmyra in the World Trade
of the First Three Centuries CE

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Preface

This book is a result of the projects *Palmyrena: City hinterland and caravan trade between Orient and Occident* (2009–2013) and *Mechanisms of cross-cultural interaction: Networks in the Roman Near East* (2013–2016). Both projects were funded by the Research Council of Norway. The *Palmyrena* project included three seasons of joint Syrian-Norwegian archaeological survey in the steppe and mountains north of Palmyra over the years 2008–2011. The survey and other results of the project have been and will be published separately by other team members.

I am most obliged to the Syrian Directorate General of Antiquities and Museums (DGAM) and to Palmyra Museum, at that time under the directorship of Waleed al-As'ad, for the opportunity to work in Syria and Palmyra. Also I would like to thank project leader Professor Jørgen Christian Meyer, colleagues Dr. Nils Anfinset, Dr. Torbjørn Schou, and other team members for the opportunity to be a part of the survey and thus to get first-hand knowledge of Palmyras ecological setting, so important for its role in the caravan trade. With respect to this no individual was more important than our guide, driver, interpreter and facilitator Adib As'ad. I would like to thank the scholarly community engaging with Palmyra for warmly welcoming and supporting newcomers in the field. I am also most obliged to Professor Meyer and Dr. Leonardo Gregoratti for our many discussions of Palmyrene matters, and to Meyer, Professor emeritus Richard Holton Pierce, and Professor Dr. Kai Ruffing for reading and commenting on the manuscript of this book.

I had the opportunity to visit Syria and Palmyra a number of times in the period 2004–2010. On most occasions I had the pleasure of enjoying the hospitality and assistance of the Turki family, especially Naim and Ahmed. I would also like to thank colleagues, hosts, guides, drivers, fellow travellers, vendors, and all the Syrians who made my visits to their country and to Palmyra so enjoyable and rewarding. Thanks also to my wife and daughters for their support for and patience with my work and travels.

As this book was written Syria was being torn apart by civil war. The ruins of Palmyra were dismantled by the terrorist group known as the Islamic State and became a battleground during the government reconquest. My thoughts have constantly been with the people of Syria and the sufferings they are forced to endure. I hope that Palmyra and other parts of Syria's proud heritage and history can contribute to a better future when peace one day returns to the country.

University of Bergen, Department of archaeology, history, cultural studies and religion,
August 2016,

Eivind Heldaas Seland

The caravan city

This small book is about the long-distance trade revolving around the ancient city of Palmyra. Palmyra is situated in the northern part of the Syrian Desert, at about equal distance from the oasis of Damascus, the fertile plains of northern Syria, the agricultural lifeline of the Euphrates, and on the border between the Roman and Arsacid, later Sasanid empires. The modest oasis settlement grew to become one of the major cities of the ancient world in the course of the first three centuries CE. A driving force behind this development was the Palmyra's role in the long-distance trade between Indian Ocean and Mediterranean. As earlier commentators have pointed out, there was nothing natural or predetermined about this development: Palmyra was never on the most convenient route between east and west,¹ and many cities shared her position on the eastern edge of the Roman world. Thus, although Palmyra's success was built on a number of preconditions, it must also be explained as a result of the agency of the people living in and around the city.²

Two basic questions are discussed in this book: why and how? What circumstances allowed a small community at the periphery of two great empires to rise to a position, from where in the mid-third century, it was able to challenge the might of both, even if only briefly? How did the population of Palmyra utilise the opportunities offered by the city's geopolitical situation to reap the profits of a highly lucrative long-distance commerce? In order to answer these questions, a number of topics are explored. This chapter continues with a discussion of earlier research, the most relevant source material relating to Palmyrene trade, and the analytical tools that will be utilised in order to approach this data. Chapter two considers at the city, its hinterland, climate, population, regional economy, social and political composition and historical background. Chapter three surveys the products, places and routes of travel involved in Palmyrene trade. Chapter four explores the practicalities of organising caravan trade, while chapter five situates Palmyra in the wider setting of proto-global trade between Mediterranean and Indian Ocean – Asia, Europe, and Africa around the turn of our era.

Previous scholarship

In the late 17th century, the ruins of Tadmor, which is the Semitic name of Palmyra, caught the attention of European expatriates in Aleppo. From classical sources and their later reception in art and literature, Palmyra was well known to the European readership as the home of Zenobia, the queen who tried to install her son Vaballathus as Roman emperor in the third quarter of the third century.³ The first reports from the site reached Europe in the wake of a successful expedition in the autumn of 1691,⁴ and several illustrated accounts were published following subsequent visits, most famously Robert Wood's *The Ruins of Palmyra* (1753). Palmyra's role as a mediator in the trade between the Roman Empire and the East was

1 Gawlikowski, 1988, pp. 163–164; Young, 2001, pp. 137–138.

2 Young, 2001:137–138.

3 Hartmann, 2001; Hvidberg-Hansen, 2002; Southern, 2008.

4 Browning, 1979, pp. 54–62; Halifax & Conder, 1890 (1695).

known from literary accounts, and already familiar to Wood.⁵ Many of the so-called caravan inscriptions found in the Agora and the Colonnaded Street were published as early as 1870.⁶ Nevertheless the commercial activities of the Syrian city, were not seriously addressed until 1932, when M. Rostovtzeff published his seminal travelogue, *Caravan Cities*,⁷ linking the rise of Palmyra to the trade in aromatics, spices and textiles from Arabia, India and Persia. The book gave Palmyra the “caravan city” epithet it has carried in scholarly literature as well as popular imagination ever since, along with Petra in southern Jordan, and arguably with less justification Dura Europos in eastern Syria and Jerash of the Decapolis.⁸ Rostovtzeff, however, also published a contribution of more scholarly nature and ambition in the same year. In *Les inscriptions caravannières de Palmyre* he analysed the inscriptional evidence of Palmyrene caravan trade known until then.⁹ The texts mentioned individuals holding the municipal offices of *synodiarchês* (Aramaic: *rb šyrt*) – “caravan leader” and *archemporos* (no Aramaic equivalent preserved) – “head merchant”. Rostovtzeff saw these people as representatives of a merchant-aristocracy, which not only invested in, organised and protected caravans, but also ruled the city, and who based their power on the income generated from trade.

Rostovtzeff’s interpretation prevailed until Ernest Will’s 1957 article *Marchands et chefs de caravanes à Palmyre*,¹⁰ where he drew a distinction between the roles of caravan patrons, members of the local elite who financed and protected caravans, and the caravan leaders (synodiarchs) who were in charge of the actual operation and organisation. Drawing on Daniel Schlumberger’s surveys and excavations in the mountains north-west of Palmyra,¹¹ which had uncovered extensive estates and villages dating to the Roman period, Will thought the caravan patrons had substantial pastoral and agricultural resources at their disposal, thus bringing them more in line with local elites elsewhere in the Roman Empire.

Will’s main distinction between patrons and organisers has passed the test of time, insofar as it has been accepted in later scholarship,¹² although commentators have pointed out that the difference in status between caravan leaders and patrons – the honourands mentioned in the inscriptions – is not always clear, and that the synodiarch seems to have been an individual of considerable standing rather than the mere technical subordinate proposed by Will.¹³ The existence of a regular role of caravan patron has also been cast into doubt, and the services rendered by members of the Palmyrene elite to the caravans are interpreted in more general terms as acts of euergetism towards the city community.¹⁴

Much literature on Palmyrene trade has focused on the city’s connection with Dura Europos on the Euphrates and from there eastwards through upper Mesopotamia to Iran. Dura was indeed home to a sizeable Palmyrene community,¹⁵ including a garrison of Palmyrene

5 Wood, 1753, p. L.

6 Waddington, 1870.

7 Rostovtzeff, 1932a.

8 Millar, 1998.

9 Rostovtzeff, 1932b.

10 Will, 1957.

11 Schlumberger, 1951.

12 Gawlikowski, 1994: 31; Sommer, 2005b: 208–12; Teixidor, 1984: 15–9.

13 Andrade, 2012; Sommer, 2005b: 212; Will, 1957, p. 270; Yon, 2002: 101–4; Young, 2001:137–8.

14 Sommer, 2005b: 209–12; Young, 2001:154. Will, however, also saw this as an important part of the role played by the Palmyrene elite.

15 Dirven, 1999.

soldiers in Roman service in the second and third centuries.¹⁶ The epigraphic records from the two cities, however, show little trace of any role played by Dura in long-distance commerce, and cities in Middle and Southern Mesopotamia appear to have been the main destinations of Palmyrene caravans.¹⁷ In more recent and better attested periods, the Euphrates was more often crossed at Ana (also the site of a Palmyrene garrison), Hit, Jubba and Falluja, all far downstream from Dura.¹⁸ The Syrian section of the probable route from Palmyra to Hit, discussed in more detail in chapter three (see below, p. 45), was surveyed from the air by Antoine Poidebard in 1930 and the Iraqi section by Aurel Stein in 1938–39,¹⁹ and from there trade was probably conveyed by river downstream to the main cities of the Arsacid Empire and the Persian Gulf.²⁰ Indeed, as the work of Henri Seyrig, Michał Gawlikowski, and others has shown, Palmyrene caravan trade seems to have linked up primarily with the Persian Gulf commerce,²¹ which was in turn part of the larger Indian Ocean system of exchange.²² In this context it also becomes possible to appreciate the growing evidence of Palmyrene presence from Red-Sea and Indian Ocean settings discussed in chapter three (below, p. 38).²³

More than 80 years after *Caravan Cities*, the epithet has been discarded for the other cities described in Rostovtzeff's book as no actual evidence suggests that their economy was primarily based on this activity. However, it remains unchallenged for Palmyra.²⁴ We know much about the 'where' and 'what' aspects of Palmyrene commerce, but other dimensions are still underexplored, namely the 'why?' and 'how?' questions, which are the points of departure for this book. While there is a solid tradition of recent scholarship on Palmyrene urbanism,²⁵ art,²⁶ epigraphy,²⁷ religion,²⁸ society,²⁹ and political history,³⁰ it is symptomatic that only one comprehensive study of Palmyrene commerce has been published – Javier Teixidor's excellent, but brief and now somewhat dated *Un port romain du désert* (1984).³¹ Other contributions have been in the form of articles on specific aspects of Palmyrene trade, or shorter parts of works dealing with a wider range of topics.³² Rostovtzeff's observation that

16 Edwell, 2008.

17 Gawlikowski, 1994, 1996.

18 Historical crossings: Beawes, 1929, p. 18; Carmichael, 1929, p. 156; Carruthers, 1929, p. 156; Grant, 1937, p. 169. Palmyrenes at Ana: *PAT* 0319; 2757; Gawlikowski, 1983, pp. 60–61.

19 Gregory & Kennedy, 1985; Mouterde & Poidebard, 1931; Poidebard, 1934.

20 Gawlikowski, 1983, pp. 168–169.

21 Delplace, 2003; Gawlikowski, 1988; 1994, pp. 28–29; Healey, 1996; Seyrig, 1936; 1950, pp. 2–3.

22 Seland, 2011.

23 Egypt: Bernand, 1984: 146–8, 238–41, 262–263; Bingen, 1984; Dijkstra & Verhoogt, 1999. Hadramawt: Bron, 1986. Socotra: Dridi, 2002; C. Robin & Gorea, 2002.

24 See Millar, 1998. He concludes that Palmyra is the only city of the Roman East, for which the epithet is justified.

25 Gawlikowski, 2003; Hammad, 2010; Plattner & Schmidt-Colinet, 2011; Schmidt-Colinet & Al-As'ad, 2013.

26 Colledge, 1976; Tanabe, 1986.

27 Hillers & Cussini, 1996; Yon, 2012.

28 Kaizer, 2002.

29 Andrade, 2013; Smith, 2013; Sommer, 2005b; Yon, 2002.

30 Hartmann, 2001.

31 Teixidor, 1984. Only the first 55 pages deal with the long-distance commerce.

32 Arguably, this applies also to R. Drexhage, 1988. Her study deals primarily with the caravan inscriptions. For treatments of Palmyrene trade as parts of more wide-ranging works see Smith, 2013, pp. 68–80; Sommer, 2005b, pp. 202–224; Will, 1992, pp. 57–102; Yon, 2002, pp. 99–124; Young, 2001, pp. 136–186. For shorter accounts see Gawlikowski, 1994, 1996; Seland, 2014b, 2015a.

we know next to nothing about the internal organisation of the Palmyrene caravans remains as valid as it was in 1932.³³ We also know very little about the practicalities of Palmyrene commerce, and the role of Palmyra and the Syrian Desert in the exchange between Indian Ocean and Mediterranean compared to other cities and regions continues to be poorly understood.

Sources

The relative paucity of literature on these matters must be ascribed partly to the nature and limited quantity of data directly addressing the topic. Most references to Palmyra in classical literature stem from the period after the city lost its position in long-distance commerce, and deal with the city's role in the wars against the Sasanian Empire and Zenobia's attempt at imperial power in the third quarter of the third century CE. While authors such as Strabo, Pliny the elder, Josephus and Ptolemy contain valuable information about the world that Palmyra was a part of, the only direct literary reference to Palmyrene trade is in Appians' *Civil Wars*, where we learn that the Palmyrenes conveyed Indian and Arabian goods to the Roman Empire by way of Persia (the Arsacid Empire).³⁴

Compared to most cities of the Roman East, however, Palmyra, has an exceptionally rich epigraphic record, with ca. 3000 inscriptions in Palmyrene Aramaic, Greek, and to a more limited extent, Latin.³⁵ The longest and arguably most famous of the texts, the 237+149 lines Greek/Aramaic bilingual known as "the tax law" of Palmyra,³⁶ unfortunately deals only with the local and regional economy of the city,³⁷ and reveals little about the long-distance trade. Our main evidence of Palmyrene trade remains limited to a body of c. 35 honorific texts, all but one of them found in or near Palmyra.³⁸ These commemorate the successful return of caravans (*synodia/šyrh*) and assistance given to them, or document the presence of Palmyrene merchants (*emporoi/tgr*) and other individuals in cities of Middle and Southern Mesopotamia. There are also a number of inscriptions referring to the activities of Palmyrenes from other places.³⁹ Many of these were dedicated by Palmyrenes doing military service in Roman auxiliary forces, but others are certainly or likely connected to commercial activities, such as the dedication made by Palmyrene merchants in Koptos on the Nile,⁴⁰ the presence of two Tadmoraans at a ceremony in the frankincense producing kingdom of Hadramawt in South Arabia in the mid-third-century,⁴¹ and the dedication made by a Palmyrene in a sanctuary in the Hoq cave of Socotra in the Gulf of Aden.⁴²

In order to place these texts in context, it is necessary to draw on other categories of data. Direct archaeological evidence of Palmyrene long-distance commerce remains limited for several reasons. Palmyrene trade was primarily a transit trade. Although some imports were

33 Rostovtzeff, 1932b, p. 805.

34 Appian, *Bell. Civ.* 5.1.9.

35 As'ad, Yon, & Fournet, 2001, pp. 13–15; Hillers & Cussini, 1996; Yon, 2012.

36 *PAT* 0259/*OGIS* 629/*IGR* III.1056. Recent commentaries and translations in Healey, 2009 (Aramaic), Fox, Lieu, & Ricklefs, 2005; Kottsieper & Jördens, 2005 (Aramaic and Greek).

37 Matthews, 1984; Meyer, 2013; Teixidor, 1983; 1984, pp. 57–90. On the regional role of Palmyra see also the reports of the Syrian-Norwegian survey north-west of the city, 2009–2011: Meyer, 2009, 2011.

38 List in Yon, 2002, pp. 263–264.

39 List in Yon, 2002, pp. 272–273. Later additions: Gorea, 2012; Robin, 2012a.

40 *I. Portes* 103.

41 Bron, 1986; Robin, 2012b.

42 Bron, 1986; Gorea, 2012.

undoubtedly consumed in the city, most were probably destined for Syrian and Mediterranean markets.⁴³ Many of these goods, such as spices and aromatics, were used in food, medicinal drugs, cosmetics and incenses, and were thus consumed already in antiquity. If they were not used up, they have only rarely survived in archaeological contexts. Durable goods, such as pearls and gems, can in many cases be traced to their point of origin, but not to transit points such as Palmyra. Textiles stand out from this picture, for numerous fragments have survived from funerary settings in Palmyra. Fibres, fabrics, patterns and dyes can be traced, and shows the city's connections to India, China and Central Asia.⁴⁴

There is, however, considerable indirect archaeological evidence, which can contribute towards a more comprehensive understanding of Palmyra's role. Road stations, milestones, wells, roads and tracks, although often serving primarily military or pastoral activities rather than trade, help reconstruct routes and infrastructure also used by merchants. Moreover, Palmyra seems to have been an important player in ancient Indian Ocean commerce, a field where major archaeological advances have been made over the last two decades,⁴⁵ especially with regard to ceramics,⁴⁶ excavations of port sites,⁴⁷ and archaeobotanical studies.⁴⁸ While such studies reveal little about Palmyra itself, they lend context, which makes it possible to fit the city into the wider jigsaw puzzle of ancient world trade.

A final category of indirect evidence is ethnographic, topographic, geographic, climatic, meteorological, hydrological, and later historical data. The physical world in which Palmyrene traders operated is still there to study. Life in this world was shaped, to a certain extent even determined, by conditions that remained very much the same from antiquity and until the early twentieth century. Travelogues, geographical handbooks and ethnographic accounts report on patterns of subsistence and movement, which give useful analogies for our limited evidence. This does not in any way imply that life in the Syrian Desert has not changed since antiquity, but simply that the natural conditions facing people almost two thousand years ago, were more or less the same as those prevailing in the region until the advent of motorised transportation, and that reports from the later part of this period can also shed light on the available space for interaction between people and their environment in earlier parts of the period. Drawing from the discipline of ethnoarchaeology, we can distinguish between what Valentine Roux labels 'simple' and 'complex correlates'.⁴⁹ The distribution of perennial wells and the topography and seasonal climate variations of the Syrian Desert have remained virtually unchanged since the Palmyrene period (see below, p. 15), enabling the identification of simple (direct) correlates. Does that imply that the Ottoman period caravans well documented in early modern travelogues and diaries can serve as analogies or complex correlates for those undertaken by the Palmyrenes, and that the Ottoman period Bedouin resemble the Roman period nomads called the *skenitai* ("tent-dwellers")? These historical phenomena were certainly not identical, but they are nevertheless comparable. They represent people acting under similar ecological, technological, and in related political settings.

43 See discussion below, p. 52.

44 Schmidt-Colinet, Stauffer, & Al-As'ad, 2000.

45 Cf. Seland, 2014a; Sidebotham, 2011; Tomber, 2008.

46 Tomber, 2007.

47 Berenike, Egypt: Sidebotham, 2011. Adulis, Eritrea: Peacock & Blue, 2006. Myos-Hormos, Egypt: Peacock & Blue, 2007. Qana, Yemen: Salles & Sedov, 2010. Pattanam, India: Cherian, 2011.

48 Cappers, 2006.

49 Roux, 2007.

Studying ancient societies in comparative context offers the opportunity to gain an insight into their *Lebenswelt* that is often denied by fragmentary data. This of course also entails the risk of anachronism, which, however, is inherent to any study of the past, but easier to deal with if comparisons are made explicitly than if analogies remain implicit.

Theoretical approach: Networks, organisations and institutions

Most literature on ancient commerce depicts trade routes as lines on a map, along which material goods were transported. While the movement and exchange of commodities are certainly the hallmarks of long-distance trade, such depictions tend to obscure the fact that trade routes were never lines on a map. Indeed ancient merchants, while they did have access to route descriptions, almost certainly never utilised maps at all. Trade routes were people moving through landscapes, riverscapes and seascapes by means of animals, boats, ships, and importantly their own feet. Anyone with even the slightest experience of animals, riverboats, sailing ships or trekking, can start to imagine the smell, boredom, monotonousness, bad food, fatigue and sore feet of ancient long-distance travel. Add to that the brackish well-water, burning summer sun, dust storms, freezing winter rain, and occasional sleet of the Syrian Desert, the monsoon showers of the Indian Ocean, and the ever present danger and occasional reality of highwaymen, predatory authorities or a violent storm. All of a sudden the commerce in oriental luxuries loses some of its romantic attraction, and the practical challenges facing ancient, or indeed any premodern traders, come into the foreground.

In order to appreciate this human element of ancient trade, and inspired by the substantial recent work done by others on networks in the ancient Mediterranean and in other settings,⁵⁰ this study approaches trade in terms of networks. These include physical networks of places and objects as well as social networks of trade and power. In a basic sense, describing networks is nothing more than saying that people were in touch with each other, and that they interacted with animals, places and objects. By describing networks, however, we can visualise the layout and extent of such interaction. Networks are composed of nodes, which can represent individuals, texts, artefacts or even meeting places or arenas of interaction. Groups of interconnected nodes within a network are called clusters. By identifying such clusters, it becomes clear which nodes are vital to the continued operation of the network and how the network is integrated. The lines connecting the different nodes are called ties or edges.⁵¹ To the student of the past these are of special interest because trade networks were social networks and they represent the ties connecting the people constituting the network. They also stress the point argued by Bruno Latour, that networks have no independent existence, they are created and recreated by the actions of the participating actors.⁵² So which social, political and economical mechanisms were at work when commodities were moved and changed hands: friendship, kinship, tribal affiliation or citizenship – sale, barter, gift-exchange, taxation, tribute or robbery? Below a variety of network approaches and terminology is used

50 On network analysis see Brughmans, 2013; Collar, 2013; Knappett, 2011, 2013; Malkin, 2011; Malkin, Constantakopoulou, & Panagopoulou, 2011; Rivers, Knappett, & Evans, 2013; Ruffini, 2008; Schor, 2011; Sindbæk, 2009. On networks as a theoretical approach also Borgatti, Mehra, Brass, & Labianca, 2009; Knappett, 2011; Mann, 1986; Padgett & Ansell, 1993; Wasserman & Faust, 1994.

51 For an introduction to the terminology of Social Network Analysis, see Wasserman & Faust, 1994. Network Science in archaeological scholarship, see Collar, Coward, Brughmans, & Mills, 2015.

52 Latour, 2005.

partly as a metaphor in order to explain what was going on, partly as an analytical tool in order to describe it.

The mechanisms sustaining networks can be approached with help of tools borrowed from the field of New Institutional Economy. In *Violence and Social Order: A Conceptual Framework for Interpreting Recorded Human History*, Nobel laureate Douglass C. North and his colleagues John. J. Wallis and Barry Weingast engage with the fact that all societies have to deal with the problem of containing violence. North et al. argue that societies do this by way of *organisations* and *institutions*. By organisations, they mean “groups of individuals pursuing a mix of common and individual goals through partially coordinated behaviour”.⁵³ In the context of Syria in the first centuries of our era, a non-exhaustive list of such organisations would include not only the Roman and Arsacid empires, but also a number of city states, including Palmyra, robber bands and nomadic tribes of the steppe, petty kings along the Euphrates, associations of merchants and artisans and even, as we shall see, Palmyrene caravans. Institutions, North et al. define as “the patterns of interaction that govern and constrain the relationships of individuals”.⁵⁴ With regard to the individuals and groups interacting in ways significant for Palmyrene trading activities, such institutions would include all the mechanisms, mentioned above: friendship, kinship, tribal affiliation, citizenship, sale, barter, taxation, tribute, robbery. The merit of this approach is that by using the concepts of organisations and institutions, otherwise very dissimilar groups and processes can be interpreted within a common framework. The Roman Empire, a Palmyrene caravan and a group of highwaymen, were different with regard to size, capacity, social composition and a myriad other aspects, but they had one thing in common, namely that they aimed at extracting revenue from long-distance trade, and in order to do that they would have to interact, or, seen from the perspective of the caravan merchant, minimise interaction by way of the institutions listed above.

The application of modern models to ancient history has been controversial, but the ambition here is not to force ancient data to fit modern theory, but to apply these perspectives of networks, organisations and institutions in a loose manner, in order to construct a framework that can help interpret a fragmentary source material that is partly of indirect and comparative nature.⁵⁵ In Moses I. Finley’s polemical words: “The familiar fear of *a priorism* is misplaced: any hypothesis can be modified, adjusted or discarded when necessary. Without one, however, there can be no explanation”.⁵⁶ Finley’s own model of the ancient economy, with its heavy emphasis on mentality and status, was never able to explain the Palmyrene example, which he considered an anomaly.⁵⁷ Arguably the models borrowed from Network Analysis and New Institutional Economics are better suited to create the framework necessary to appreciate the significance of Palmyrene long-distance trade.

53 North, 1990, pp. 4–5; North, Wallis, & Weingast, 2009, p. 15.

54 North, 1990, pp. 4–5; North et al., 2009, p. 15.

55 As called for by Manning & Morris, 2005, pp. 1–43.

56 Finley, 1986, p. 66.

57 Finley, 1992, p. 59; Millar, 1998.