Roman and Late Antique Wine Production in the Eastern Mediterranean

A comparative archaeological study at Antiochia ad Cragum (Turkey) and Delos (Greece)

Emlyn K. Dodd

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Cover: Reconstructed lever press, *Villa dei Misteri*, Pompeii (E. Dodd 2015).

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For my Grandfather,
whose scholarly prowess never failed to inspire

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Acknowledgements

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Abbreviations

Miscellaneous

ACARP	Antiochia ad Cragum Archaeological Survey Project
d.	depth
diam.	diameter
ÉfA	École française d'Athènes
est.	estimated
ext.	external
h.	height
int.	internal
masl	metres above sea level
RCASP	Rough Cilicia Archaeological Survey Project
SA	surface area
St. Cyrique	also Kyrique, Quirique, Κύρικος, Κήρυκος
w.	width

Journals

Used in accordance with those given by *L'Année Philologique*

AJA	American Journal of Archaeology
ANMED	Anadolu Akdenizi Arkeoloji Haberleri
AnTard	Antiquité Tardive
AR	Archaeological Reports
ArchClass	Archeologia Classica
Atiqot	'Atiqot
BABesch.	Bulletin Antieke Beschaving (or BABESCH)
BASO	Bulletin of the American Schools of Oriental Research
CPh	Classical Philology
CR	Classical Review
CRAI	Comptes Rendus des S*éances de* l'Académie des Inscriptions et Belles-Lettres
DOP	Dumbarton Oaks Papers
EMC	*Échos* du Monde Classique - Classical Views
IEJ	Israel Exploration Journal
IJCT	International Journal of the Classical Tradition
JAOS	Journal of the American Oriental Society
JAS	Journal of Archaeological Science
JHS	The Journal of Hellenic Studies
JIH	Journal of Interdisciplinary History
JJP	The Journal of Juristic Papyrology
JÖAI	Jahreshefte des Österreichischen Archäologi-schen Instituts in Wien
JRS	Journal of Roman Studies
JS	Journal des Savants
JWR	Journal of Wine Research
KUB	Keilschrifturkunden aus Boğazköi
MDAI(A)	Mitteilungen des Deutschen Archäologischen Instituts, Athenische Abteilung
MHR	Mediterranean Historical Review
PalEQ	Palestine Exploration Quarterly
PCZ	Zenon Papyri [ed. C.C. Edgar (Cairo; 1925-1931)]
Topoi (Lyon)	TOPOI: Orient-Occident

Ancient Authors and Texts

Where applicable, used in accordance with the *Oxford Classical Dictionary* 4th *ed.* [Esther Eidinow (ed.), (Oxford University Press; 2012)].

Ant. Thess., *Ant. Pal.*	Antipater of Thessaloniki, *Anthologia Palatina*
Ap. Rhod., *Argon.*	Apollonius Rhodius, *Argonautica*
App., *Mith.*	Appian, *Mithridatic Wars*
Ath., *Deip.*	Athenaeus, *Deipnosophistae*
Gell., *NA*	Aulus Gellius, *Noctes Atticae*
Callim., *Hymn* 4	Callimachus, *Hymn to Delos*
Cato, *Agr.*	Cato, *De Re Rustica/De Agricultura*
Cod. Theod.	*Codex Theodosianus*
Columella, *Rust.*	Columella, *De Re Rustica*
Dion. Hal., *Ant. Rom.*	Dionysus of Halicarnassus, *Antiqui-tates Romanae*
Dioscorides, *MM.*	Dioscorides, *Materia Medica*
Galen, *De San. Tuend.*	Galen, *De Sanitate Tuenda*
Hero, *Mech.*	Hero of Alexandria, *Mechanica*
Herodotus, *Hist.*	Herodotus, *Histories*
Hes., *Op.*	Hesiod, *Opera et Dies (Works and Days)*
Isid., *Etym.*	Isidorus, *Etymologiae*
Lib., *Oratio*	Libanius, *Oratio*
Macrob., *Sat.*	Macrobius, *Saturnalia*
Martial, *Ep.*	Martial, *Epigrams*
Palladius, *Op. Agr.*	Palladius, *Opus Agriculturae*
Paus.	Pausanias
Plin., *HN*	Pliny the Elder, *Historia Naturalis*
Plin., *Ep.*	Pliny the Younger, *Epistulae*
Plut., *Pomp.*	Plutarch, *Pompeius*
Strabo, *Geog.*	Strabo, *Geography*
Sulp. Sev., *Dialog.*	Sulpicius Severus, *Dialogues*
Tert., *Apol.*	Tertullian, *Apologeticus*
Tert., *De Pal.*	Tertullian, *De Pallio*
Theod., *HE*	Theodoret, *Historia Ecclesiastica*
Theod., *Pag. Mal.*	Theodoret, *Cure of Pagan Maladies*
Varro, *Rust.*	Varro, *De Re Rustica*
Virgil, *G.*	Virgil, *Georgics*
Vit., *De arch.*	Vitruvius, *De architectura*
Xen., *An.*	Xenopohon, *Anabasis*

Definition of Terminology

Byzantine: This term is used in a broader sense than that of 'Late Antique' and denotes the period from the founding of Byzantium (Constantinople) *c.* 330 AD under Constantine to the early 13th century AD (and the fall of Constantinople to the Crusaders in AD 1204). This term is applicable to the eastern half of the Mediterranean and should not be confused with the, slightly later, medieval period in the western Mediterranean (after the collapse of the western Roman Empire).

Late Antique: In accordance with definitions provided by Lavan and Rossiter in publications related thematically to the present study, Late Antiquity is defined herein as the period from Diocletian to the Lombard invasions: the late 3rd century to *c.* 600 AD.[1]

Mediterranean: Including the: **Central** regions of Italy (*Italia*), the Italian islands (*Corsica*, *Sardinia, Sicilia*) and *Illyricum*; **Eastern** regions of Greece (*Hellas*, *Macedonia*), the Aegean islands (*Cyclades, Dodecanese*), Turkey (*Asia Minor*, *Pamphylia*, *Cilicia*, *Lycia, Lycaonia*), Syro-Palestine (*Syria*), the Levant (*Judea*), Egypt and the Black Sea littoral (*Colchis*, *Armenia*, *Ponius*, *Galatia*, *Bithinia*); and **Western** regions of modern France (*Gallia*), Spain and Portugal (*Hispania*), and Great Britain (*Britannia*).

Viniculture:* A term used to define certain aspects specific to the production of wine; most appropriately used to describe processes post-harvest. This can include: treading, pressing, fermentation, and cellaring – generally, processes that are completed either within the press installation or larger winery.

Viticulture:* A broader term used to describe the overarching process of grape production, regardless of the end product – from agricultural preparation, planting and harvesting through to the pressing of grapes and fermentation of must. This can also include the production of grapes, and secondary *vitis* products (vines and leaves), for other commodities, including raisins, table grapes, and grape syrup.

*It is my recommendation that these definitions be applied to modern studies of ancient wine production into the future; not only to avoid confusion of terminology within the expanse of publications relating to the topic, but to aid in clarifying certain aspects of the production process as well as modernise terminology in academic publications thus making it more relatable to contemporary wine production.[2]

[1] Lavan 2007: xviii; Rossiter 2007: 94 with n. 4.

[2] The author recommends that the reader review the detailed Lexique provided by Amouretti and Brun (1993: 587-95) as an invaluable resource to understand the various individual components of oil and wine presses in antiquity. The varied and confusing nature of viticultural terminology, particularly between translators and lexicographers, is also recognised by White (1975: 109).

Part 1
Prolegomenon

Chapter 1:
Wine Production in Antiquity

1.1 General Introduction

The view is impressive atop the elevated podium flooring of the Imperial temple at Antiochia ad Cragum; a deteriorated wine press to one side, agricultural fields on the other, and, directly in front, the jagged countryside of *Cilicia Tracheia* dropping sharply into the Mediterranean. It is easy to imagine that the dilapidated stone terracing of the surrounding fields once contained rows of cultivated grape vines, thriving on the southern slopes of this coastal eastern Mediterranean climate. The scene from antiquity unfolds before one's eyes: sweaty workmen trampling harvested grapes on the treading floor, freshly pressed must flowing into the collection vat, a monumental, disused Graeco-Roman temple providing shelter and shade in the heat of Spring – it is one of a prospering, ancient agricultural industry.

A strikingly similar scene is realised on the Cycladic island of Delos. Walking through the ruined structures of the vast Hellenistic city, one occasionally encounters viticultural installations; often constructed haphazardly over earlier houses, shops or civic buildings. Here, the installations are clustered near the water's edge, vying for a strategic position close to the port. One imagines the occupants of Late Antique Delos, survivors of the tragic invasions and economic hardship of past generations, forging ahead and building a prosperous viticultural industry with which to characterise the reinvigorated settlement. A short journey south along the island allows one to appreciate the extent of their agricultural industry; stone boundary walls still clearly demarcate the fields into what was once a terraced lattice worked by the Delians. The ancient pathways are also still visible; those that bustled during the vintage as workmen transported grapes from the rural terraces into the town to be pressed at the centralised installations.

Driving up the slopes of Mount Etna, Sicily, I recall fond memories of the archaeologically inspired, viticultural reveries at Antiochia ad Cragum and Delos. Winding along the narrow, vineyard-lined road that makes its way from the rural Sicilian village of Solicchiata toward the summit of the mountain, ruined *palmenti*[3] could be seen dotting the countryside. This fertile volcanic soil is home to many vineyards and wineries in the present day, as it has been for millennia. While the countryside is greener than that of Rough Cilicia or the Cyclades, the scene is remarkably similar. In pre-industrial Sicily grapes were harvested from surrounding terraced fields and brought into these *palmento* complexes; here, the must was extracted by extensive manual treading on large floors and mechanical pressing with colossal lever presses.

Despite being over one thousand years apart, and in vastly different climatic and socio-cultural conditions, the fundamental processes and architecture associated with wine production are almost indistinguishable. Indeed, viti- and vinicultural methods remained relatively analogous throughout the Mediterranean from prehistory through antiquity, albeit with occasional technological evolution, until the advent of modern industrial production methods and scientific influence. In fact, select wineries in modern Eurasia continue to reflect on their past and incorporate traditional methods into their viticultural practice.[4]

The origin of these chronologically long-lasting and continuous viticultural practices can be traced back *c.* 20,000 years BP, with the earliest evidence found at the prehistoric Neolithic site of Ohalo.[5] The majority of early evidence, however, dates from 8000-6000 years BP and is found in the eastern Mediterranean in the form of organic remains, including grape pips, skins and wood along with chemically analysed wine jars.[6]

As time passed, wine became a staple commodity of the ancient world, particularly in the Mediterranean region, surpassing even the popularity of other fermented beverages in areas where wine was not traditionally popular.[7] The increasing popularity of

[3] *Palmento*: literally, 'a place where grapes are pressed.'

[4] This is particularly prevalent in areas of Georgia, where colossal *qvevri* are still used in fermentation and aging processes. Traditional methodologies are becoming increasingly common with the globally spreading popularity of the 'natural' wine movement.

[5] McGovern 2003: 2 with map 2.

[6] McGovern 2003: 2 with map 2. Brun (2003: 11) provides a useful overview of the chronological spread of viticultural practice, from the first attestation at Hajji Firuz Tepe, Iran (*c.* 5500 BC) to the beginnings of viticulture in Gaul and Spain (*c.* 600 BC). Technological developments have allowed the scientific, chemical and biomolecular study of the early evidence for wine and, as a result, these fields have received much attention in recent years (cf. Barnard *et al.* 2011; McGovern 2003; 2013; McGovern *et al.* 1996; Pecci, Ontiveros and Garnier 2013; Pecci *et al.* 2013).

[7] An interesting example of this includes the increasing prevalence of wine in Egypt and the Near East, particularly as the region became Hellenised, Romanised and, later, saw the popularity of monasticism throughout (Dzierzbicka 2005; 2010; 2015). Forbes (1956: 131-39) discusses the influence of Alexander the Great, who spread wine

the beverage created new infrastructure, architecture and technology, broadened trade patterns, and had socio-economic and cultural implications for the wider Mediterranean and civilisations within.

This book focuses the discussion on the facilities and processes involved in ancient viti- and viniculture, removing the often-used emphasis on ceramic and amphorological data. Through this lens, and by utilising a comparative, transdisciplinary approach across two broad case studies, I hope to illuminate exactly what vinicultural installations can reveal, even when discovered in isolation, and the extent to which this can form a meaningful contribution to our understanding of the past.

Scope and Aims

The present study arose from a desire to better understand what solitary press remains can reveal when contextual ceramic evidence, among other things, is lacking. The recognition of certain *lacunae* within the scholarship of ancient viticulture, along with the desire of the author to apply new methodologies and interdisciplinary analyses, contributed largely to the structure, foci and framework of the current text. The opportunity to explore a recently discovered press installation at the site of Antiochia ad Cragum (Turkey) then formed a platform from which the study developed.

While the corpus of published archaeological research discussing press installations is rapidly thickening, it still lacks in comparison to that of ceramic, literary or historical viticultural data. Thus, this book promotes the archaeological evidence of press installations and utilises other evidentiary forms as support. It is my hope that this will encourage new insight and opinion regarding the production of wine in antiquity and underline the growing recognition of viticultural installation analyses within the broader research scope of ancient agricultural production.

As an example, most major conclusions regarding Rough Cilician wine production possess a heavy reliance on ceramic analyses and survey data, rather than a detailed archaeological study of individual press installations. While studies of this nature are certainly beneficial, they neglect, and often fail, to recognise important ancient vinicultural features and productive methods. The style and methodology of this book aims to stimulate a renewed assessment of Rough Cilician viticulture, while also adding to and supporting existing scholarship.

eastwards, and the Romanised spread of wine into frontier regions of the Empire, including Gaul, Spain, Britain, and the Rhinelands.

The geographical scope of the present study should also be acknowledged. The opportunity to survey and excavate a press installation at Antiochia ad Cragum, along with the relatively well-researched nature of ancient viniculture in other regions, led to a focus on the eastern Mediterranean; first, in Rough Cilicia and, later, at Delos.[8] More broadly, this includes the study of installations within modern Turkey, Greece and Italy, along with comparative material drawn from the thorough pre-existing vinicultural database of Syro-Palestine and the Levant.[9]

This geographical focus complements the chronological framework of the present study, which encompasses the Late Roman, Late Antique and Byzantine periods; all of which saw flourishing viticultural activity across the eastern Mediterranean in contrast to diminishing activity in the west. Thus, unless otherwise stated (for example, in ch. 1.2), the general focus of discussion and analysis is limited to the period from Diocletian (*c.* 284 AD) to the fall of Constantinople in AD 1204. Due to the longevity of viticultural practice as well as the habitually lethargic vinicultural technological development and innovative uptake of the time, however, it is often appropriate to incorporate evidentiary and literary comparanda from chronological periods outside that of the primary chronological focus. This is particularly appropriate in areas of the central Mediterranean, where Late Antique material culture is intrinsically more difficult to access than that of earlier periods.[10]

Any attempt to examine the entire viticultural corpus of the eastern Mediterranean in detail requires significantly more space than is afforded by the present volume. The methodological foundations of the present project, therefore, lie in a 'case study' approach. An examination of the extant modern scholarship, along with the benefits and faults that lie therein, suggests that this approach provides a useful method in which to examine agricultural archaeological remains along with any related research themes.[11] It also prioritises clear and detailed discussion, highlights additions to the current academic corpus, and articulates accessible data.

Case study sites were selected based on their compliance with the following:

[8] It is also important to acknowledge the continued presence of ancient viticultural research in the western Mediterranean. Specific projects are underway in France and Spain to examine viticultural productivity in these regions (cf. Oliveras 2015a; 2015b). This furthers the necessity for an equal, contemporary emphasis in the eastern Mediterranean; a region often dominated by the study of oil.

[9] On the existing research of the Levant, see ch. 1.3.

[10] cf. n. 55 on this matter.

[11] Frankel (1999) uses a thematic approach based on technological development in a somewhat similar manner; however, he includes many varied exemplary sites within each chapter rather than the focussed, site-specific approach of the current study.

1. Conformity to the geographic and temporal restrictions;
2. No, or relatively little, research previously published of this nature;
3. The potential to yield new data after the application of an interdisciplinary approach;
4. The ability to reveal information regarding:
    a. Viticultural installations and the reuse of existing architecture,
    b. Early Christianity and a related evolution in local wine production, or
    c. Re-ruralisation or contraction of previously urban contexts.

Research themes 4.a and 4.c , above, are particularly interesting to explore within this temporal and geographic context (see chs 3.7, and 5.5), because:

1. Pre-existing, often monumental, architecture is regularly reused in the construction of these agricultural facilities;
2. A study of these features bears the potential to reveal trends regarding agricultural, constructional, socio-political and trade attitudes, along with temporally fluctuating socio-spatial boundaries; and
3. An examination of changing spatial usage and preference (rural vs urban; agricultural vs other) assists in an identification of the socio-cultural, industrial, economic and political priorities of a Late Antique community.

Presentation of Material

The following subchapter (ch. 1.2) provides suitable pre-industrial and modern comparanda in the form of a brief ethnographic and ethnoarchaeological discussion. A justification of this method and its inclusion within the present study is also given, which outlines the benefits of such an approach along with any potential pitfalls.

The bulk of this book is dedicated to two archaeological case studies, which reveal new archaeological data and expand upon or evolve currently existing theories and published works.

Case Study 1: Antiochia ad Cragum (Güney Köyü, Gazipaşa, Turkey)

Part 2 (chapter 2 and chapter 3) comprises a detailed case study regarding the viticulture of Antiochia ad Cragum (located within ancient Rough Cilicia). The broad array of data revealed through the analysis of a single press installation is particularly noteworthy. A recently discovered press installation at Antiochia possesses several features not yet explored in the viticultural scholarly corpus of this region; most prominently, it is the only example of a fully excavated, built press installation in Rough Cilicia.[12]

Chapter 2 details the methodology used during the excavation and analysis of the press; geographical and topographical data; astro-archaeological analyses; and a detailed archaeological analysis of each productive 'zone' of the vinicultural installation. Chapter 3 includes analytical discussions regarding: production processes; fermentation possibilities; types and quantities of wine produced; chronologies and dates of use; and links between the agricultural installation and religious change at Antiochia ad Cragum.

Case Study 2: Delos (Cyclades, Greece)

Part 3 (chapter 4 and chapter 5) encompasses a case study of viticulture on Delos; one that provides the 'other side of coin' to that of Case Study 1 – an example of multiple interconnected installations. While certain aspects of the viti- and viniculture of Delos are already studied, some are now outdated and in need of a more detailed, interdisciplinary approach. It is also important to consider the viticultural industry of Delos within the context of an eastern Mediterranean agricultural boom in Late Antiquity. The surveys undertaken for this project provide a more detailed data set regarding the vinicultural installations of Delos than those published previously, and incorporate, for the first time, a detailed, accesible photographic database of each installation. The same detailed, individual analysis is applied as for Case Study 1, and this elucidates a number of key features unrecognised in past publications.

The bulk of Chapter 4 consists of detailed archaeological analyses of six wine-producing installations on the island. Chapter 5 provides analytical discussions and explores new theories, including: a thorough justification of wine production at the suite of installations; an exploration of viti- and vinicultural practices on Delos during Late Antiquity; theorised quantification of viticultural production from the material culture; a discussion on dating the installations; temporal mechanical press trends; and how and where these installations, and viticulture in general, fits within the context of paleochristian Delos.

Comparative Analyses

Part 4 includes comparative discussions regarding the two case studies and their associated material culture.

[12] The ability to measure and analyse an excavated, intact collection vat has not previously been possible in Rough Cilicia due to surveying and permission limitations associated with preceding research, leading largely to the study of only damaged, debris-laden, or unexcavated collection vats (cf. Aydinoğlu and Alkaç 2008: 281 with n. 10). This allows never-before completed calculations of production quantity, architectural design and scale.

Chapter 6 suggests a new framework in which to situate ancient viticultural production, inspired by the present study. The comparative analysis is also broken into more specific themes, which compare: architectural press types; topographic locations (urban vs rural); the Late Antique reuse of structures; religious connections with wine production; and production purpose.

1.2 An Ethnographic Approach

An ethnographic, or ethnoarchaeological, approach (on the most basic level) utilises modern or pre-industrial studies to illustrate relevant ancient examples. Most commonly this involves researchers immersing themselves in contemporary cultures to better understand people groups, socio-cultural behaviours, traits and attitudes. The present volume utilises an ethnographic approach in a slightly different manner.

Rather than focussing solely on the study of a people group, ethnoarchaeology is used herein to analyse how an agricultural product (grapes) and any associated technologies and processes were utilised. This ranges from agricultural methods used in viticulture, processing methods, storage, cellaring, and post-production processes (including: trade, exchange, consumption, and usage patterns).

The sparse, often lacking, archaeological record of the ancient viticultural process, most often limited to a few surviving inorganic (often architectural) elements, encourages one to search 'outside' one's typical archaeo-historical methods in an attempt to more completely understand wine production in antiquity.[13] While the ancient literary and artistic record can occasionally resolve questions raised by archaeological material, often a lack of evidence limits the understanding of certain viticultural aspects of a site or region. At Delos, for example, nothing is known of the characteristics, flavour or colour of the wine produced in any period (see chs 4.2 and 5.2); ethnoarchaeology is utilised here to raise possibilities and suggest solutions, backed by valid comparative data.

Incorporation of an ethnographic approach herein, while used with caution, aims to address the shortcomings frequently reached in archaeological and historical analyses and provide appropriate comparative material in which readily applicable conclusions can be drawn between the ancient, pre-industrial and modern worlds. Such an approach allows, often bare, archaeological data to be fleshed out and even explained.[14] Rossiter recommends ethnoarchaeology as a viable method to resolve questions raised by archaeological material culture, while also 'filling in the gaps' in our understanding of ancient viticulture;[15] Frankel demonstrates the effective use of pre-industrial comparanda to understand the operation of mechanical presses for wine and olive oil in Israel; and Burton and Lewit pepper their technical and analytical studies on press technology with useful ethnographic comparanda from contexts across the Mediterranean.[16]

There is certainly no automaticity regarding the benefits and validity of an ethnographic approach in every case or region. Forbes provides an excellent example, using olive oil production in Ermionis (Greece) over the last 2000 years, where an assumed changeless productivity from antiquity to modern times is probably incorrect.[17] He concludes (and this must be stressed for the present chapter) that an ethnographic approach and analogous comparison between antiquity, the pre-industrial and modern era is only valid when sufficient archaeological data and historical documents are present to support such a method.[18]

The application of an ethnoarchaeological approach is made increasingly more valid due to the slow-moving and relatively comparable nature of viti- and viniculture throughout the ages. The continued use of ancient methods in pre-industrial and modern times, along with the extant ancient literary database and the surviving archaeological record, suggest an endurance of viticultural technique and process, which lends further weight to the applicability of an ethnographic approach.[19] This survival of ancient

[13] Exceptional cases do exist. At Pompeii, for example, the work of Jashemski (1968; 1973a; 1973b; 1979) included remarkably well-preserved organic materials. Similarly, the occasional discovery of carbonised and preserved grape seeds provides an invaluable glimpse into the organic material culture that formed the majority of the viticultural process in antiquity (cf. Barnard *et al.* 2011; Figueiral *et al.* 2010; Koparal *et al.* 2014; McGovern 2003; McGovern *et al.* 1996; 2013). Current archaeological excavation methods prioritise the recognition and attainment of bioarchaeological organic material culture to a much greater extent than before.

[14] On the other hand, although in relation to the production of olive oil, Forbes (1993: 213) warns against the dangers of an assumed commonality between the pre-industrial and ancient worlds.

[15] Rossiter (1998: 599-600), commenting on Amouretti and Brun (1993), notes that the ethnographic parallels utilised within their text are of great value and the results are 'frequently compelling'. Amouretti *et al.* (1984: 379-421), in relation to the oleiculture of Portugal, further highlight the usefulness of a comparative ethnographic approach. Lewit (2020) frequently uses ethnographic methods, via medieval and pre-industrial case studies, in a thorough and convincing manner to suggest solutions and comparable methods to those from antiquity (cf. observations on medieval and early modern apprenticeships and collegiality that enhanced the diffusion of innovation and transmission of technical knowledge, pp. 327-31).

[16] Burton and Lewit 2019; Frankel 1999: 160-63; Lewit 2020; Lewit and Burton 2019.

[17] Forbes 1993.

[18] Forbes 1993.

[19] Although this occurs across the Mediterranean region, the examples in Israel and North Africa, given by Frankel (1999: 160-61), are particularly enlightening; pre-industrial installations reuse ancient weight stones, are distributed in a similar spatial patterns to

techniques into modern times, particularly before the advent of industrial processes, and the incorporation of ethnographic data allow extensive cross-chronological and interregional comparison.

The 18th century observations of Lazzaro Spallanzani during his expedition through southern Italy provide an example of the relevance of ethnography.[20] Spallanzani noted that ancient techniques were still in use over 1500 years after their first descriptions in literature; this included the crushing and fermentation of raisins to make sweet wine and the architecture and design of a winery very similar to that of Antiochia ad Cragum and those on Delos.[21] He also described how vines were grown near the seashore at Stromboli in order to produce *passito* – a notable parallel to case studies within this book.[22] Carlo Hauner continues these practices to this day; his vineyards are located mostly on the S or SE facing slopes of these same islands, at altitudes of 50-100 m above sea level.[23] The fact that such similar viticultural practices remain unchanged from antiquity (as noted through the literary and archaeological evidence), through the pre-industrial era (described by Spallanzani) and up to the present day (by Hauner) support the rationale of an ethnographic approach and valid comparisons between ancient and pre-industrial habits in these Mediterranean regions.

Vinicultural features were noted on the slopes of Mt Etna, in eastern Sicily, during exploratory field surveys that are closely reminiscent of ancient descriptions, archaeological remains and the pre-industrial observations of Spallanzani. Ruined agricultural structures known as *palmenti*[24] dot the countryside, mostly abandoned and robbed of useful materials; however, the preserved skeletal structures illuminate a method of winemaking with strong parallels to antiquity. Unfortunately, precise details regarding the chronology of these *palmenti* use are largely unknown – locals suggest that they were used anywhere from 500-100 years ago.[25]

During such an exploratory field trip in July 2014, I was led to a number of these ruins by local winemakers from Solicchiata. One example nearby, known as 'Terra Mia', has a treading floor with steps that allowed grapes to be dropped in from above. The must then flowed through an overhanging channel carved from local lava rock into a large collection vat. A single screw press, made purely from wood, is located in a separate compartment adjacent to the vat. There are also multiple, additional compartments and vats for the separation of produce and various qualities of must. A ruined villa in Bivio Pirao provides a second, slightly more recent, pre-industrial example (see Pl. 41). It is even larger in size, with multiple large vats and collection/fermentation areas. As with the first example, it is also multi-level, with channels that run from a second storey, elevated treading area into lower storage and catchment areas (Pl. 42b). A similar hydraulic concrete or plaster covers the treading area and extends high up the walls in a similar manner to the *opus signinum* of many ancient vinicultural facilities (cf. chs 2.3, 4.5 and 4.6). All that remains of the once-present monumental lever press is a section of a large wooden beam and some iron fittings (Pl. 42a).

These Sicilian *palmenti* are more evocative of the Roman Imperial villas that engaged in industrial wine production than the later installations included within the present study; particularly their capacities, construction within a villa framework, and location within the agricultural fields. The architectural features, processes and context, however, still support the notion of an enduring vinicultural practice from antiquity, through the pre-industrial age and into modern times.

An ethnographic approach also bears the potential to illuminate further detail by 'filling in the gaps' in the modern understanding of ancient viticulture in a more general sense. Indeed, as wine became increasingly popular over time, embedded within numerous aspects of everyday life, a wider chronological, ethnographic focus might reveal an overall change in production purposes.

1.3 A Summary of the History of Research

As one of the most common agricultural commodities throughout the Mediterranean,[26] wine and its production are expansive topics that have been

their ancient counterparts, and utilised relatively similar technology. Those on mainland Europe are more diverse in design and type and, thus, more difficult to analyse (Frankel 1999: 161-63). It is interesting, however, that Frankel does not mention the evidence from Italy or any of the *palmenti* discussed below (cf. ns 24 and 25).

[20] See chs 3.1 and 3.5.

[21] Spallanzani 1798: 95.

[22] Spallanzani 1798: 126.

[23] C. Hauner, 2019, Hauner Azienda Agricola, viewed 10 January 2017, <http://www.hauner.it/ita.htm>.

[24] cf. n. 1. In Sicily, the term 'palmento' is used for both the winemaking complex and that style of making wine.

[25] The term '*palmentum*' probably originated sometime in the Middle Ages (Botti, Thurmond and La Greca 2011: 8). Other vinicultural structures called *palmenti*, mostly rock-hewn features or vats, are found in the Cilento region, Campania, and elsewhere in Italy (Botti, Thurmond and La Greca 2011). While there is certainly a common viticultural nature, the Cilento examples are much more rudimentary and rustic than those found around Mt Etna (although there are also simple rock-hewn vinicultural installations in Francavilla di Sicilia, near Etna, which are also referred to as *palmenti*: Botti, Thurmond and La Greca 2011: 11 with fig. 4). The term *palmenti* or *palmento* is, therefore, a more general term to categorise an agricultural facility as 'wine-producing.'

[26] As described by Curtis (2001: 372) and seen in an analysis of the surviving ancient literature based on the weight given to each form of produce; grapes are one of the three most important agricultural products in the Mediterranean (the other two being cereals and olives, forming the 'Mediterranean Triad').

discussed for millennia. Indeed, one can find texts describing wine as early as the third millennium BC, where authors commented upon positive attributes and uses of the liquid. Modern, critical studies of wine and viticulture in antiquity progressed through varying phases of interest within the scholarly community; this has lead to both detailed and general commentaries. A selective analysis of pertinent texts, pioneering contemporary research, and relevant archaeological studies follows here, framed chronologically to clearly display the changing attitudes and research foci of viti- and vinicultural studies across the modern era.

The Beginnings of Viticultural Research

The emphases of pre-19th century excavation, analysis and publication caused neglect in the study of agricultural remains, often less visible in the archaeological record, along with minimal study of the unimpressive 'everyday' material culture. Rostovtzeff (1957) noted this emphatically, albeit in a more general sense, when he said:

> It is not surprising that in most modern works on the Roman Empire the country and the country population do not appear at all or appear only from time to time in connection with certain events in the life of the state or the cities.[27]

And, more recently, by Dickenson (1990), who remarked:

> Given the importance of wine and the vine in European society it is surprising how little research has been undertaken on the historical geography of viticulture and the wine trade.

Studies over the past two centuries have, nonetheless, gradually recognised the importance of examining the productive mechanisms of ancient agricultural commodities and, consequently, raised such topics to a greater level of importance than mere curiosity within the research community. This has somewhat corrected the historically 'stereotyped view of Roman agriculture...(stemming) from ignorance of its methods.'[28]

Early Developments in Italy and France

An increasing focus on excavations around Roman *villae rusticae* throughout mainland Italy in the late 19th to early 20th centuries provided an impetus for the beginnings of specific ancient viticultural research. This led to numerous contemporary publications that provided analyses for Roman Republican and Imperial rural wine production.[29] This trend was continued through the first half of the 20th century, with studies by Curtel (1903), Billiard (1913), Dalmasso and Marescalchi (1937), and Dalmasso (1941). The expansive publication (*La Vigne dans l'Antiquité*) of Billiard (1913), in particular, demonstrated the important and vast nature of viticulture in antiquity, and was the most comprehensive study of its time. The majority of the text deals with epigraphic, ceramic, literary, numismatic, and artistic evidence and, thus, largely ignores the physical remains of pressing installations;[30] this can be excused, in part, due to the haphazard nature of Mediterranean archaeology in the preceding years and a lack of excavated pressing complexes. The text attempts to incorporate broad chronological periods, wide-ranging geographical regions, and varied pieces of evidence for viticulture in antiquity and, as a result, becomes a broad and generalised assessment of the topic. Even so, useful and interesting information is often presented, some of which has since only been studied in limited detail, including: a catalogue of sorts, which includes ancient table grapes and wine grapes separated into species accompanied by descriptions as provided by the ancient literature;[31] and in-depth descriptions of viticulture-specific agricultural methods and tools, climate, soil, and reproduction processes.[32]

An ever increasing quantity of archaeological evidence began to be included in studies of this time; however, research continued to rely upon an interpretation of the surviving ancient literature to enhance and support claims made from the often sparse, excavated material culture. This trend continued through to the late 20th century.[33] Although this should be considered an effective starting point, a heavy reliance on the textual data precludes important considerations regarding changing features, technologies, and the quantification and distribution of viti- and viniculture throughout many of the ancient eras. A balanced approach and

[27] Rostovtzeff 1957: 193.

[28] Noted by White (1970a: 11) who discusses the general neglect of Roman agronomists over the preceding 150 years despite 'notable advances in archaeology, epigraphy, numismatics, and other vital aids to the rediscovery of the past'. Chavarría and Lewit (2004: 10 with n. 17) note that, in recent years, far more attention began to be paid to archaeological remains related to farming, including productive installations; this is increasing exponentially today.

[29] cf. the useful site-specific bibliography in Rossiter (1981: 360-61 with Appx. A).

[30] Except for pp. 423-62, which discuss '*les vendanges et la vinification*' and include production and pressing figures, as evidenced through ancient art, architecture and some (limited) excavated material culture (Billiard 1913: 423-62 with figs. 145-57).

[31] cf. Billiard 1913: 310-17. Of particular interest to the present study are the *Apiana* (p. 312) and *Psithia* (p. 314) varietals.

[32] On various agricultural methods and tools, see pp. 345-73 with figs. 91-3, 110-18; on the climate and soil, see pp. 237-60; on reproduction processes, including cutting, layering and grafting, see pp. 261-89. This has since been added to greatly by the studies of Forbes (1955) on ancient technologies, White (1970a; 1970b; 1975) on Roman agriculture, and, more recently, Curtis (2001) on ancient food technology.

[33] For a similar comment on English works in the 1960s onwards, particularly in relation to White (1970a) and Frayn (1979) and the lack of quantified analyses at the time, see Bowman and Wilson (2013: 2).

considered incorporation of relevant textual and archaeological data in an interdisciplinary fashion, along with other forms, must be implemented for studies of this nature.[34]

Work of the early to mid-20th century was chiefly focussed on viticulture within Italy and the archaeological evidence found therein. This posed limitations on an understanding of the geography of ancient wine production, the temporal differentiation in styles of ancient viniculture, and the consequent trade, distribution, and economic implications of wine.

Our understanding of ancient viticulture progressed through the early 20th century, helped, in part, by the pioneering study on olive oil production by Drachmann (1932). Although Blümner previously undertook studies regarding ancient presses in his *Technologie und Terminologie* (first published in 1875), along with discussion in Hörle and Beck's commentaries on Cato,[35] Drachmann provided the first scientific, detailed monograph organised in a categorical, progressive manner. The book is divided into two parts, to reflect the order of production: the first, on the *trapetum* ('olive crusher'), and the second, the *torcular* ('olive press') along with evidence from Pliny, Cato, Vitruvius, Columella, Hero and contemporary archaeological findings.[36] This categorisation and discussion of press structure, along with the methodology and analytical apparatus applied, provided inspiration for later publication and research on both wine and oil technology.[37] While some aspects can be equally applied to viniculture and wine pressing (such as mechanical press technology and other mechanical systems), the majority of the text renders no information intrinsically useful to the vinicultural process (such as fermentation, pre-treatment, storage, and cellaring methods).

One of the first regions outside the Italian peninsular to see a concerted research effort on ancient viticulture was France. With a prosperous modern wine industry that can be traced back through antiquity to the pre-Classical era, it seems logical that a provincial study of ancient Roman wine might begin in such an area.[38] An interdisciplinary study was released by Dion (*Histoire de la Vigne et du Vin en France des Origins au XIX*e *Siècle*, 1959) utilising a geographical perspective on the history of viticulture in the region. Assessing a wide chronological period, it traces the development of wine production from its Greek origins, through the medieval era, to the advent of champagne in the eighteenth century and observes environmental and locational factors underlying the emergence of viticulture in different parts of Gaul and, later, France. Since the 1960s, interest in the history of viniculture within this region has grown with a number of other French studies completed, in particular Pijassou (1980) and Roudié (1988). Most focus largely on analyses of the post-medieval and pre-industrial periods, however, and have been labelled, by Dickenson and Salt (1982), as frequently insubstantial in nature (in relation to their neglect of historical geographic viticultural analyses).[39] Brun (1986; 1993a) later remedied the lack of a comprehensive study regarding ancient viticulture, oleiculture and agricultural pressing technology in France.

As the study of ancient viticulture advanced through the mid-20th century, so too did general studies of ancient agricultural technologies. This is, perhaps, best seen in the publication of Forbes (1955), as a part of his expansive *Studies in Ancient Technology* series, of which the sections on 'Fermented Beverages 500 B.C.-1500 A.D.' and 'Crushing: pressing' are particularly relevant.[40] The first chapter should be commended on its attempted assessment of material from a wide chronological span, in particular that less well known from the Late Antique and Middle Ages.[41] It also attempts to include material of a geographically broad, Mediterranean-wide scope, but resolves to focus largely on Italy and the west. Additionally, while the incorporation of data from later periods is commendable, the text now appears dated through its neglect of Imperial, Late Roman and Byzantine material from the eastern Mediterranean; particularly the large scale, industrial, export viticulture of Asia Minor and the Near East in these eras. The section on pressing provides a review of the ancient literature and discusses press technologies, usefully dividing the discussion into the various types of mechanism used.[42] Increased reference to extant archaeological remains in Italy, Egypt and Greece is given along with some modern comparanda

[34] For particularly relevant examples of effective interdisciplinary approaches, along with the present study, see De Sena (2005) and Marzano (2007; 2013a), along with the other, varied agricultural studies by the latter author.

[35] cf. Hörle (1929) and Beck (1887: 418-38); along with brief mentions in various other commentaries on Pliny (*HN* XVIII, ed. Rackham, *Loeb*), Vitruvius (*De arch.* VI.9.3, ed. Granger, *Loeb*), and Hero (*Mech.* III.13-21, ed. Nix and Schmidt, Leipzig 1900).

[36] Also, see the reviews of Robinson (1933: 636) and Laing (1934: 363).

[37] cf. Brun 1986; 1993a; 2004a; 2004b; Frankel 1997; 1999.

[38] See Johnson (1989: 82-9) for details on the archaeology of pre-Greek viticulture in France.

[39] Dickenson and Salt 1982: 159-63; Unwin 1996: 4. Dickenson and Salt (1982) emphasise the contemporary focus in modern viticultural literature, geared largely towards the present-day wine drinker and producer. See their impressive bibliographical review (pp. 162-63) to gain an understanding of the French focus in contemporary viticultural studies.

[40] Forbes 1955: 106-24 and 131-38.

[41] cf. Forbes (1955: 122-24) on material from the fall of the Roman Empire and Middle Ages onwards. Viticultural publications of this time deal predominantly with earlier Graeco-Roman literature and data, as seen above.

[42] Though Burton and Lewit (2019: 547-48) have recently discredited the interpretation of various press mechanisms by Forbes, among others; these misinterpretations are thought to stem largely from Drachmann's (1932) earlier influential work.

in Egypt, the Aegean, the Alps and Italy; this provides a distinction from earlier studies and proof of an evolved understanding of ancient agricultural material culture at this point.[43] The work falls short in the same manner that those earlier 20th century studies do, however, by remaining overly focussed on the ancient literature and failing to incorporate a suitable degree of archaeological and interdisciplinary data. This can be excused, somewhat, by recognising the nature of the text – a general guide to technology in antiquity – and by the insubstantial nature of archaeological analysis into ancient viticulture at the time of publication.

An Expanding World of Viticultural Research: The Late 20th Century

The path forward for ancient viticultural research was assisted by the seminal studies of White (1970a; 1975) on Roman farming and related technology, which drove the acceleration and advancement of ancient agricultural research in general.[44] While White (1970a) noted his sources to be both literary (technical and non-technical) and archaeological, his text often follows the roughly contemporary path of Forbes (1955) by giving greater weight to the literary evidence of the Roman agronomists, along with the illuminating evidence of mosaics and wall paintings. The chapters on farm buildings, however, incorporate archaeological evidence and analyses from the archetypal *villae* studies of the time and effectively combine this material with the literary evidence to draw informative conclusions.[45] Most usefully, White provides an illustrated overview of the *villae rusticae* classification scheme of Rostovtzeff and adds a detailed appendix of Campanian sites and features.[46] White quickly followed this study with another in 1975, which aimed to clearly discriminate and describe Roman farming implements and technologies through a terminological assessment, predominantly using the literary and epigraphic record and incorporating limited archaeological data.[47] A detailed discussion on vine-props and stakes is included, which provided a valuable illumination on matters often overlooked or no longer available in the archaeological record.[48] Of particular relevance to the present study is his discussion of the viti- and vinicultural process.[49] While the text here is still a valuable assessment of the literary material, from an archaeological perspective it now appears dated, misinformed and limited by the lack of included and available material comparanda.[50]

Thus the 1970s and '80s brought an upsurge of interest regarding the agricultural production methods of antiquity, which, combined with the emergence of specialised archaeological agricultural research, led to an unprecedented focus into the investigation of ancient viticulture. Of particular relevance are the publications of Bruneau and Fraisse (1981; 1984), Rossiter (1981), Hirschfeld (1983) and Bruneau (1987).

Bruneau and Fraisse, with the École Française d'Athènes on the Cycladic island of Delos, published notable evidence on the importance of Late Antique and paleochristian wine production in the eastern Mediterranean, although this significance was not completely recognised at the time. In their 1981 report, a general overview ('*Pressoirs à Vin de l'Antiquité et de la Grèce Moderne*') is provided to set the scene for the following, more detailed study; including sections comprising comprehensive descriptions of the vinicultural material data along with discussions of date in relation to adjacent structures.[51] Perhaps most interesting is their recognition and direct comparison to similarities found in pre-industrial and modern presses on neighbouring Mykonos;[52] this gave partial inspiration to ch. 1.2. These publications by Bruneau and Fraisse are capped by an overarching, reflective study by Bruneau (1987), which briefly comments upon the remains of a particularly interesting press, *le pressoir de l'Agora des Italiens* (cf. ch. 4.3) and suggests a later date than previously thought, based on iconographic, stratigraphic and epigraphic evidence.[53] These reports were an important and much needed reassessment of the material culture from the early 20th century exacavations, much of which was either unrecognised or misunderstood at the original time of publication.[54]

Contemporaneously to the work carried out on Delos, Rossiter (1981) published a detailed discussion, using the Classical literature as an impetus to analyse recently discovered wine and oil facilities on Roman farms in Italy. As indicated in the title, however, his analysis follows early 19th century trends and limits its geographical scope to that of Italy, thus excluding viticultural comparanda from the wider Mediterranean. Its scope is, again, limited chronologically and only

[43] cf. Forbes 1955: 132-37.
[44] Also see the mention of K.D. White's studies by Rossiter (1998: 597).
[45] Most of which are based on earlier proposals by Rostovtzeff, Carrington and Day (cf. White 1970a: 422-40 with figs. 5-12).
[46] White 1970a: 434-45.
[47] He also aimed to stimulate discussion on the socio-economic context and relevance of particular items and explicate such matters as size, form and function (White 1975: xiii). Certain interpretations, likely influenced by Drachmann, are now corrected by recent studies, most prominently White's theories on press evolution (Burton and Lewit 2019: 548; Lewit and Burton 2019: 97).
[48] cf. White 1975: 19-23.
[49] White 1975: 112-17.
[50] Seen immediately in the limited discussion of the treading vat, where construction in stone is the only type given (White 1975: 112-13).
[51] Bruneau and Fraisse 1981: 141ff and 145-50; 1984.
[52] Bruneau and Fraisse 1981: 129 with figs. 7 and 8.
[53] Bruneau 1987: 339-40. The surveys within these texts were updated by the recent topographic study of Moretti *et al.* (2015).
[54] The neglected and misidentified nature of viti- and vinicultural archaeological remains continues to this day, and the present study makes a number of important corrections to these existing reports in addition to newly recognised data (cf. chs 4 and 5).

includes evidence from late Republican to early Imperial *latifundia*, *villae rusticae*, and *villae urbanae*. This is not surprising, as Late Antique vinicultural material culture is often more difficult to identify in the Italian archaeological landscape.[55] Among other sites, the well-preserved evidence from Granaraccio, Pompeii and Boscoreale is presented and plays a central role in his discussion of the material culture.[56] Particularly useful, though, is the identification and bibliographical list of select Roman farms and villas in Italy containing archaeological evidence for wine production.[57]

Along with Italy and Greece, the importance of viticulture in the Near East was introduced by Aharoni (1956), who briefly glosses the findings of a *c.* 4th century AD wine press within a church, while reporting on the larger results of the excavations at Rameth Rahel (within modern Israel).[58] Krauss discussed references to viticultural technology within rabbinical literature in the early 20th century; however, the terminology is often difficult and confusing in nature.[59] The physical scale of viticulture in this region, particularly in the Levant, was not realised through the archaeological record until Hirschfeld (1983) published a thorough study on the ancient wine presses found in the Park of Aijalon. In this work, he describes 15 presses that were surveyed and attempts to categorise these into four classes.[60] This methodical categorisation of wine presses was an unprecedented and vital step forward in the generation of a working typology for vinicultural technology. He also correctly recognises that it is necessary to conduct further, systematic survey and excavation of presses throughout the Levant before attempting to determine the precise typological development of wine presses in the region.[61] Hirschfeld provides a Palestinian distribution map for the presses discussed within his text;[62] this too is an inclusion that played an increasingly important role in the study of ancient viticulture, particularly in relation to economic and trade implications along with studies of ancient land usage and knowledge networks.

The late 1980s also saw the emergence of J.-P. Brun into the field of ancient wine and oil scholarship, whose 1986 publication (L'oléiculture antique en Provence: Les huileries du département du Var) provided a base from which he launched extensive research and excavation into agricultural facilities. In this first study Brun took the concept touched briefly upon by Hirschfeld (above) and developed an extensive series of working typologies for each mechanical press type; including the: lever, screw, and direct pressure presses along with their associated counterweights.[63] The published isometric drawings that illustrate his typologies, including hypothetical wooden assemblages, continue to form the basis for the archaeological analysis of mechanical pressing systems in the present day. These are equally as valuable for understanding ancient wine production as they are for their original purpose of oleiculture. The extensive ethnographic discussion incorporated into his text regarding oil production is a valuable addition to his argument.[64] Along with the pioneering typologies and extensive, illustrative archaeological comparanda, the interdisciplinary nature of Brun's study, which draws on archaeological, literary, epigraphic, artistic, ethnographic and scientific fields, firmly cements its place as a text of authority within the study of ancient agriculture.

While Brun began his research in France (specifically, Gallia Narbonensis) and excavated oileries at La Roquebrussanne, Cavalaire, Rians, La Crau, and Pignans, he later increased his research scope to include wineries at Pompeii (Italy) and Torre de Palma (Portugal). Through this expansion, which included both wine and oil production, Brun has since linked, and differentiated, ancient perfume production to the two former agricultural processes.[65] Perhaps one of the most significant contributions to the field is his reassessment of oil and wine producing installations in Roman Lusitania (particularly, Torre de Palma), where he attempted to display that certain facilities previously recognised as oil mills were, in fact, wine producing.[66] Although errors inherent to his argument were identified by the, then, Torre de Palma site directorate (of S.J. Maloney and M. da Luz Huffstot),[67] Brun rightly recognised that historiography has traditionally undervalued viticulture due to the omnipresence of

[55] Due to: excavation models focussed on retrieving evidence from earlier periods and destroying Late Antique stratigraphic layers in the process; the continued use of earlier technology into later periods leading to the incorrect dating of structures; the gradual abandonment of Roman agricultural facilities and techniques during Late Antiquity in Italy; or simply a lack of data from the Late Antique periods, along with other, more complex causes.

[56] For Granaraccio, see Rossiter (1981: 348-49); for Pompeii/Boscoreale, see pp. 348-50.

[57] Rossiter 1981: 360-61 with Appx. A.

[58] cf. Aharoni 1956: 107 and 110 with fig. 3.

[59] Krauss 1911: 233. Hirschfeld (1983: 208 with n. 7) recognises the difficulty associated with the terminology.

[60] Hirschfeld 1983: 207.

[61] Hirschfeld 1983: 207. The original text reads 'country' rather than 'region'; however, with the benefit of retrospectivity, I believe 'region' to be more a more applicable descriptor. The typology and chronological development of wine presses in Palestine can now generally be applied to the greater Near East and parts of Anatolia with a relative degree of accuracy, while adjustments are made for slightly different chronologies due to the varied velocity of technological diffusion.

[62] Hirschfeld 1983: 215 with fig. 6. These are labelled as 'working' typologies; occasional discoveries of slightly different counterweight forms and reassessments of the existing evidence demands amendment to such typologies (cf. chs 4.4 and 4.6).

[63] cf. Brun 1986: 86 and 121-25 with figs. 28 and 59-61.

[64] cf. Brun 1986: 42-58.

[65] cf. Brun 2000: 277-308.

[66] cf. the conclusions reached by the collaborating Brun, in Lancha and André (2000).

[67] For a discussion of the errors present in the theory and reassessment of Brun, see Maloney and Huffstot (2002: 138-40).

oil production in certain Mediterranean areas;[68] a hasty attribution as an oil mill often obscures relevant archaeological signifiers pertaining to vinicultural activity. While Brun proposed a reassessment for Africa, particularly the modern territory of Algeria, it is my belief that this mindset should also be applied to recent studies and excavations in Anatolia, along with the wider eastern Mediterranean, where a lack or misunderstanding of evidence often leads to the misinterpretation of agricultural facilities.[69]

The research of Brun into ancient wine and oil production resulted in three of the most comprehensive treatments of the topic to this day (2003; 2004a; 2004b). These broad geographical and chronological publications are organised in a systematic manner that allows the casual reader or expert to easily approach the material culture of specific regional productions. The ambitious nature of these texts does not blemish their quality and they will remain essential resources for the viticultural (and oleicultural) researcher into the future.

The 1970s and '80s, therefore, played host to an awakening of ancient viticultural and broader agricultural studies, seen through continual work in Italy, along with new research in France, Greece, Syro-Palestine and the Levant. The importance of increased appreciation within the research community became evident, not only to further knowledge of the viticultural process and technology itself, but to allow greater understanding of the ancient economy, trade, urbanisation and ruralisation, along with attempts to cognise land usage patterns and population distribution; particularly important in the later periods of antiquity. This was supported, as continues today, by a more balanced, interdisciplinary research approach, which involved both the Italian peninsular and wider Roman provinces.

Expansion of the Working Typology and a Levantine Emphasis

The following period saw an increasing focus on the survey, excavation, analysis and research of vinicultural practices in Syro-Palestine and the Levant. This culminated in the systematically detailed, overarching and widespread publication by Frankel (1999). Essentially an in-depth catalogue of mechanical pressing systems, wineries and technologies from ancient Israel, the study also provides valuable comparisons from the wider Mediterranean along with pre-industrial parallels.[70] Perhaps inspired by the rudimentary typology of Palestinian mechanical presses by Hirschfeld (1983), Frankel creates a more developed typology as well as an attempted regional chronology for both wine and oil production. This typology, along with those of Brun, formed a base for the majority of modern vinicultural studies and continues to provide an effective chronological backbone from which minor changes and developments can be made for mechanical pressing systems found within Syro-Palestine, Anatolia, and the wider Near East.

The study of Frankel is supported by the extensive contemporary publication of excavation reports and site surveys, along with descriptions of specific vinicultural material data *in situ* on an increasing scale, the most valuable of which include: Rahmani (1991); Hirschfeld and Birger-Calderon (1991); Diler (1995); Frankel (1997); Khalil and al-Nammari (2000); Sivas (2002); and Sidi, Amit and 'Ad (2003). This expanse of published material might be due to the relative ease by which ancient viticultural material data can be accessed in the aforementioned regions, aided by two possible factors. First, the rapid growth of agricultural productivity in these regions during Late Antiquity caused the creation of wine and oil processing facilities on a previously unseen scale. Second, the comparatively extensive and continued occupation of these regions throughout Late Antiquity, which produced surplus agricultural commodities, resulted in a more complete archaeological record at accessible stratigraphic layers; compared to the diminished Roman presence, and all too often desecrated and invisible archaeological data, in the west.

A 21st Century Focus on the Birthplace of Wine: Anatolia

It soon became clear that an increased understanding of ancient viticulture was beneficial to the larger fields of trade and the economy, while also improving the understanding of individual sites, their agricultural activity, export trade and wider regional relationships. Thus, the path was opened for viticultural research to expand into other areas of the Graeco-Roman and Byzantine world. While studies in the Levant and Syro-Palestine continued, Anatolia, as one of the posited areas for the discovery of the earliest fermented grape juice, became another focal point. This included research into Phrygian, Pamphylian, Pisidian, Cilician, Carian, Lycian, and Lycaonian agricultural production (both oil and wine) from the Hellenistic to Byzantine and Medieval periods; led by the likes of Diler, Decker and, more recently, Aydinoğlu and Rauh, and

[68] Although applicable to a large area of the Mediterranean rim, this is not the case for peninsular Italy, where oil production is undervalued when compared to the abundant literature and evidence for viticulture. Similarly, and of particular relevance here, oil production and cultivation is now thought to be undervalued when compared to the more abundant evidence for viticulture on Delos (cf. Brun 2000).

[69] This is displayed in the current study where renewed surveys illuminate previously unrecognised viticultural evidence at historically well-excavated and thoroughly studied sites (cf. ch. 4.7). See also my work at Pompeii in *insula* I.20 (Dodd 2017).

[70] cf. Frankel 1999: 160-63.

supported by dedicated archaeological survey and excavation programs, including the RCASP and the ACARP commencing in the mid-1990s.[71] Although not always specifically focussed on agricultural production methods and technology, these projects have identified and aided the study of viticulture in the region of Cilicia through their overall methodologies and objectives.

The pioneering study by Diler (1995) includes results obtained strictly by survey undertaken for a larger, monographic study and limits itself to a focus on one wine press type, stated as the 'most common' within the vicinity of Cilicia and Lycia: the rock-cut, or hewn, press.[72] This trend remains true for the region – built presses are far fewer in number than their rock-cut counterparts. Diler presents general locations for exemplary forms, along with reasons for architectural and stylistic differences. Perhaps most notably he argues for the standardisation of press architecture;[73] this notion is challenged through the results of recent excavation and results displayed in this book. Diler also attempts to provide reason and justification for the topographic locations of pressing installations, most of which remain valid at the present time.[74]

The archaeologically-focussed results of Diler are complemented by the later publication of Decker (2005), which almost completely neglects the material culture, particularly press installations, and focusses largely on a combination of Classical literature, epigraphy, geography and climatic conditions, while also incorporating a small discussion on the evidence presented by Late Roman amphorae. His discussion is not without problems and now appears dated at times. Decker seems unaware, for example, of the earlier publication of Diler (1995) and states:

> 'Wine press finds in the territory of former Roman-Byzantine Cilicia are extremely rare. Recent fieldwork has yielded only a handful of installations.'[75]

Such a statement directly opposes the many rock-cut installations presented and analysed by Diler a decade earlier; for most of which a tentative period of use has been ascribed to the Roman-Byzantine period.[76] Similarly, the claim of Decker that those presses so far identified in Cilicia have been labelled as oil producing also appears ignorant of Diler's results and the work of the RCASP (see below).[77] Nonetheless, and similarly to Brun, he correctly asserts that the misidentification of pressing installations is an issue that must be addressed in the eastern Mediterranean.[78] Another particularly useful section of the text includes a discussion on Cilician wine types and ancient grape varieties – a problematic field, yet one that modern scientific technology and analyses are beginning to illuminate.[79] Caution should be used, however, when equating the *Psithia* and *Apiana* varieties, as Decker appears to do.[80] More research is required, but recent studies might suggest that these are two distinct varieties.[81]

Contemporaneously to the aforementioned viticultural-specific studies, the RCASP revealed particularly interesting archaeological and scientific evidence; some of which is presented in Rauh *et al.* (2006). Using a combination of material, cultural, environmental, textual and epigraphic sources, the RCASP team undertook the largest interdisciplinary study of western Rough Cilicia to date, and continues to do so today. The extensive 2006 publication by Rauh, Dillon, Dore, Rothaus, and Korsholm uses pioneering methodologies to link viticultural and oleicultural production to population spread and urban and economic development. Of particular note and interest to the current study is their use of IKONOS 4-band multispectral satellite imagery to analyse the vegetation patterns of modern wild grapevine growth, and their attempt to link this to vestigial ancient growth patterns and grapevine distribution.[82] The 2006 publication also presents a discussion on press technologies encountered during ground surveys at various sites in western Rough Cilicia, albeit geared for the most part towards olive oil presses, and continues the debate deliberating whether oil and/or wine production occurred at these installations.[83] Thus, the question is raised: which commodity was most prominent within the region? An answer to this question is attempted, and the conclusion that olive oil production was more prominent than wine production is reached (though it is also concluded that olive oil was consumed locally for

[71] For relevant site and region-specific agricultural studies, see the following: Phrygian (Sivas 2002); Pisidian (Vanhaverbeke *et al.* 2004); Cilician (Autret and Rauh 2008; Aydinoğlu 2008; Aydinoğlu and Alkaç 2008; Decker 2005; Diler 1995; Hoff and Townsend 2013; Iacomi 2010; Pilhofer 2006; Rauh, Dillon and Rothaus 2013; Rauh and Slane 2000; Rauh *et al.* 2006; Rauh *et al.* 2009; Şenol 2008); Carian (Gider and Büyüközer 2013); Lycian (Diler 1995); Lycaonian (Baldiran 2008).

[72] Diler 1995: 83.

[73] Diler 1995: 84-6.

[74] Diler 1995: 88.

[75] Decker 2005: 56.

[76] Diler (1995: 89) directly mentions and labels at least ten separate installations in his text, along with many more by association and vague description.

[77] Decker 2005: 56.

[78] Here, he cites his own work, along with that of Frankel (1999), and believes that North Syria is in particular need of this reassessment (cf. Decker 2005: 56 with n. 28).

[79] A reflective and somewhat narrowed discussion of Billiard's (1913) earlier catalogue (Decker 2005: 53).

[80] Decker 2005: 53 with n. 6.

[81] cf. the distinction made by Dalby (2013: 165-66) and Billiard (1913: 312 and 314). In an earlier publication, however, Dalby (2000: 137) equates the two, stating *Psithia* is the Greek name and *Apiana* the Latin. Pliny (*HN* XIV.81) seems to agree with this, at least in reference to the *Psithian* variety used in Italy and the neighbouring provinces, while also adding the name '*scripula*'.

[82] Rauh *et al.* 2006: 61-3.

[83] Rauh *et al.* 2006: 63-75.

the most part, whereas wine was exported in greater quantities).[84]

Just over a decade after the initial study of Diler (1995), Aydinoğlu and Alkaç (2008) released a similar publication, again, dealing strictly with rock-cut wine presses from Rough Cilicia. The text discusses and analyses data obtained from fieldwork, including a wide range of sample installations throughout the region, and attempts to put forth a regional typology. In addition to this, a categorisation of monolithic weight stones into two types is provided and it is recognised that, at times, weight stones were reused pieces of existing architecture (notably, column drums).[85] In a similar fashion to Diler (1995), a 'standardisation' of press dimensions is suggested; however, it is here that the study lacks. Unlike Diler's work, Aydinoğlu and Alkaç fail to discuss specific sites, mention exact press locations, or relate their standardisation hypotheses to labelled and categorised installations in Rough Cilicia. Thus, the reader is often left to guess what site is referred to when evidence is discussed. A more concrete critical apparatus and system of specific, evidentiary support are needed in order to provide a convincing argument. The inherent difficulties when ascribing a date to presses are also mentioned, and there is a complete reliance on the ceramic evidence to propose periods of use for rock-cut presses in Rough Cilicia.[86] They fail, therefore, to create a more detailed chronology in relation to rock-cut press architecture, and conclude with the resolution that the presses were used from the Early Bronze Age until the Byzantine period.[87] It is hoped that a more in-depth publication is provided in the future, which labels and details specific press sites and attempts to place these within a typology and rigid, interdisciplinary dating structure.

The increased interest and combined research output of viticultural and agricultural studies in Rough Cilicia (and, more generally, Anatolia) culminated in late 2008, when a symposium was held in Mersin, Turkey. This led to the publication of symposium proceedings edited by Aydinoğlu and Şenol (*Antik çağda Anadolu'da zeytinyağı ve şarap üretimi: Sempozyum Bildirileri*, 2010) discussing a range of recent research outcomes largely based on archaeological and epigraphic sources.[88] This symposium and the publication of its proceedings further demonstrate the vital importance of viticulture and oleiculture in Anatolia throughout the various stages of antiquity. In relation to the present study, it highlights the central role Rough Cilicia played in Late Antique viticulture and wine export. The following review provides a brief analysis of pertinent texts within the larger publication.

The central importance of Rough Cilician viticulture in antiquity is best observed, firstly, by Iacomi (2010), who provides an epigraphy-based analysis of wine (and oil) production, utilising texts found at the Korykos necropolis and within the Abydos Tariff, along with ceramic evidence from Late Roman 1 amphorae. The results indicate that wine and oil productivity played a central role in the Korykos economy, particularly from the 5th-6th centuries AD, and caused a renewed revival of urban centres in the region, as Cilician traders were allowed special taxation privileges and exemptions.[89] Secondly, Autret and Rauh (2010) provide a useful overview of survey, geo-analysis, and petrography completed at three Roman kiln sites within close proximity of modern Gazipaşa. A preliminary analysis of the amphora (and other ceramic) types produced at each site is given, and dates and uses for each are posed. The evidence compliments and agrees with that reached in the 2006 RCASP publication (Rauh *et al.* 2006): agricultural productivity boomed and flourished from the Imperial to early Byzantine periods with wine and olive oil the foremost commodities produced and, potentially, exported from the region.

The contribution of Aydinoğlu (2010) to the proceedings is also of particular interest. Although it deals specifically with olive oil production in Rough Cilicia, several similarities can be applied to viticulture within the region. A thorough analysis of olive oil production is provided, again, noting a flourish of agricultural activity and economic vitality during Late Antiquity. Similarities between oil and wine production can be elucidated from this text, including the topographical location of press installations, technology employed and the problematic dating of those installations recognised. He also notes the reuse of monumental architecture at press installations, which is of particular relevance here (cf. chs 2.2, 2.3 and 4.3). The similar features of oil and wine presses have been recognised in the past, and difficulties in distinguishing these production facilities are noted again. It is valuable, therefore, to observe both similarities and differences between the agriculture, architecture, production, storage, and export processes that may further explicate the prominent role these, all too often interconnected, commodities held in certain regions.

Mention must also be made of an international conference held in Lincoln, Nebraska, which discussed

[84] Rauh *et al.* 2006: 65ff.
[85] Aydinoğlu and Alkaç 2008: 282-83.
[86] Aydinoğlu and Alkaç 2008: 284. See ch. 3.2 for recommendations regarding more detailed dating methodologies for vinicultural installations.
[87] Aydinoğlu and Alkaç 2008: 284.
[88] This large publication includes various articles that concentrate on sites within a widespread geographic area, the most relevant and useful to the present study are: Aydinoğlu (2010: 1-19); Iacomi (2010: 19-33); Autret and Rauh (2010: 109-23); Scardozzi (2010: 277-303); and Baldiran (2010: 303-19).
[89] Iacomi 2010: 27-8.

new approaches to the historical and archaeological study of Rough Cilicia. Hoff and Townsend (2013) published and edited the proceedings and, while not focussed on agricultural production specifically, the volume gives Rough Cilician archaeology, and by association the agricultural production of the region, a prominent place in the study of the ancient Mediterranean. The contribution of Rauh, Dillon and Rothaus (2013) is particularly relevant, and provides a firm historical and archaeological backbone to the current study; their extensive illustration, mapping and archaeological discussion of a broad chronological period and inclusion of a range of evidentiary forms is commendable. The contribution of Elton (2013) should also be mentioned; his work allows direct comparison between religious structures and settlements within Rough Cilicia and re-justifies viticultural activity in later periods.

The proceedings of various conferences held in the early 21st century are compiled in a useful series, entitled *Late Antique Archaeology*. With a general eastern Mediterranean focus, they are pertinent both geographically and chronologically. Particularly relevant is the bibliographic essay by Chavarría and Lewit (2004) that provides an extensively referenced overview of the work completed regarding production industries, including agricultural methods, in Late Antiquity. Lavan (2007) also discusses technological change and development, seen through the lenses of innovation, stagnation, recession and replacement, and emphasises the 5th-6th century AD interconnected booms in the economy and agricultural productivity throughout the eastern Mediterranean.[90]

More recently, Burton and Lewit (2019) and Lewit (2020) pushed the study of mechanical press installations and innovation to new heights, with detailed interdisciplinary study and pan-Mediterranean evidentiary bases. Most importantly they highlight the now accepted notion, backed by chapters herein, that press technology and agricultural habits evolved in a regional or microregional modus, not through historically accepted linear or chronological developments.

Pioneering Scientific Approaches: Biomolecular Archaeology

Modern scientific methods and technologies are in a constant state of improvement and are readily applied to various aspects of archaeology. Many are particularly useful to the study of ancient viticulture. The most notable figure pioneering approaches in biomolecular archaeology is Patrick McGovern. His focus on the study of ancient organic remains and alcoholic beverages allowed new conclusions to be reached regarding the origins of viticulture and wine production in the Mediterranean. An appreciation of the progress made within the fields of scientific and chemical analysis of ancient organic residues is vital in order to appropriately approach excavation and the analysis of viti- and vinicultural material culture *in situ*; it is increasingly common and recommended to incorporate archaeobotanical analyses into excavation.

In an attempt to trace the origins of viticulture, McGovern (1996), along with Fleming and Katz, edited an expansive publication that targets archaeological, chemical, and epigraphical remains from the Near East and wider eastern Mediterranean.[91] Following this, McGovern (2003) authored another publication, which utilises a chronological framework whereby viticulture is traced from its prehistoric origins through to its use in Judeo-Christian times.[92] Throughout these studies primary emphasis is given to scientific and chemical analysis, as influenced by the expertise of McGovern in biomolecular archaeological techniques. A more recent publication, edited by Ciacci, Rendini and Zifferero (2012), studies the archaeology and history of viticulture and wine in Tuscany and Lazio and incorporates numerous scientific and archaeobotanical analyses into its content, further presenting the fruitful nature of this methodology.[93]

These larger publications are supported by other contributions to the field, some of which include: Romanus *et al.* (2009);[94] Barnard *et al.* (2011); McGovern *et al.* (2013);[95] Pecci, Ontiveros and Garnier (2013);[96]

[90] In relation to the present study, see also Bes (2007), Lewit (2007) and Mattingly (1996).

[91] In relation to the present study and of particular interest to the beginnings of historical viticulture in Anatolia, see Gorny (1996: 133-75). On the challenges of detecting ancient wine using pioneering, biomolecular approaches, see McGovern and Michel (1996: 57-67).

[92] Of particular relevance to the present study is the analysis of wine and its usage in the Holy Land (cf. McGovern 2003: 210-36).

[93] cf. Ciacci, Rendini and Zifferero 2012: 133-65.

[94] Discusses new chemical evidence for how pitch and resin were used in wine and oil containers, including discoveries that challenge the traditional belief that resin was used exclusively in wine or fish sauce-carrying amphorae; the scientific community now agrees that if a layer of resin/pitch is thick and easily discernible to the naked eye, the jar probably held wine or fish sauce (also see: Bernal-Casasola 2015; Garnier, Silvino and Casasola 2011; Pecci and Cau 2010). The difficulties posed by the potential reuse of amphorae are also discussed, and hypotheses relating to the reuse of wine containers for olive oil, but, importantly, not *vice versa*, are put forth (p. 908). In relation to this, Bernal-Casasola (2015: 70) highlights a range of typological features that suggest an amphora carried wine, including the presence of a flat bottom and fermentation holes.

[95] Highlights evidence from Etruscan amphora (*c.* 500-475 BC) and a limestone press platform (*c.* 425-400 BC) at Lattara in southern France; suggests that exported Etrurian wine fuelled an interest in the product in France and, consequently, the later transplantation of the vine and beginning of a Celtic wine industry.

[96] Highlights the value of chemical analyses on the study of badly preserved archaeological material culture and attempts to distinguish the agricultural process that was primarily undertaken at that site (p. 4496). Also illustrates an outlier case of reuse within an agricultural installation (a collecting vat at Son Peretó, p. 4496).

and Arobba *et al.* (2014). Most recently, Woodworth *et al.* (2015) questioned the traditional belief that African amphorae only held olive oil; they verified, through scientific analysis, that Keay 25/Africana 3 amphorae transported a range of produce, of which one was undoubtedly wine. Equally as important is their affirmation that the presence of resin or pitch is not a sufficient enough argument to exclude oil as the content of an amphora.[97] As time continues the contribution of chemical analysis and biomolecular archaeology will increase and an interdisciplinary approach will allow greater understanding and comprehension of viticulture throughout antiquity. Such methods also bear great promise to clarify chronologies, typologies and, at times, provide a tangible 'taste' of the past.

The Future of Ancient Viticultural Research

With origins in early Italo-centric studies, viticultural research themes have since progressed to include additional foci, including: links between wine production, settlement patterns and urban development; the quantification of viticultural data with attempts to discover production quantities and land usage; and the incorporation of a wide range of evidence in an increasingly interdisciplinary fashion (including archaeological, ceramic, epigraphic, botanical, and ethnographic data).[98] Indeed, Rossiter recognised that relatively recent studies on ancient agriculture have set challenging new standards by incorporating increasingly wider ranges of evidence and developing innovative typologies and methodologies, most of which will remain essential for years to come.[99]

It is now time to broaden the scope of ancient viticultural studies, not only by locating and correcting *lacunae* in regional understanding, but by linking the existing research database with emerging research themes and combining this with present day archaeological investigation and discovery to show that such viticultural research can contribute significantly to our understanding of the past. Certain links have already, or are currently, being explored, including: the role of wine in the ancient economy; the regional importance and effects of wine production on trade; and the relationship between wine production and the extant ceramic record. Others must now be advanced, and the present study hopes to illuminate some of these, including the:

1. Temporal relationships between wine production and ritual use, including the quantification and economic significance of this data;
2. Relationship of vinicultural installations to their immediate contexts, including the reuse of monumental architecture;
3. Establishment of more accurate installation and architectural typologies utilising interdisciplinary analysis; and, on a larger scale, the
4. Temporal, quantified analysis of press installations and what production trends this might reveal over wider chronological spans.

Interdisciplinary research themes are also already tentatively being explored and it is vital to progress these in the current research environment.[100] For example, the:

1. Importance of viticulture in regards to ancient land use patterns;
2. Quantified examination of viticultural output and local settlement sizes;
3. Chemical analyses of organic residues; and
4. Relationships between agricultural areas (viticulture) and productive/industrial areas (viniculture).

The geographical widening of ancient viticultural research, ever increasing from the 20th century to the present day, instigated the exploration of almost every corner and province of the Roman and Byzantine world through agricultural, archaeological and interdisciplinary research in some form. This has resulted in a growing scholarly publication output, with more resources than ever before available to the ancient viticultural researcher. The expansive studies of Drachmann, Frankel, Brun and McGovern continue to provide an excellent base from which to launch an investigation of the subject and are a valuable contribution to the greater understanding of viticulture and wine production in antiquity. Nonetheless, various aspects of viti- and viniculture in antiquity remain a mystery, and, all too often, ancient agricultural research continues to be neglected in favour of the historically popular areas of architectural and funerary archaeology (undoubtedly important in their own right). As recently as the last decade scholars have emphasised the importance of prioritising an examination of utilitarian agricultural features and productive aspects of rural life in order to enhance our comprehension of the ancient landscape.[101] This project, therefore, presents a meaningful contribution

[97] cf. n. 94; Bernal-Casasola 2015: 69.

[98] This is particularly clear in Rauh *et al.* (2006; 2009; 2013), as well as the majority of work undertaken by the RCASP.

[99] The range of evidence includes the results of: 'archaeological survey, the manufacture and distribution of amphorae, the study of palaeobotanical remains, and the observation of modern or "ethnographic" parallels' (Rossiter 1998: 597).

[100] Jackson (2013: 220-21) provides similar interdisciplinary recommendations for the study of rural Byzantine settlements in Rough Cilicia.

[101] In relation to Late Antiquity, see Chavarría and Lewit (2004: 44).

to our current understanding of ancient viticulture, and the past more generally, across a number of research themes.

1.4 A Summary of the Ancient Literature

The importance of archaeological evidence, scientific testing and contemporary literary review is vital to the comprehension of ancient viticulture. Of equal importance and necessary consideration, however, is a review and inclusion of the ancient literary texts – the agricultural treatises of the Roman and Late Antique periods are of particular relevance to the archaeological evidence presented herein. The accuracy of agricultural literary sources before the 3rd century BC is debatable, largely due to the sparse extant record; White provides a detailed examination of what can be elucidated from earlier agricultural literature, comprised mainly of Greek and Phoenician writers.[102] Thorough reviews of the Roman and Byzantine literature also already exist in a number of modern studies and, thus, it is not necessary to include an exhaustive discussion of what these texts offer to the modern viticultural archaeologist.[103] It is useful, nonetheless, to review the literature of particular relevance here, and consider how it can work with (and against) other forms of viticultural material culture.

In order to best display the evolution and thematic nature of the ancient literary sources, a chronological, author-by-author approach is adopted. In an attempt to be succinct and discuss with clarity, reference to more thorough reviews of these texts is given where possible, along with cross-references to specific details used in the current study.

Marcus Porcius Cato (234-149 BC): De Agri Cultura

Seen as the pioneering Latin work on agriculture, the *De Agri Cultura* (or *De Re Rustica*) provides direction and advice for the: management of a winery;[104] cultivation and growth of vines, including specific grape types;[105] equipment necessary for a vineyard and winepress;[106] creation of must and fermentation;[107] recipes for making wine;[108] and instructions for the cellaring and sale of wine. While the text is criticised for its brief and unsystematic nature when compared to later agricultural literature, it does, at times, follow either a logical seasonal or processual arrangement. Modern studies (predominantly geared towards oil production) have attempted various reconstructions of the 'Catonian', lever and drum press and Cato's scale of vineyards and production are regularly referred to in quantitative analyses.[109]

Marcus Terentius Varro (116-27 BC): Res Rusticae

A compact predecessor to the larger text of Columella (below), the *Res Rusticae* of Varro (pub. 37 BC) refers explicitly to the earlier, pioneering work of Cato and builds upon the advice provided therein.[110] The most significant departure from Cato's text is the ability of Varro to recognise the benefits of balancing adherence to proven practice with experimentation using new and improved methods.[111] An examination of soils and topographies best suited to vine growth is provided, which names particular vine species at one point, along with a discussion of different vineyard types, their benefits and disadvantages.[112] Varro reviews figures from both Cato and Saserna regarding slave quantities and the division of equipment across vineyards of various sizes, while also imposing his personal opinion on the matter.[113] Seasonal directions are also given, in a more detailed manner than the earlier Cato, describing when certain viticultural activities should take place in relation to celestial movements.[114] Varro was aware of beneficial, and experimental, viticultural practices, including propagation, grafting and hybridisation.[115] A brief, though useful, description of the vintage and associated activities is presented; including a clarification of different must qualities.[116] Varro also recognises the benefits of aging wine, particularly the Falernian variety, and states that at least one year should be added to the age of any wine.[117] As is also written

[102] Including Democritus, Xenophon, Archytas of Tarentum, Aristotle, Theophrastus, Hieron II, along with Phoenician sources, including Mago, that are cited in the later texts of Cato and Columella (cf. White 1970a: 15-8).

[103] See, for example: Chevallier's (1990: 3-8) review of the ancient sources relating to viticulture in Gaul and the neighbouring provinces; White's (1970a) review of the Roman agricultural sources from Cato into the Late Roman, Byzantine and Arab periods (pp. 18-33), as well as his summary of Columella's text, particularly in relation to the economy of viticulture (pp. 241-46); Humphrey, Oleson and Sherwood (1998: 116-20 and 154-59) provide translation and commentary on select ancient passages that discuss viticulture and wine production. Manzi (1998) provides frequent references, both notational and within the body of his argument, to the ancient literature throughout his general discussion of Roman viticulture and oenology. Marzano (2007: 85-101) provides a broader review of the ancient literature in relation to Roman villas and the agriculture that surrounded them.

[104] Cato, *Agr*. 1-7.

[105] Cato, *Agr*. 6.4 (for grape types), 27-8, 31-3, 40-1 and 49.

[106] Cato, *Agr*. 11 (for a vineyard), 12-13 and 18-9 (for the press room).

[107] Cato, *Agr*. 23 and 25-6.

[108] Cato, *Agr*. 24, 105 (for the creation of Greek wine), 104 (wine for the hands), 107-15 and 122-25.

[109] Reconstruction of the Catonian press: Adam 1998; Brun 1986: 241 with fig. 208; Curtis 2001: 387 with fig. 33; Drachmann 1932: 145 with fig.12. Utilisation of Cato's figures: De Sena 2005; Goodchild 2013: 57-8; Marzano 2007: 106-7; 2013a: 93-100; 2013b: 108 with n. 5. For recent analyses on Cato's press description and how it influenced Pliny's later text, see Burton and Lewit (2019: 556).

[110] He is also particularly fond of the work of Mago (Varro, *Rust*. I.1.10).

[111] White 1970a: 23.

[112] Varro, *Rust*. I.7-8 and I.26-7.

[113] Varro, *Rust*. I.18-19 and I.22.

[114] Varro, *Rust*. I.31-6.

[115] Varro, *Rust*. I.41 (grafting) and I.54 (mentions hybrid varieties).

[116] Varro, *Rust*. I.54.

[117] Varro, *Rust*. I.65.

in later texts, directives for the cardinal orientation of a cellar is given; Varro suggests that cellared wine requires cool air on the jars and thus windows should face east.[118]

The combined nature of the texts of Cato and Varro provided an impetus for the following major agricultural treatises, which form the most complete surviving ancient literary record of viti- and viniculture.

Lucius Junius Moderatus Columella (unknown, c. 1st century AD): De Re Rustica

Known as the longest and most systematic of the surviving Roman agricultural manuals, the *De Re Rustica* of Columella devotes one quarter of the overall text to viticulture.[119] His knowledge, attention to detail and exactitude surpasses any of his predecessors and are well matched to the precise nature of viticultural endeavour.[120] In order to begin his treatment of viticulture, he clarifies where and in what climate you should attempt to cultivate each type of vine.[121] The text then proceeds to list a plethora of known and recommended grape species along with benefits and detriments for each.[122] Particularly useful to the quantification of ancient viticulture is his examination and stipulation of vineyard productivity, both past and present.[123] As in the text of Varro, recommendations for the cultivation, cutting and nursing of vines are given, along with detailed instructions for the selection and preparation of soil and, of interest to the present study, the topographical location of vineyards (see chs 2.2 and 4.2).[124] Regarding the annual cycle of viticultural activities, Columella illuminates the recommended seasons and times for planting and the processes therein.[125] He also recommends not mixing grape species within a vineyard.[126] Roman methods to frame and train vines are provided – literary evidence that complements the frequently insubstantial archaeological record.[127] An emphasis is placed on the importance of small sickles and iron hooks, where, he states, as many as possible are needed for the vintage;[128] if large quantities of such artefacts are found in modern times within appropriate contexts, this knowledge might help to classify structural remains. The importance of the vinedresser is also stressed throughout the text.[129] Columella reserves the treatment of provincial vines to Book V, and therein states that the most approved are those which stand by themselves on a short stock without any support; an echo to the un-trellised vineyards commonly found today in Greece.[130] He also gives directions for the inter-planting of larger trees as vine supports, a habit shown true by archaeological discoveries and modern practices.[131]

Of particular relevance is his treatment, in Book XII, of the vinicultural aspects of antique wine production. Pitching storage vessels and the boiling down of must is discussed, the latter leads to a discussion regarding the preservation of wine using various types of pitch, seawater and brine.[132] Instruction is also given on how to make a type of sweet wine, including important pre-treatment, production and post-production techniques.[133] Finally, he provides recipes for various types of wine, including a Greek wine, which involves a drying and production method similar to that seen in ch. 3.5.[134]

Brief mention should also be given to the other, earlier work of Columella, *De Arboribus* – of which only the second, of potentially three or four original books, survives. The arrangement, placement and weight of material in this text, again, emphasise the importance of agriculture, predominantly crop and animal husbandry, in the socio-cultural context of the Roman period. In a similar manner to the more thorough *De Re Rustica*, *De Arboribus* begins by discussing how to suitably choose land, plant vines, select species, and prune and care for the vine, all with relevant seasonal and temporal indicators.[135] Detailed instructions on the cultivation, propagation and grafting of vines are given, along with an indication of the required work force for one *iugerum*.[136] Similarly to the *De Re Rustica*, guidelines

[118] Varro, *Rust*. I.13.7.
[119] White 1970a: 27.
[120] cf. White 1970a: 28.
[121] Columella, *Rust*. 3.1.3-10.
[122] Columella, *Rust*. 3.2-3.
[123] Citing, along with his personal experience, Cato, Varro, Seneca, Julius Graecinus, and Julius Atticus (Columella, *Rust*. 3.3-4).
[124] Columella, *Rust*. 3.4-7 and 3.10-12.
[125] Columella, *Rust*. 3.14-19. For similar advice on provincial viticulture, see 5.5-6.
[126] For reasons seen in: Columella, *Rust*. 3.21.5-9.
[127] Columella, *Rust*. 4.13, 4.17 and 4.19-20.
[128] Columella, *Rust*. 12.18.2.
[129] As it is in Cato's *De Senectute* (15.51-53), where the wild vine is tamed and moulded by the ever-skilled vinedresser.
[130] Columella, *Rust*. 5.4.1. Particularly pertinent to chs 4.2 and 5.2 within the present study; seen throughout Attica and the Aegean islands in modern times (especially the Cyclades).
[131] Columella, *Rust*. 5.6-8. The work of Jashemski (1973a: 825-26; 1973b, 32 and 34-5 with ill. 3; 1979: 204-15 and 227-32) at Pompeii, in Regions II.5, I.20 and III.7, uncovered clear evidence for the inter-planting of larger trees in vineyards during the Roman era; however, here the vines were staked rather than trained to these trees. In the *suburbium* of Rome, Volpe (2004: 461; 2009: 372-73) uncovered further evidence for the use of trees as supports, inter-planted between vines, on Republican farms. This practice is commonly seen throughout Greece today, where medium sized fruit trees are planted intermittently throughout vineyards.
[132] Columella, *Rust*. 12.18.5-7 and 12.19-26.
[133] Columella, *Rust*. 12.27.
[134] Columella, *Rust*. 12.37 (for Greek wine) and 12.38-42 (for others); including a particularly relevant section (12.39) on the making of raisin wine (see ch. 3.5).
[135] Columella, *De Arboribus* 1-4.
[136] Columella, *De Arboribus* 5-10 (cf. 5.5-6 for work force per *iugerum*).

for the inter-planting of larger trees and their use as supports are given.[137]

Gaius Plinius Secundus (AD 23-79): Naturalis Historia

As one of the largest extant texts on the natural history of the ancient world, Pliny the Elder devoted an entire book (XIV) to the cultivation of grapevines and production of wine. He directly mentions the (roughly contemporary) Columella along with the earlier Cato and Varro as some of his sources, and is particularly appreciative of the latter two contributions to the field of agricultural discussion.[138] Despite writing at a time near the height of Italian wine production, Pliny affords significant space for the discussion of a number of foreign vine species and wine types contemporaneously imported to Italy. From a description of grape varieties, through a ranked analysis of wine types, the text is largely arranged either by wine type, geographical origin or production technique. Cilician wines are mentioned, along with his personal opinion and the unique production process used therein (see ch. 3.5). A clue to the often wanting archaeological record is given, where he states that wooden casks are sometimes used to store wine, albeit most commonly in cooler climates (for example, the Alps).[139] A reflection upon the *cella vinaria* recommendations of Cato is also clear, where Pliny repeats the optimal cardinal orientation and topographical placement of wine cellars.[140] Particularly significant is the listing of several mechanical press types (see ch. 2.3), some of which provide strong chronological indicators for technological development and innovation in the Mediterranean.[141] Additionally, and of relevance to later chapters herein, he notes that long press levers press better than all others.[142] These references, among others to innovative technologies, provide important evidence against the prevalent belief that agricultural evolution remained dormant throughout the Imperial period.[143] In this same book, organised seasonally, the order of operations during the vintage is given, as indicated by celestial activity, detailing when the grapes should be harvested, pressed, and the must post-treated.[144]

Palladius Rutilius Taurus Aemilianus (unknown, late 4th century AD): Opus Agriculturae

A man of high status (*vir inlustris*), Palladius originated from Gaul but possessed farms in Italy (near Rome) and on Sardinia.[145] The aim of his text appears clear: to provide an easily understood, accessible farming manual. This was achieved by organising the entire text on a calendrical basis, with each month (or book) composed in the same sequence, and by using a succinct and unsophisticated style.[146] The source for viticultural material was largely his predecessor, Columella; however, his discussion on the flavouring of wines and the architecture of farm buildings, including wineries, originates elsewhere.[147] The text differs to that of Columella or the *Geoponika* (below) in the fact that fruit trees occupy more pages than vines; nonetheless, the considerable personal viticultural experience of the author is revealed in his detailed treatment of the subject.[148] He does not provide an exhaustive listing of vine types, as Columella does, instead, stressing that a farmer should rely on types tried and tested in his locale.[149]

Palladius opens with a series of 'maxims essential to farming' followed by a description of the farm and its buildings. The former includes specifications for the orientation of vineyards;[150] the topographical setting of vines;[151] pruning recommendations;[152] and other scattered viticultural counsels.[153] The latter includes a valuable description of a vinicultural installation with a treading floor, collection vats, fermentation *dolia*, channelling pipes, excess storage areas, and emergency measures put in place.[154] An illuminating comparison is drawn between the design of the installation (specifically, the treading area) and a basilica.[155] It

[137] Columella, *De Arboribus* 16. See also n. 131.
[138] Plin., *HN* XIV.44-48.
[139] Plin., *HN* XIV.132-3. This, perhaps, shows that in areas of the eastern Mediterranean a lack of archaeological evidence cannot always simply be attributed to decayed organic remains, as items, such as wooden casks, were often not used in these regions at this time.
[140] Plin., *HN* XIV.133-4.
[141] Plin., *HN* XVIII.317-8. For modern efforts to reconstruct these presses, see Drachmann (1932: 145-9 with figs. 12, 14 and 16-7), Adam (1998) and, importantly, Burton and Lewit (2019) for a revised interpretation. Such revisions now suggest that mechanical press evolution was largely site-specific, dependent on individual requirements (see n. 804); it is unlikely that the linear development of press technology ever occurred as some interpretations of Pliny's text suggest (Lewit 2020: 311).
[142] Plin., *HN* XVIII.74.316; Lewit 2020: 312 with n. 20.
[143] White 1970a: 28.
[144] Plin., *HN* XVIII.315-21.
[145] See Fitch (2013: 11ff) for an introduction to Palladius and his text.
[146] Fitch 2013: 14-5.
[147] Anatolius of Beirut (4th century AD) provided the compilation of material used by Palladius for his recipes of flavoured wines; Greek writers continuously added to the text of Anatolius until it was codified in the 10th century AD as the *Geoponika* (see below). The *Synopsis of Private Architecture* of Cetius Faventius (3rd or 4th century AD) provided details for the sections on farm architecture (Fitch 2013: 13 with n. 4).
[148] For evidence on the personal experience of Palladius, see Fitch (2013: 11 with n. 2).
[149] Fitch 2013: 14; Palladius, *Op. Agr*. 3.9.1-6.
[150] Palladius, *Op. Agr.* 1.6.2-3.
[151] Palladius, *Op. Agr.* 1.6.7.
[152] Palladius, *Op. Agr.* 1.6.4 and 1.6.9
[153] cf. Palladius, *Op. Agr.* 1.6.10-18.
[154] Palladius, *Op. Agr.* 1.18.
[155] '...arranged in such a way that (basilica-like) it has a pressing floor built at a higher level' (Palladius, *Op. Agr.* 1.18.1). Fitch (2013: 50 with n. 28) notes that this raised area (or dais/*tribunal* in a basilica) could be rectangular or apsidal in design. This description, along with the notes of Fitch, helps to illuminate and clarify vinicultural installations

is interesting to note that Palladius does not feel compelled to describe the appearance, construction or features of a mechanical press for either wine or olive oil production, simply stating (for the latter): 'For the olive-mills and wheels and press, the shape dictated by custom is well known.'[156] This suggests that, by this period, older mechanical press systems were still commonly used and designs were well known across the relatively broad socio-economic demographic audience of this text, while, on the other hand, advancements and change occurred regarding the design of the larger vinicultural installation necessitating its description in the text.[157] It also illuminates the lethargic development, and wide geographic spread, of mechanical press technologies in the ancient Mediterranean (see chs 2.3 and 3.2).

The text continues, month by month, to describe the entire annual viticultural process. The working year of Palladius begins in January, where instructions are given for the preparation of the ground, measurement of vineyard areas, and the suitability of soil, climate, and topography.[158] He recommends that vines should be planted in February and that a variety of vines should be planted in each field to avoid disease wiping out the entire crop (in contrast to the recommendation of Columella).[159] This illustrates that ancient viticultural practice was not limited to one grape variety per settlement or region. Details and instructions are also given for provincial vines and vineyards, including a recognisable description of low-lying vines trained in circular forms.[160] The practice of tying vine branches to canes in a circular pattern, as described by Palladius and Columella, is still recognisable in the current day, particularly on the Cycladic islands of Greece; the modern vines of Santorini are trained in this circular fashion to encourage the fruit to grow within the interior, protected microenvironment of the vine.[161] The later date of Palladius' text is reflected in his opinion on the reuse of architectural items; in the preparation of a threshing floor he recommends the use of a column drum fragment to compress the floor structure.[162] This might also reflect changing attitudes towards the upkeep of monumental structures and the relationship between urban and rural spheres, with increasing re-ruralisation in later eras.

Palladius describes the ancient vintage in detail and situates it within the months of August (for preparation) and September-October (for a typical Mediterranean vintage).[163] Recipes and directions sourced from others are given in order to season, improve and change the flavour of various wines, including the use of additives.[164] Particularly useful is a passage describing the production process for raisin wine, although it is likely that Palladius is referring to production in North Africa here rather than the case study regions of the present study.[165]

Geoponika (unknown, 10th century AD)[166]

The *Geoponika* is a Byzantine Greek farming manual dedicated to the Emperor Constantine Porphyrogenitus (r. 913-959 AD).[167] While it directly cites material from a variety of Greek texts, particularly 4th and 6th century sources, it clearly draws the bulk of its viticultural information from Roman agricultural treatises, namely, Columella and Palladius.[168] The geographical scope is largely limited to the eastern half of the Mediterranean; dealing with the region from Greece, through Bithynia and Pontus, Palestine, Arabia, and down into Egypt. As noted for the much earlier texts of Columella and Palladius, viticulture and wine making are given pride of place over other crops, with five of the twenty books dedicated to this pursuit, confirming the continued importance of wine in the socio-cultural and -economic landscape of the later, eastern Roman Empire. Of relevance to the present study, the text instructs on the entire viti- and vinicultural process: from the selection of land and suitable terrain,[169] the first cultivation and planting of the vines,[170] through to the processing of grapes, creation of must, fermentation and storage of the wine produced.[171] This is detailed for a variety of grape types, geographic locations, and agricultural methods.

At odds with Palladius and, particularly, Columella, who state that vines are best grown in the provinces on a short stock with no support, the *Geoponika* states that the most advantageous provincial vines are those that are tree-trained, as they produce a superior wine that

in the archaeological record, particularly cases of structural reuse from the Late Antique and Byzantine periods. The similarities in apse design and use might also further explain links between the church and wine production in Late Antiquity (cf. chs 3.7 and 5.5)

156 Palladius, *Op. Agr.* 1.20.

157 Noted by the particular description and inclusion of the vinicultural installation and new architectural comparisons to the design of a basilica (*Op. Agr*. 1.18).

158 Palladius, *Op. Agr.* 2.10-14.

159 Palladius, *Op. Agr.* 3.9.9-13; Columella, *Rust*. 3.21.5-9; cf. n. 126.

160 Palladius, *Op. Agr.* 3.11. Parallels are seen to the text of Columella (above and n. 130).

161 Observed on an exploratory trip during July 2014 (see ch. 4.2).

162 Palladius, *Op. Agr.* 7.1.

163 Palladius, *Op. Agr.* 9.1-3, 10.11 and 11.3

164 Palladius, *Op. Agr.* 11.14-19. See n. 455, below.

165 Alluded to by his commendation of the raisin wine produced in North Africa and apparent reference to it throughout the passage (Palladius, *Op. Agr*. 11.19.1-2).

166 See Dalby (2011: 9-49) and n. 147 for an examination of the sources, origin and content of the *Geoponika*.

167 Dalby 2011: 9.

168 Dalby 2011: 9-13.

169 cf. *Geoponika* 5.1-5.

170 *Geoponika* 4.12-13, 5.3 and 5.6-19.

171 *Geoponika* 5.45-51 (on harvesting), 6.1 and 6.11-19 (on the creation of must), 7.1-37 (on fermentation, treatment and storage). Book 8 contains a list of recipes for various types of drinking and medicinal wine.

is sweeter and better-keeping.[172] Frequent examples are given, particularly from Bithynia, of suitable locations, planting, training, and up-keep for tree-trained vines, including exactly which trees are suitable for inter-planting.[173] Instructions are provided regarding the planting and care for various types of vines and grapes, including advice on how to avoid pests and mistakes, along with particularly detailed instructions on grafting techniques; also noted in the earlier manuals.[174] Recommendations for the topographical setting of vines (including aspect, altitude and soil type) are discussed, with a particular commendation for Egypt in this regard, along with an interesting, albeit brief, notation that discusses how to predict what kind of wine a vineyard will produce.[175]

Along with the agricultural side of viticulture, instructions are given on the production process and preparation of facilities.[176] Particularly relevant are descriptions regarding how to produce and ferment desirably sweet wines.[177] Post-production procedures are discussed in Book 7, including: opening the vats; racking wine; and testing, tasting and stabilising.[178] Book 8 largely contains recipes for medicinal wines and attempts to imitate famous and popular flavours (e.g. *Aminean* or *Thasian*).

Smaller References in Texts Throughout Antiquity:

While the texts above form the bulk of the extant ancient literature on viticultural practice, there are numerous smaller references that provide important insights into changing views, practices and technologies throughout antiquity. One of the earliest is Hesiod, who mentions different methods of wine production and grape treatment.[179] Saserna (or the Sasernas – possibly a father and son authorship), who wrote between Cato and Varro, called attention to the fact that vines could now be planted in regions previously too cold for their growth (an occurrence he attributed to climate change).[180] The text of Tremellius Scrofa, also cited by Varro and Columella, was important as it embodied specific advances in the technical knowledge of viticulture not seen before.[181] Cornelius Celsus is also frequently cited by Columella on subjects of viticulture.[182] Virgil's *Georgics*, although containing references to viticulture here and there, are of highly questionable accuracy regarding technical aspects and procedures for the production of wine (also noted by Seneca). A significant loss is the contribution by Julius Atticus, who is believed to have written solely on viticulture, making contributions to both technical and economic aspects of vine growing.[183] Another favourite of Columella, Julius Graecinus, appears to have written a similar treatise to Atticus on viticulture, albeit with a more personal and enquiring viewpoint. Through the text of Columella, Graecinus often chides contemporary viticulturists and comments on their mistakes.[184] The harvest of vines and production of wine is mentioned briefly in Pliny the Younger's *Letters*; interesting, due to the personal tone conveyed and the insight given into the operations of an estate at this time.[185] Hero of Alexandria provides a thorough description of what is, according to Drachmann, a 'Greek' mechanical press, and, in doing so, provides a beneficial comparative example to those described by Cato and Pliny; though recent research now questions the appropriateness of the label 'Greek' and, indeed, whether such a press was ever used.[186] Three authors from the period between Pliny the Elder and Palladius wrote on agriculture: The Quintilii, Curtius Iustus, and Gargilius Martialis. While the only fragments that remain are of Martialis, it is not certain whether any of these texts dealt specifically with viti- or viniculture.[187] Macrobius, in the *Saturnalia*, discusses why must left for different periods of time may or may not cause drunkenness, and, through this, recognised the process of primary fermentation and alcoholisation that occurs.[188] Brief, less technical mentions are made of wine or viticulture in the texts of Dioscorides, Martial, Galen (in a medical context), Athenaeus, and Virgil.[189] Finally, the references that exist to viti- and vinicultural processes in the religious texts of the Bible, Tosefta and other rabbinical writings should be mentioned. While these are of some use, their value is often skewed by religious bias and they do not provide the technical expertise and knowledge that is presented in the agricultural manuals. However, the value they add to the discussion is addressed below (cf. n. 415).

[172] *Geoponika* 4.1. The *Geoponika*, and its sources, can be considered largely provincial when compared to the Italo-centric Columella and, to a lesser extent, Palladius.
[173] *Geoponika* 4.1.
[174] *Geoponika* 4.12-13.
[175] *Geoponika* 5.1-2, 5.4-5 and 5.7.
[176] *Geoponika* 6.1-19.
[177] *Geoponika* 7.18-19.
[178] *Geoponika* 7.5 (opening the vats), 7.6 (racking wine) and 7.7-17.
[179] Hes., *Op*. 609-18; see also, n. 443.
[180] Columella, *Rust*. 1.1.4-5; White 1970a: 21.
[181] White 1970a: 21 with n. 30.
[182] cf. White (1970a: 24 with n. 41) for a list of where these occur in the text of Columella.
[183] Columella, *Rust*. 1.1.14; White 1970a: 25 with n. 42.
[184] cf. Columella, *Rust*. 3.3.4, 3.3.6 and 4.3.3.
[185] Plin., *Ep*. IX.XVI: 'Personally I have neither time nor inclination for hunting; no time because I am busy with the grape harvest, and no inclination because it is a bad one. But I am bringing in some new verses instead of new wine and...I will send them when the fermenting stage is over.' *Ep*. IX.XX.2: '...at this very moment I am gathering in the grape harvest, which is poor, but better than I had expected; if you call it 'gathering' to pick an occasional grape, look at the press, taste the fermenting wine in the vat, and pay a surprise visit to the servants I brought from the city...'
[186] Hero, *Mech*. 3.13-20; Burton and Lewit 2019: 544-59; Lewit and Burton 2019: 103.
[187] This cannot be ascertained by their later citations in Palladius or the *Geoponika*.
[188] Macrob., *Sat*. 7.7.14-18.
[189] cf. ch. 3.5.

Although it is useful to consider the full chronological scope of ancient viticultural literature, it should be noted that those 'later' texts are most temporally appropriate to this book. Cautious and targeted reference to earlier works, Cato, for example, is used to illuminate specific details where necessary.