A MEASURED HARVEST
GRAIN, TITHES, AND TERRITORIES IN HELLENISTIC AND ROMAN SICILY.
(276–31 BCE)

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RECOMMENDED FOR ACCEPTANCE
BY THE DEPARTMENT OF ART & ARCHAEOLOGY

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For Aidone.
ABSTRACT

During the reign of the Syracusan monarch Hieron II (269-215 BCE), Sicily’s famed agricultural resources were, for the first time, comprehensively mobilized through a sophisticated administrative system designed to collect an annual grain tithe from cities within his kingdom. Hieron’s administrative system was so effective at harnessing the productivity of the island that the Romans, eager to feed their growing urban and soldier populations, retained the annual grain tithe and applied it to the whole of Sicily, thereby transforming the first of their provinces into the grain-basket of their burgeoning empire. As Roman authority replaced that of Hieron in Sicily, so the groundwork was laid for Rome’s expansion across the Mediterranean.

This traditional narrative of agricultural administration in Hellenistic and Roman Sicily is based largely on a single courtroom speech of Cicero (“De frumento”; In Verrem II.3). Yet, a substantial body of archaeological material has passed largely unnoticed and underappreciated for its documentary value to ongoing scholarly discussions about the economic and political significance of the island’s agricultural resources. My dissertation takes a new approach and recasts this narrative in terms of monumental granaries, standardized grain measures, and the circulation of bronze coinage—material elements of agricultural administration emerging from excavations on the island.

Chapter One offers a brief historical introduction to topic of agricultural administration in Hellenistic and Roman Sicily and situates the dissertation within the existing field of scholarship. Chapter Two introduces a new and largely unstudied class of artifact into the discussion of agricultural administration, namely ceramic vessels used for measuring dry goods, such as wheat and barley. By treating these artifacts as
documents of a city’s participation in an administrative system governing agricultural production and taxation, I use the standardized vessels to demonstrate that metrological unification may be treated as an index of political consolidation. *Chapter Three* presents a pair of monumental granaries at Morgantina and considers their function in relation to the agrarian policies pursued by Hieron and the Romans. I argue that the construction of the granaries at Morgantina is symptomatic of political control over agricultural resources and of a community’s participation in a political and economic network that extended far beyond its borders. *Chapter Four* considers the substantial body of numismatic material from the agora at Morgantina in light of taxation and trade in grain. I argue that the circulation of bronze coinage at sites on the interior of the island may document transactions of grain for cash.

Taken together, these three material elements offer a rich and contextual perspective on the impact of agricultural administration on the political, economic, and social environment of Sicily and Italy between the third and first centuries BCE.
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ABBREVIATIONS


**ABBREVIATIONS OF PERIODICALS AND SERIES**

*AA* Archäologischer Anzeiger: Beiblatt zum Jahrbuch des Deutschen Archäologischen Instituts

*ABSA* The Annals of the British School in Athens

*AIIN* Annali dell’Istituto Italiano di Numismatica

*AION ArchStAnt* Annali dell’Istituto Orientale di Napoli. Sezione di Archeologia e Storia Antica

*AJA* American Journal of Archaeology

*AM* Mitteilungen des Deutschen Archäologischen Instituts, Athenische Abteilung

*ANSMN* American Numismatic Society, Museum Notes

*AntAfr* Antiquités africaines

*AntCl* L’antiquité classique

*AntK* Antike Kunst

*ArchCl* Archeologia classica

*Ἀρχ. Δ.* Ἀρχαιολογικὸν δελτίον

*BCH* Bulletin de correspondance hellénique

*BEFAR* Bibliothèque des écoles françaises d’Athènes et de Rome

*GRBS* Greek, Roman, and Byzantine Studies

*Hesperia* Hesperia: Journal of the American School of Classical Studies at Athens
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<td>JHS</td>
<td>Journal of Hellenic Studies</td>
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<td>JRA</td>
<td>Journal of Roman Archaeology</td>
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<td>JRS</td>
<td>Journal of Roman Studies</td>
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<td>Kokalos</td>
<td>Kokalos: Studi pubblicati dall’Istituto di storia antica dell’Università di Palermo</td>
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<td>MAAR</td>
<td>Memoirs of the American Academy in Rome</td>
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<td>MEFR</td>
<td>Mélanges d’archéologie et d’histoire de l’École française de Rome</td>
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<td>MEFRA</td>
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<td>MonAnt</td>
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<td>OF</td>
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<td>ÖJh</td>
<td>Jahreshefte des Österreichischen Archäologischen Institutes in Wien</td>
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<td>OpRom</td>
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<td>RIN</td>
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CHAPTER I: INTRODUCTION

In the opening lines of the twenty-third book of his *Universal History*, the first-century historian Diodorus Siculus praises his native Sicily, writing that,

"Ὅτι Σικελία πασῶν τῶν νῆσων καλλίστη ὑπάρχει, ὡς μεγάλα δυναμένη συμβάλλεσθαι πρὸς αὐξησιν ἡγεμονίας

Sicily—of all islands—is the noblest, since it can contribute greatly to the growth of an empire (23.1–2).

Located at the nexus of major maritime corridors, Sicily, by Diodorus’ time, had certainly seen its share of conquerors come and go. One suspects that the quality which made Sicily so *kalliste* in the eyes of Diodorus and would-be hegemonic powers was neither its warlike population nor its untapped mineral resources. Rather the island’s beauty lay in its agricultural fecundity.

It is well attested that Sicily, for much of antiquity, was capable of producing grains and other agricultural products in quantities well beyond the consumption of its resident population. This ability to produce an agricultural surplus allowed the island to become a major exporter of grain from as early on as the sixth century BC. At one time or another, Sicilians would find themselves sending grain to many of the premier cities of the Classical Mediterranean world, including Athens, Rome, Alexandria, and Carthage.¹

In fact, Sicily’s role as an abundant provider of grain for Mediterranean communities was so perennially consistent that the island even received mythological priority in the etiology of agriculture.² It was claimed by some ancient authors that grain

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¹ Sicilian grain is thought to have reached Athens in great quantities during the fourth century BCE. On this point, see GARNSEY (1988, 151–54); also, Demosthenes 32 (*Against Zenoethemis*) and 56.9 (*Against...

² This idea is found in literary contexts as late as the first century AD. Sicily as home of Demeter and Persephone, Diodorus 5.2.3–5.1; Cicero, *Verr.* 4.48.106; Ovid, *Fasti* 4.417. For the cult of Demeter and Persephone in Sicily, HINZ (1998). and its political overtones, WHITE (1964).
(σῖτος) originated in Sicily, and even that the agricultural goddesses Demeter and Persephone called the island home. As, for instance, Pindar (I Nemean, 13–16),

σπειρέ νυν ἄγλαϊν τινά νάσῳ, τὰν Ὄλυμπο δεσπότας 
Zeús ἔδωκεν Φερσεφόνα, κατένευσέν τε οἱ χαίταις, ἀριστεύοισαν 
εὐκάρπου χθονὸς 
Σικελίαν πίειραν ὀρθώσειν κορυφαῖς πολίων ἄφνειας.

Sow some splendor on the island, which Zeus the lord of Olympus gave to Persephone; he nodded assent with his flowing hair, that as the best land on the fruitful earth he would make Sicily fertile and prosperous in her cities blossoming with wealth.

Grains—particularly wheat and barley—formed the nutritional basis for most of the ancient Mediterranean’s population. Not surprisingly, the considerable role of grain supply and agriculture in ancient Mediterranean society has become a topic of major interest for archaeologists and ancient historians working in both Greek and Roman contexts. Sicily lends itself quite well to serious discussion of grain supply and trade in the ancient Mediterranean, though its position in scholarship has been peripheral or ancillary to studies of grain supply in Athens and Rome.

As a reliable source of food for hungry communities around the Mediterranean, Sicily’s reputation in antiquity was certainly secure, but as Diodorus suggests, grain could be much more than a simple foodstuff. It was also a valuable commodity to be exploited for economic, military, and even political gain. In a world where food crises were frequent and arable land in short supply, ensuring a reliable source of grain took on immeasurable significance for the island’s political and military leaders. Consider, for

4 OSBORNE (1987, 195), writes “the Classical city was embedded in the countryside. Agriculture made the Greek city possible and established its limits.”
5 For instance, GARNSEY (1988) and ERDKAMP (2004).
instance, the demands made by the Syracusan tyrant Gelon in the lead-up to the Persian invasion of Greece in 480 BCE (Herodotus, 7.158). In return for sole military command of the Hellenic forces, Gelon offered to provide enough grain to feed the entire Greek army for the duration of the war—an enormous amount by all estimates. What is instructive about this episode—regardless of its historicity—is the underlying message that agricultural resources could be translated into political authority and military power.

Cicero, writing four hundred years after Herodotus, offers a similar opinion from the perspective of a Roman for whom Sicilian grain is equated with imperial expansion. For Cato, Sicily was a cellam penarium rei publicae and nutrix plebis Romanae—a storehouse for the Republic and nurse of the Roman people.

Itaque ad omnes res sic illa provincia semper usi sumus ut, quicquid ex sese posset effere, id non apud eos nasci sed domi nostrae conditum putaremus. Quando illa frumentum quod deberet non ad diem dedit? Itaque ille M. Cato Sapiens cellam penarium rei publicae nostrae, nutritem plebis Romanae Siciliam nominabat. Nos vero experti sumus Italico maximo difficillimoque bello Siciliam nobis non pro penaria cella, sed pro aerario illo maiorum vetere ac referto fuisse; nam sine ullo sumptu nostro coriis tunicis frumentoque suppeditando maximos exercitus nostros vestivit, aluit, armavit.

And therefore we have always so esteemed the island of Sicily for every purpose, as to think that whatever she could produce was not so much raised among the Sicilians as stored up in our own homes. When did she not deliver the grain which she was bound to deliver, by the proper day? Therefore that illustrious Marcus Cato the wise called Sicily a storehouse of provisions for our republic—the nurse of the Roman people. But we experienced, in that long and difficult Italian war which we encountered, that Sicily was not only a storehouse of provisions to us, but was also an old and well–filled treasury left us by our ancestors; for, supplying us with hides, with tunics, and with grain–without any expense at all to us–it

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7 For similar discourse, see Nicias’ speech (Thucydides 6.20–22) in the debate leading up to the Athenians’ Sicilian expedition of 415–413 BCE.
During the reign of the Syracusan monarch Hieron II (269–215 BCE), Sicily’s famed agricultural resources were, for the first time, comprehensively mobilized through a sophisticated administrative system designed to collect an annual grain–tithe from poleis within his kingdom.\(^8\) On the basis of this legislation, commonly referred to as the *Lex Hieronica*, Hieron established a thriving Hellenistic kingdom in the southeastern corner of Sicily, stretching from the coastal cities of Syracuse, Catania and Kamarina, up into the hinterland around Morgantina (Figure 1).\(^9\) With its broad coastal plains and long, arid summers, this region was climatically and geographically disposed to intensive grain production.\(^10\)

Enormously enriched by this annual tithe, Hieron ruled for an exceptional fifty-four years, embellishing his subject states with monumental buildings (e.g. theaters, baths, granaries) and winning fame for his substantial gifts of grain to the Romans, Carthaginians, and Ptolemies of Egypt.\(^11\) Hieron’s administrative system was so effective in harnessing the productivity of the island that the Romans—eager to feed their growing urban and soldier populations—retained the annual grain tithe and applied it to the whole of the island, thereby transforming their newly minted province into the “grain–basket” of Rome’s burgeoning empire.

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\(^9\) For recent discussion on the extent of Hieron’s kingdom, see ZAMBON (2008); BELL (2007a, 2007b); KARLSSON (1993).
\(^10\) DE ANGELIS (2000, 111–47); BARBAGALLO (1904).
\(^11\) For Hieron’s gifts of grain to the Romans, see Diodorus 23.8.1; 24.1.4; 25.14, Eutropius 3.1.3, Livy 23.21.5. For gifts to the Carthaginians, Polybius 1.83.2–4. The great ship reportedly sent by Hieron to Ptolemy II (Athenaeus, *Deipn.* 5.206e–209c) was said to hold, among other gifts, sixty thousand *medimnoi* of grain.
Sicily witnessed immense political and economic transformation between the third and first centuries BCE and, throughout, it was the island’s agricultural productivity that was time and again mobilized as an effective tool for achieving political and military ends. Hieron II used surplus grain to secure the position of his kingdom against the encroachment of Rome and Carthage in the aftermath of the First Punic War, engaging in what Peter Garnsey has termed “corn diplomacy.”\textsuperscript{12} The Romans preferred a far more blunt approach—Sicilian grain kept their soldiers fighting foreign wars.\textsuperscript{13} Characteristic are the emergency measures taken by the Roman Senate during the war with Antiochus III (191–188 BCE) when for three consecutive years a surplus–tithe, two–and–a–half times the normal tithe (roughly seven million \textit{modii} of grain), was levied in order to feed Roman legions campaigning in Asia Minor.\textsuperscript{14}

Since Jérôme Carcopino’s \textit{La loi de Hiéron et les Romains} (1919), scholars have been keenly aware of the significant role played by Sicily’s agricultural resources in the political, military, and economic development of the kingdom of Hieron II and later of the Roman Republic. While the traditional narrative—as outlined above—of agricultural administration in Hellenistic and Roman Sicily emerges largely from literary sources, a substantial body of archaeological material has passed unnoticed or underappreciated for its documentary value.\textsuperscript{15}

\textsuperscript{12}GARNSEY (1988, 183–185); also, ECKSTEIN (1980).
\textsuperscript{13}ERDKAMP (1998, 88ff.).
\textsuperscript{14}1 Roman \textit{modius} (8.75 dry–liters) of wheat weighed roughly 7 kilograms; Livy, 36.2.12; 37.2.12; 37.50.9. For figures and discussion, see ERDKAMP (2004) 212. Such “emergency measures” may have become something of standard procedure, with Roman legions constantly on the move during the second and first centuries BCE. Livy (42.31.8) records at least one more emergency–tithe collected during the Third Macedonian War (171–169 BCE). Gaius Verres again collected the maximum surplus–tithe for the three years (73–71 BCE) of his governorship of Sicily.
\textsuperscript{15}See for instance PRITCHARD (1970; 1971) who relies almost exclusively on the testimony of Diodorus and Cicero in his reconstruction of first–century Sicily. For an archaeological approach, see BELL (2007a, 2007b).
The present dissertation recasts this narrative in terms of grain measures and monumental granaries, circulation of bronze coinage and patterns of rural land–use—the material elements of agricultural administration emerging from excavations and intensive landscape survey on the island. Agricultural institutions, which provide a remarkable point of continuity between the Hellenistic and Roman periods, have yet to receive comprehensive treatment despite the growing interest in studies of ancient grain–supply and agriculture. Approaching this continuity through the archaeological record promises to offer fresh perspective on salient issues discussed at length by classical archaeologists and ancient historians, including patterns of rural land–use in antiquity, the existence of market economies in the Hellenistic Mediterranean, and the provincial administration of Roman Sicily, to name only a few.

In order to address these and other issues, my dissertation will focus on three bodies of archaeological material, closely associated with the agricultural administration of the island during the Hellenistic and Roman periods. Careful analysis of these materials will lead to heuristic models that move discussion beyond simple description and classification of artifacts to encompass complex readings of social, economic, and political developments taking place in Sicily at this time.

Chapter One introduces a new and largely unstudied class of artifact into the discussion of agricultural administration, namely ceramic vessels used for measuring dry goods, such as wheat and barley. Grain measures were manufactured in Sicily according to standardized sizes and were occasionally stamped with inscriptions designating their

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16 GARNSEY (1988); GALLANT (1991); Rickman (1980); ERDKAMP (2005); MORENO (2007)
official status. Such measures have been found across the eastern portion of the island in archaeological contexts ranging from the fourth to first centuries BCE. By treating these artifacts as documents of a city’s participation in an administrative system governing agricultural production and taxation, I will use their distribution to arrive at a more accurate estimate of the territory subject to Hieron II, a topic of immediate concern for archaeologists and ancient historians working on Hellenistic and Roman Sicily.

Furthermore, the geographic and chronological distribution of these vessels, once established, will expose continuities (or discontinuities) in agricultural administration between the Hellenistic and Roman period. One point of continuity is immediately apparent and ultimately informative with regard to Roman attitudes towards the adoption of pre-existing administrative infrastructure in their provinces.

In Chapter Two, I consider a pair of monumental granaries at Morgantina in relation to agricultural activity in central Sicily and with regard to the agrarian policies of Hieron and the Romans (Figure 2). Morgantina’s agora is the setting for two large granaries of Hellenistic date, which were likely built to house the city’s agricultural tithe (Figure 3). Careful analysis of the ceramic and numismatic evidence recovered in their excavation will elucidate the chronology of these buildings, making it possible to more precisely establish the moment at which these civic granaries were built and when they ceased to be used for grain storage. It is clear that during the latter half of the second century BC, after the absorption of Sicily into Rome’s empire, the Morgantina granaries ceased to function as grain warehouses and were instead converted into industrial spaces.

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17 The best-known comparanda for the Sicilian measures are from the Athenian Agora, LANG and CROSBY (1964) and the Panhellenic sanctuary at Olympia, HANORT (1981) and SCHILBACH (1999).
19 PRAG (2007) presents a similar case of adoption by the Romans in Sicily with specific regard to the role of gymnasia in the training of auxilia troops during the Republic.
20 PR XII, 324; DEUSSON (1994); SERRATI (2000, 115–33); PRESTIANI–GIALOMBARDO (2004).
used for ceramic production.\textsuperscript{21} The abandonment of the granaries may reflect larger administrative changes taking place in the collection and movement of grain in Sicily during the Roman period and is deserving of further study. Establishing a chronology for this transition should help determine whether similar shifts in tithe–collection centers occurred elsewhere on the island and whether such developments had economic ramifications that can be traced in the material record.

As discrete units of volume, the granaries also provide a unique window into cereal productivity and land–use in the territory of Morgantina during the third century BC. By calculating the volumes of these two granaries, one may determine the amount of grain paid by the citizens of Morgantina as a tithe to Hieron. Comparing the estimated tithe (10\% of the annual harvest) with statistics for early–modern crop yields in Sicily, calculations may be made for the percentage of the city’s territory that was put under intensive cereal cultivation.\textsuperscript{22} These estimates can then be considered in relation to the findings of an intensive field survey carried out in the territory of Morgantina by members of the University of Virginia in the 1990’s.\textsuperscript{23} Preliminary research suggests that during the course of the third century occupation of the countryside around Morgantina shifted from disperse habitation throughout the \textit{chora} to a concentration of settlement at only a handful of sites. It is my working hypothesis that this transformation of rural activity reflects an intensification of agriculture in the territory of Morgantina in response to the agricultural policies of Hieron.

\textsuperscript{21} MS III, 11–16, 42–48.

\textsuperscript{22} BARBAGALLO (1904, 477–504); PRATT and FUNNELL (1997, 194–207); BETHEMONT and PELLETIER (1983, 191–92), suggest that until the last decades of the twentieth century agricultural practice in Sicily was essentially compatible with practice in antiquity.

\textsuperscript{23} THOMPSON (1999).
Finally, in Chapter Three, I will consider the substantial body of numismatic material from the agora at Morgantina dating to the Hieronian and Republican periods with regard to the agricultural administration of the island. I will argue that in the monetized economy of third through first centuries BC, the circulation of bronze coinage at sites on the interior of the island, such as Morgantina, may document transactions of grain for cash. I will test a model that posits the development of a market economy in southeastern Sicily during the reign of Hieron II. This model is predicated on the view that the annual grain tithe mandated by the *Lex Hieronica* created appropriate conditions and stimuli for economic growth fueled by intensive exploitation of agricultural resources. In order to test this hypothesis, I will bring to bear a wide range of materials including bronze coins minted at the coastal city of Catana in the late third and early second centuries, which have turned up in large numbers at inland sites within the territory of Hieron’s kingdom. It is my working assumption that these small bronzes are material traces of a thriving trade in surplus grain that began under Hieron II and continued throughout the first century of Roman rule. Administrative changes made to the collection of the tithe and sale of surplus grain during the Roman period may have effectively removed the possibility of transforming agricultural surplus into commercial profit for the majority of Sicilian farmers.

Taken together, these three material elements promise to offer a rich and contextualized perspective on the developments and responses taken to the agricultural administration of the island between the third and first centuries BCE. The implications for a study of this nature are numerous and far-reaching, with resonance for issues as diverse as the existence of market economies in the Hellenistic Mediterranean and the
development of Rome’s provincial administration. My goal is to create a compelling model of change and development for the Sicilian landscape in the Hellenistic and Roman periods by uniting a diverse body of archaeological, epigraphic, and numismatic evidence with surviving literary accounts. Only by taking into account the material evidence for the agricultural policies of Hieron and the Romans in Sicily can scholarship begin to fully appreciate the immense impact that control of agricultural resources had on the social, economic, and political development of Hieron’s kingdom and the Roman Empire.
CHAPTER II:
CONSOLIDATING THE KINGDOM: STANDARDIZED MEASURES

I. Introduction.
This chapter focuses on vessels used for measuring dry goods, such as wheat and barley, and considers their relationship to the operation of tax administration in Hellenistic and Roman Sicily. A brief review of capacity measures from archaeological sites in Sicily will demonstrate that there was a widespread emergence of standardized measures throughout much of the eastern part of the island during the first half of the third century BCE. This florescence is explained in the context of administrative developments occurring within the kingdom of Hieron II. The discovery of officially endorsed measures further strengthens the identification of these vessels as instruments associated with the administration of the Hieronian tithe. Drawing on documentary sources from the ancient Mediterranean, discussion turns to the role of standardized measures both within the Hellenistic royal economy and within that of Hieronian Sicily.

II. Sicilian Grain Measures: Typology, Chronology, and Archaeology.
Even among archaeologists, ancient vessels used for measuring dry goods are not particularly well–known or easily recognized artifacts.24 While a handful of careful studies have been completed for dry measures from the Greek mainland, most notably those from Athens and Olympia, measures from Sicily have received only sporadic attention. For this very reason, this section outlines several of the common morphological characteristics of these vessels and attempts to divide the known Sicilian specimens into

24 On ancient measurement more broadly conceived, see BAILEY (2011, 20–22).
several distinct types. Discussion of the Sicilian measures continues with an analysis of
the various archaeological contexts from which the vessels were recovered. The purpose
of this analysis is twofold. First, it establishes a chronological framework for the
emergence and use of standard capacity measures in Sicily and, second, it situates these
objects within the ancient contexts in which they were used. This is of vital importance as
the remainder of Chapter II argues that these vessels are indices of economic activity and
tools of political control.

Sicilian dry measures share clear formal similarities with their counterparts from
the Greek mainland. The well–known series of dry measures from Athens offers the best
body of comparanda. More than fifty published examples have come to light from Athens,
of which the vast majority were recovered during excavations in and around the area of
the Classical and Hellenistic agora.25 The Athenian measures range in date from the late–
sixth century BCE to the first century CE. A well–preserved and typical specimen from
Athens is the so–called North Slope Measure (Figure 4), named after its find–spot on the
north slope of the Acropolis.26 This vessel, which dates to the fifth century BCE, exhibits
many of the standard characteristics associated with measures of that period, including its
simple cylindrical form and horizontal grooves incised around the top and bottom.
Measures produced in the fourth century, such as Lang and Crosby’s DM 45 (Figure 5)
retained many of the same visual characteristics of their predecessors. Still, deviations
occurred. For instance, the number of incised grooves have diminished on DM 45,
compared to the North Slope Measure. In their place, the grooves have been replaced by
raised collars around the top and bottom of the vessel. The cylindrical form persisted, but

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25 The Athenian measures have been the subject of detailed study by LANG and CROSBY (1964, 39–55).
26 BRONEER (1938, 222–24).
in the fourth century portions of the ring foot are cut away to produce three, low, tripod– like feet. Athenian measures maintain this form for much of the fourth century and appear to influence the measures found elsewhere in the Greek world at this time, such as at Corinth (Figure 6) and at Thorikos (Figure 7). While the majority of Athenian measures are terracotta, a handful of specimens in bronze and stone have also been discovered. Based on similarities in form and decoration, Lang and Crosby posited that the bronze vessels may have served as models for contemporary terracotta measures.

Dry measures have also been recovered at several other sites in Greece, including Corinth, Thorikos, and the panhellenic sanctuary at Olympia. In almost every instance, scholars have associated the measures with a civic interest in regulating commercial transactions.

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27 An early–fourth century measure from Thasos takes this form, but retains the ridges around the top and bottom. The estimated capacity of the vessel is 0.245L, which is identified as a kotyle by GHALI–KAHIL (1960, 135, no. 35, 793π). A square stamp bearing the image of either a kantharos or volute krater is visible on the body of the vessel. Both the kantharos and volute krater appear prominently on the silver coinage struck by the Thasians between c. 410–350 BCE; cf. SNG.Cop 1029–31. Similar stamps have been found on ‘official’ Athenian measures, though with the iconography of their own civic coinage, namely the owl and bust of Athena. This would suggest the Thasian vessel was, in fact, a civic measure. Two terracotta measures of this form, also of the fourth century BCE, have been discovered at Corinth; Inv. CP–445 and Inv. C–71–335; cf. WILLIAMS and FISHER (1972, 156, no. 21).

28 Bronze measures: Agora Inv. B1082 (Agora X 52, DM 42); Agora Inv. B2094, CAMP (2007, 654); see also, SEG 24:157, an inscription from 222/1 BCE, which records the transfer of bronze measures from an out–going group of metronomoi to the year’s in–coming group. KNIGGE (2005, 130, nos. 152–153, pl. 64) publishes two late–fifth–century bronze measures from the Kerameikos. Stone measure: Cylinder of white marble found in the Roman Agora; 1st CE; Inscribed: Μεδιµνος ονθρακο[ν] δηµοσιος [public measure for charcoal]; KOUMANDOUDES (1970, A.58, no. 5); cf. SEG 36: 1986.233. For the sale of charcoal, see also, Syll. 974.

29 LANG and CROSBY (1964, 40).

30 For Corinth, sopra n. 27. VANHOVE (2006, 70–1, no. 127; inv. TC 63.588) publishes a terracotta measure from Thorikos with painted inscription, [δ]εµι[οσιον]. The vessel was found in excavations by the Belgian School of Archaeology in the area of the theater. Vanhove speculates that a nearby building, the so–called House No. 2, may be identified as the prytaneion for the deme of Thorikos. Fragments of several dozen measures from Olympia are published by HANDORT (1981) and SCHILBACH (1999).
IIa. Defining a Sicilian Typology.

To date, my research has lead to the identification more than one hundred dry measures, or fragments thereof, from seven sites across eastern Sicily.\(^{31}\) Among this number, at least four distinct types, which can be distinguished from one another by size and form, have emerged.

*Type I.* These are small cylindrical vessels with flat bottoms. They are decorated with incised grooves that often extend over the entirety of the vessels’ exterior. Diameters tend to range between 10.0 and 16.0 centimeters, though exceptions exist. Two different sizes of Type–I measures have been identified with certainty—one with a volume of ca. 0.97L and a second, which held roughly twice as much, with a volume of ca. 1.84L (Figure 8).

Type–I measures have been found in great numbers at both Morgantina and Kamarina. Given their limited capacity, these vessels were likely used for measuring small quantities of grain or other dry goods, possibly for routine commercial transactions. This may be partially confirmed by the concentration of Type–I measures recovered from commercial contexts in the *agorai* of Morgantina and Kamarina.

The volume 0.97L corresponds closely to a well–attested measurement of dry goods from mainland Greece, known as a *choinix* (χοῖνιξ), which in Attica seems to have an ideal volume of approximately 1.07L to 1.1L.\(^ {32}\) Ancient sources frequently cite rations

\(^{31}\) The vast majority remains unpublished and can be found within the storerooms of the Morgantina and Kamarina excavations.

\(^{32}\) HULTSCH (1882, 514) calculated that the Attic choinix had a capacity of 1.094L; LANG and CROSBY (1964, 45–47) estimate the ideal capacity to be 1.087L, but found that estimated capacities of the physical *choinix*–measures from the Athenian Agora to have range from 0.99L to 1.16L. Based on literary and epigraphic evidence, the capacity of the choinix seems to have varied from region to region. For instance, the Aeginetan choinix is believed to have had a ideal capacity of approximately 1.515L and the Spartan or Doric choinix a theoretical capacity of 0.906L ; OXÉ (1941).
of one *choinix* of grain per day.\(^\text{33}\) Terracotta *choinix*–measures have been found both at Athens and Olympia. The term *choinix* does not appear in epigraphic sources from Sicily, though the so–called Heraklea Tablets of the early third century BCE do refer to amounts measured in *choinikes*.\(^\text{34}\) Another clue as to the identity of the Type–1 measures with capacities of approximately 1L is the so–called Borchardt Measure (Figure 9), a bronze measure of the early sixth century CE, which bears an inscription that refers to the vessel as a *xestion* (ζέστιον). Though separated by nearly one thousand years from the majority of Sicilian measures considered in this study, the Borchardt Measure shares the same characteristic banding as Type–1 measures from the Hellenistic period. Moreover, it shares the almost exact dimensions and volume (0.96L) as a well–preserved measure from Morgantina (M–6), which itself dates no later than 250 BCE.\(^\text{35}\)

*Type 2.* These measures are characterized by their shape, which resembles a truncated cone. They have straight, inward sloping walls and flat bases, which are in some instances raised on an inner ring. Type–2 measures tend to have little or none of the incised banding that is characteristic of the other three types. Four of the six known specimens have a single vertical strap–handle, which would have facilitated handling. Two of these four vessels each have a volume of approximately 2.75L. The other two are noticeably smaller, but not so well preserved as to allow for estimates of their capacity.

\(^{33}\) FOXHALL and FORBES (1982).
\(^{34}\) IG XIV 645, ll.36, 63, 87; cf. SEG 50:1040 and SEG 53:1076. The Heraklea Tablets are a pair of bronze inscriptions discovered in the 1730s near the site of ancient Heraklea in Southern Italy. One tablet preserves a first–century transcription of the municipal laws of Heraklea, which became a Roman municipium in 89 BCE. The reverse of the tablet preserves an inscription of the late fourth or early third century BCE that records boundaries of lands owned by local sanctuaries and the rents owed by lessors of the sacred land. For the third–century inscription, which records measurements in *choinices*, see UGUZZONI and GHINATTI (1968).
\(^{35}\) BORCHARDT (1923/24, 153–55); VIEDEBANTT (1923/24, 155–64); SEG 7:64; OAKESCHOTT (1963, 154–56); see also, MANGANARO (2001, 149–56), who argues that the measure originated in Sicily.
One Type–2 vessel (Cat. M–2; inv. 62–1447; Figure 10) was found together with a Type–4 measure (Cat. M–1) in the South Demeter Sanctuary at Morgantina. With a volume of 2.75L, the Type–2 vessel has a capacity of one–twelfth that of the Type–4 measure, described below. The use of a measure known as a hemiekton (ἡ ἑκτον) is attested in Sicily during the mid–third century BCE. The hemiekton is generally believed to have had a volume equal to one–twelfth of a medimnos, a very common measure that appears to have had a different capacity in different places. For the moment, we need not be concerned with the ancient name of the Type-2 measure, only that it carried one–twelfth of a Type–4 vessel with a capacity of roughly 32L.

Type 3. These are large cylindrical vessels with straight vertical walls. They stand on three small feet (Figure 11). Type–3 measures are generally decorated with the characteristic exterior banding, but never for the entire elevation of the body, as may occur on a Type–1 vessel. Grooves are regularly confined to the upper portion of the body, extending down from the vessel's lip. The number of grooves generally ranges from six to eleven and appears to have no immediate correlation with the capacity of the vessel. Like Type–2 measures, Type–3 vessels appear to have at least one vertical strap–handle, which may have facilitated emptying the vessel when it was filled with grain.

The dimensions vary according to capacity. Type–3 vessels were made in at least three

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36 See, for instance, Entella Tablet A1 (=Nenci’s no. 5) lines 19–23, cf. AMPOLO (2001, 93–96); and the so–called Financial Inscriptions from Tauromenion (IG XIV 423–430), ARANJO–RUEZ and OLIVIERI (1965), no. I, lines 25–34 and no. III, lines 21–28. Manganaro has also interpreted the inscription on a later Byzantine measure from S. Agata Li Battiati, as indicating its capacity as a hemiekton. But, with dimensions of H. 10.4cm and Diam. 7.5, the volume is only 0.46L, making it much too small to have served as a hemiekton.

37 For instance, the so–called Sicilian medimnos (Σικελικὸς μέδιμνος) is believed to have had a volume of ca. 52.25 liters; CORRETTI (2001), VIEDEBANTT (1931, 89–90). Polybius refers on separate occasions to a Sicilian medimnos (2.15.1, 9.11a.3–4) and to an Attic medimnos (6.39.13), giving the impression that the two were somehow distinct. According to HULTSCH (1882, 104–7), the Attic medimnos held roughly 52.53 liters.

38 At 0.78 kg/L, a 32–liter terracotta measure filled with wheat would weigh in excess of 25kg.
sízes with volumes corresponding to approximately 16L, 24L, and 32L. Type–3 measures have been discovered at Morgantina, Kamarina, Akrai, Apollonia, and possibly at Megara Hyblaia.

*Type 4*. These measures are distinguished from Type–3 by their lack of handles and thicker walls, but are otherwise very similar in form, decoration, and size. Type–4 measures with volumes of approximately 24L (Cat. M–3; inv. 62–1268) and 32L (Cat. M–1; inv. 62–1448; Figure 12) have been discovered at Morgantina.

These typologies are intended only to highlight the great degree of standardization exhibited by the measures under study, not to create a rigid framework within which all measures should fit. Furthermore, it cannot be claimed that all known Sicilian measures, or those yet to be discovered, can and do fit neatly into these four categories. Still, the overwhelming number of measures thus far identified appear to belong to one of these four types. With the exception of Type–2 measures, horizontal banding is perhaps the principal visual characteristic of the Sicilian grain measure. The grooves appear to have no direct correlation to a vessel's capacity (i.e. 12 grooves ≠ 12 units, etc.). Rather, the banding seems to be a visual signifier of the vessel's function as a measuring device.39

**IIb. Measures in the archaeological record.**

The following section contains a site–by–site synopsis of Sicilian dry measures that have been recovered from secure archaeological contexts at sites located in the eastern half of the island. The purpose for such a synopsis is two–fold. First, by considering these objects within the contexts in which they were discovered, and presumably used, a clearer picture will emerge of the various ways capacity measures

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39 This seems equally true for Athenian grain measures, which are also regularly decorated with grooves—either painted or incised.
functioned within their social context. Second, a careful examination of the measures by stratigraphic context will allow us to establish a set of chronological parameters for their development and use in eastern Sicily. This section is intended as an overview of the distribution and function of dry measures within Hellenistic Sicily. A detailed catalog of each measure, or fragment thereof, is provided in Appendix I.

To date, dry measures, both published and unpublished, have been identified in the excavations associated with seven different ancient cities on the island (Morgantina, Kamarina, Akrai, Naxos, Leontinoi, Megara Hyblaia, and Apollonia). It is noteworthy that these cities are concentrated in the eastern half of the island, extending no farther west than Morgantina. For the time being, given the relatively unappreciated status of dry measures in current scholarship, it is difficult to say whether this pattern accurately reflects ancient geographic distribution or is the result of measures recovered in excavations from other sites going unrecognized or being misidentified.


dd.1. Morgantina.
The American excavations at Morgantina have produced the largest number of capacity measures from Sicily, the vast majority of which were recovered from sealed archaeological contexts and can thus be dated with some precision.\(^4^0\) Of the roughly seventy-five measures that have been thus far been identified, the majority can be securely dated to the third century BCE. There is a notable absence of identifiable capacity measures from secure fifth and fourth century contexts at the site. These third-century contexts may themselves be further refined by an association with two important events in the history of the city. The first event was the monumental building program

\(^4^0\) With the exception of the vessels published by WALTHALL (2011a), the majority of Morgantina’s measures remain unpublished.
which radically transformed the city's agora throughout the second quarter of the third century (ca. 275–250 BCE). The second event was the violent capture of the city by the Roman Praetor Marcus Cornelius in 211 BCE. \(^{41}\) Archaeologists have identified sealed stratigraphic contexts produced by both events and, within those contexts, evidence for the use of standardized dry measures of the four types outlined above.

The earliest archaeological contexts at Morgantina from which grain measures have been recovered are those associated with the destruction of the northern wing of the Central Market, a suite of six rooms located in the city’s lower agora (Figure 13). This suite of rooms was intentionally razed around the middle of the third century in order to accommodate the construction of the Great Steps. \(^{42}\) Fragments of at least fifteen distinct measures were recovered from within a layer of intentional fill (approximately 0.30–0.35 m. in depth) that was deposited over the agora floor in order to raise the ground level above the foundations of the shops. Most of the objects contained within the fill, including the grain measures, were presumably associated with the commercial activity that took place in the area. This fill layer, and the associated ceramic material, necessarily predates the construction of the Great Steps, the initial phases of which have been dated to 260–250 BCE. The numismatic material contained within the stratigraphic layers associated with intentional destruction of the shops and leveling–fill is also consistent with a date in the first half of the third century. Fragments of several more measures were recovered from within the shop rooms themselves, including a well–preserved Type–1 measure (Appendix I: M–7; Figure 14) with an estimated capacity of ca. 1.87L. Evidence for the use of standardized dry measures in commercial contexts is found elsewhere in the

\(^{41}\) Livy, 26.21.17.

agora at Morgantina, including within a shop room (room 5) belonging to a commercial complex that succeeded the shops razed for the construction of the Central Steps. Excavations conducted in 1992 within a small room attached to the so-called Central Market turned up fragments of at least two dry measures, one readily identifiable as a Type–1 vessel (Appendix I: M–69) and the other a Type–3 or Type–4 measure (Appendix I: M–70). The measure fragments were recovered from a context associated with the earliest period of use for the shop room, which has recently been dated to the first half of the third century BCE on the basis of the numismatic evidence. Together, the fragments from room 5 and those recovered from the northern wing of the Central Shops offer definitive evidence that standard measures of Types 1, 3, and 4 were already in use by 250 BCE.

The second principal event that assists in dating the measures from Morgantina is the capture of the city by the Romans in 211 BCE, which is mentioned by Livy (26.21.14–17). Traces of this event have been identified in the archaeological record by a number of abandonment and destruction contexts discovered throughout the city. These late–third century contexts mark an important terminus ante quem for the manufacture and use of many measures recovered from the site. Among the buildings to suffer during the Roman capture in 211 BCE were the North and South Demeter Sanctuaries (Figure 2). In the South Demeter Sanctuary, excavators discovered dozens of ceramic vessels smashed on the floor of the sanctuary's storeroom (room 7), among which were two well-preserved measures of Types 2 and 4 (Appendix I: M–1 and M–2). The two measures

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43 The numismatic material recovered in the excavation of these shops will be presented in WALTHALL (forthcoming).
44 PR VII, 169–70; Referring to a portion of the South Sanctuary, then known as the Priest’s House, Stillwell writes, “The accumulation of evidence regarding the destruction of the Demeter sanctuaries in
share a volumetric relationship of 1 to 12 (ca. 2.75L : 32.06L) suggesting that they were used in conjunction with one another. A similar picture of abandonment and destruction has emerged for the North Demeter Sanctuary. There, a nearly complete Type–2 grain measure (Appendix I: M–12) was discovered beneath the layer of collapsed roof–tiles of the building, as well as several large fragments of a Type–3 measure (Appendix I: M–14) from the adjacent North Sanctuary Annex. A third sanctuary to produce grain measures is a naïskos dedicated to an unknown deity, that is today located in an area of the archaeological site known as Contrada San Francesco Bisconti (Figure 2). Here, Type–1 and Type–4 measures (Appendix I: M–39 and M–11) were discovered below the collapsed roof of the Hellenistic building.

Several buildings in the city’s agora also appear to have suffered in the violence of 211 BCE. Among these is the West Stoa, which was still under construction when the Romans captured Morgantina. A well–preserved Type–3 measure was sealed by the tile fall in room 5, which presumably possessed a commercial function.

Residential quarters flanking the agora were also victims of the violence. Several measures, including a well–preserved Type–4 vessel (Appendix I: M–3; Inv. 62–1268; Figure 15) and the stamped foot of a Type–3 measure (Appendix I: M–4; Inv. 58–916; Figure 16), inscribed ἀκριβάζοντος Ἀρτεμιδόρου. This important artifact was recovered in the vicinity of a large peristyle house of the Hellenistic period, located west of the city’s agora in a residential quarter that flourished during the greater part of the third

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Morgantina in the sack of 211 BCE has grown so impressive that there can be little doubt that the destruction of this house–as well as that of the sanctuary which it served–must have occurred in 211 BCE, and no later.”

45 Construction on the building likely began in the third quarter of the third century. Only about one–third of the building had been completed before construction came to a halt. See, PR V, 278; BELL (1993, 333); STONE (MS VI, Deposit IA), dates the ceramic material recovered within the construction fill.

46 M–3: Found inside a room of a House built in the 3rd century within a debris layer that may be associated with a period immediately following the destruction of the house by fire (strata 3 and 4).
century BCE. Both the house and its neighborhood suffered heavy damage during the siege and eventual capture of the city by the Romans, which constitutes the likely *terminus ante quem* for the vessel’s manufacture and use. Excavations in the 1950’s exposed the remnants of another residential quarter to the northeast of the agora in an area known as Contrada Drago (Figure 2). Built sometime in the second quarter of the third century, this area also bore traces of abandonment and destruction in the late third century. Within a debris layer associated with the abandonment of the complex, excavators recovered a Type–3 measure (Appendix I: M–11; Figure 17) inside a room that may have functioned as a space for storing foodstuffs.

Cisterns and wells filled with debris following the violence of 211 BCE have also produced evidence for grain measures that date prior to the last decade of the third century. Many of these wells contained grain measure fragments, helping to establish again a *terminus ante quem* of 211 BCE for their manufacture and use. A fragment of a Type–1 measure (Appendix I: M–41) was recovered from within a well in the North Bath Complex (Figure 2). Analysis of the ceramic and numismatic material contained within the well has led scholars to conclude that the material was dumped herein shortly after 211 BCE, possibly from a nearby house or sanctuary space where dining took place. A well–preserved Type–3 measure (Appendix I: M–13; Figure 18) was recovered deep within a cistern of a house of the Hellenistic period, known as the House of the Double Cistern. While the cistern was filled with ceramics ranging in date from the fourth to first centuries CE, the measure was found close to the bottom, amidst third century material.

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47 For the excavation of the House of the Official, see *PR* III, 169–71 and *PR* VII, 166–68).
48 The associated archaeological evidence is summarized by BUTTREY (1965, 261–67) and (1979); for specific reference to damage suffered by the House of the Official, see *PR* VII, 167–68).
49 These deposits are treated in great detail by Stone in *MS* VI.
50 See *MS* VI, Deposit IR.1.
The measure could have been discarded and thrown into the cistern of the house during a period of cleaning following the capture of the city in 211 BCE. Once the cistern was effectively out of service, it could serve as a dump, resulting in the successive layers of ceramic material.

Measures have also been recovered from other contexts throughout the city, which may be dated with some confidence to the third century. This includes two measure fragments recovered during excavations of the East Granary. Excavators found a wall fragment of a Type–2 measure (Appendix I: M–44; inside of Room A) and a body sherd of a Type–3 measure (Appendix I: M–42; immediately to the east of Room B), both in strata associated with the pre–211 BCE occupation of the building. Two rim fragments of a Type–1 vessel (Appendix I: M–18; Figure 19) were discovered in a trench dug between the retaining wall of the ramp leading to the West Granary and a temenos wall built as part of a second–century sanctuary. The fragments were found in a stratum containing only third–century material, making them contemporary with the period of use for the West Granary and the adjacent South Shops.\(^5\) Farther to the south, in the area of a Hellenistic necropolis that lies just beyond the city walls, two rim fragments of Type–1 vessels (Appendix I: M–5 and M–19) were recovered from contexts associated with the period when the necropolis was still in use. The necropolis was most heavily in use from about 325 BCE until the middle of the third century. Accumulation of soil and debris

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\(^5\) Trench 9A was dug between the retaining wall of the ramp leading to the West Granary and the temenos wall to the east. The measure fragments in question (M–18) were found in Stratum 4. The preceding Stratum 3 was a grey, ashy soil that extended to the bottom of the temenos wall, which was itself founded upon a yellow–brown soil (stratum 4). The inner retaining wall of the granary's ramp was founded on a layer of sterile sand and rock. Stratum 3 thus appears to have been an intentional fill, added when the temenos wall was constructed. It provides a *terminus* for the construction of the temenos wall and, logically, for the abandonment of the granary, since the construction of the wall effectively blocked access to the granary from the north and west.
over the tombs in the late third and second century indicates that this area was not in use after 211 BCE, and thus the measures must have been deposited here at some point prior.

The number of measures from archaeological contexts that can be securely dated to the first and second centuries is relatively small and in most circumstances it is almost impossible to determine whether the measure are themselves products of the period or are third–century vessels that wound up mixed with later material.

Many of the measures bear traces of a light–yellow slip that had been applied to the exterior surface before firing. This slip added to the uniformity of their overall appearance, obscuring differences in the color of the clays used. Visual comparison with the fabric of ceramics known to have been produced at Morgantina suggests that several of the vessels were not local products.\(^{52}\) The clay of these supposed non-local vessels (i.e. M–4) is medium red in color (MSC 2.5YR 6/6) with a matrix of small, dark inclusions, some measuring more than 1 mm across.

\textit{IIb.2. Kamarina.}

The coastal city of Kamarina has produced the second largest number of grain measures, the majority of which were found during excavations in the city’s agora. Away from the agora to the northeast, excavators have discovered a fourth–century measure (Appendix I: K–1) at a kiln site.\(^{53}\) The complete cylindrical vessel has a prominently molded lip and base as well as a pair of horizontal striations around the middle of the body. Its publisher associates the capacity with the well–attested Attic \textit{trihemikotylon} (c.

\(^{52}\) The clay found around Morgantina is fine–grained and generally fires pale reddish brown (5YR 6/3–4) to lighter yellowish brown (5YR 7/4); see Stone 2013. I owe my sincerest thanks to Prof. Stone for sharing with me both the manuscript of his forthcoming publication and his extensive knowledge of Sicilian ceramics. Further discussion of clays found in the region around Morgantina can be found in \textit{MS} III, 126–80 and MORGENSTEIN and MORGENSTEIN (2013).

\(^{53}\) PISANI (2008, 126, no. 299 fig. 24; Inv. 2854. H. 8.2cm, D. 9.3 cm, est. vol. 0.41L). This vessel is currently on display in the Museo Archeologico Ibleo, Ragusa.
0.41L) and suggests that the incised lines marked corresponding fractions of the measure. Significantly, the vessel is of local, Sicilian manufacture.

Fragments of well over two–dozen measures were recovered during excavations in and around a long rectangular building, known as the West Stoa (Figure 20).\textsuperscript{54} While much of the ceramic and numismatic evidence from these excavations has been published, the measures have gone unpublished.\textsuperscript{55} The available archaeological evidence suggests that this building may have functioned primarily as a commercial space and warehouse throughout much of the third century. The destruction inflicted on the city during the Roman siege of 258 BCE, as reported by Diodorus Siculus (23.9.4), does not appear to have affected this building, such that the measures found in contexts associated with periods of its use and abandonment can be dated no more precisely, for the moment, than to the third century in general.\textsuperscript{56} Nevertheless, this is wholly consonant with the material from Morgantina, particularly by terms of vessel typology and size. Evidence of direct correspondence between the measures found at the two sites takes the form of a large body fragment of a Type–3 vessel (Appendix I: K–2; Figure 21), recovered in 1985 by excavators working at the corner of the North and West Stoa. The preserved foot of this vessel bears an identical inscription (\text{"\text{ἀκριβάζοντος Αρτεμιδώρου} \text{"}) as that of the stamped measure from Morgantina (M–4). The content of the stamp and its importance for

\textsuperscript{54} PELAGATTI (1984–85, 687, n.20) notes that the name “West Stoa” was given to the building on account of its long rectangular shape and perpendicular arrangement with the North Stoa, which together helped to frame the civic space. She goes on to say that further excavations were necessary to determine whether the building did, in fact, have a colonnaded façade or whether it was rather a large storeroom. This second hypothesis is strengthened by the discovery of nearly 800 empty MGS amphorae stacked together in the southwest corner of the building. A wide (ca. 2m) threshold in the western wall of the building would have allowed for large or bulky objects to be carried in and out with ease. PELAGATTI (ibid, 693) notes further that the open area to the west of the building may have functioned as a center of commercial activity, while that to the east a space for civic and religious activity.

\textsuperscript{55} For the excavations, see PELAGATTI (1984–85, 684–93).

\textsuperscript{56} For the siege of Kamarina, see also Polybius 1.24.12; and for a modern review, MATTIOLI (2002, 80–2, 118).
understanding the role of these measures in third-century Sicily will be discussed in some detail below.

Fragments of Type–1 measures comprise the majority of the Kamarina corpus (Appendix I: K–3; Figure 22). Among the larger, Type–3 vessels are several specimens for which sufficient fragments survive to allow for estimates of the dimensions and volume. In addition to the vessel K–2, a second Type–3 measure (Appendix I: K–22; Figure 23) bears a partially-preserved inscription, which appears to have been painted on the body of the vessel before firing and reads ZOD[ ]. Lexicographic and prosopographic searches have yet to yield a truly compelling explanation for the letters that appear on the measure.57 Nevertheless, as will be discussed below, inscribed measures served a valuable function in antiquity.

The concentration of measures in and around the agora at Kamarina, the city’s commercial and political center is not altogether unexpected. Located on a low promontory that faced the sea and easily accessible from the coast, the city’s agora was ideally situated to fulfill its function as marketplace. The discovery of nearly one thousand amphorae of Sicilian and South Italian manufacture in the so-called West Stoa does much to confirm this identification as a bustling marketplace, as does the discovery of several hundred small bronze coins from the third and second centuries BCE.58 Within this setting, the dry measures may have functioned as tools in facilitating private commercial transactions as well as tools for collecting taxes or public revenues.

57 The name Ζώδωρος is attested in Sicily on a Christian era epitaph from Syracuse; see IG XIV 117.
58 The numismatic material recovered during excavations in the agora at Kamarina has been published by LUCCHELLI and DI STEFANO (2004).
Ilb.3. Akrai.
Excavations were conducted in the 1960’s at a Hellenistic farmhouse at Contrada Aguglia in the territory of ancient Akrai (Palazzolo Acreide). Among the materials recovered from a cistern located within the farmhouse were fragments of several Type–3 terracotta grain measures. These were dated by their excavator to the middle of the third century BCE, when Akrai and its territory belonged to the kingdom of Hieron II. Among the measure fragments were two with stamped ἀκριβάζοντος inscriptions (Appendix I: AK–4 and AK–5). Remarkably, one of the inscriptions (Appendix I: AK–4; Inv. 55757E; Figure 24) was made using the same stamp that was also used for the stamped ἀκριβάζοντος measures found at both Morgantina and Kamarina. Although only the latter half of the inscription is preserved, enough survives to make a confident attribution. The fragment (11.7 cm high and 15 cm wide) belongs to a vessel with a diameter of approximately 38 cm, making it comparable in size to the 32–liter measures from Morgantina.

The second ἀκριβάζοντος inscription (Appendix I: AK–5; Inv. 55757C; Figure 25) was made with a distinctly different stamp. Within the stamped area, the word itself is contained within a thin line that crosses to form a small, circular loop at the left–hand of the inscription. The form of this frame is reminiscent of a tabula ansata, giving the impression of a tag that has been affixed to the vessel. An enigmatic feature of the inscription occurs immediately below the second Alpha of ἀκριβάζοντος. Here the

60 PELAGATTI (1970, 490–99). Diodorus (23.4.1) specifically names Akrai as one of the poleis subject to Hieron. The construction of a monumental stone theater and gymnasium during the mid–third century has also been taken as evidence for Akrai’s affiliation with Hieron II; BERNABÒ BREA (1956, 31–44).
61 Museo Archeologico “Paolo Orsi,” Syracuse, Inv. 55757C and 55757E. Though the stamped inscriptions from Aguglia were without known parallels in Sicily at the time of publication, Pelagatti perceptively remarked on their relationship to the dry measures, noting that similar (but uninscribed) measures had recently been excavated at Morgantina (492, n. 2, referring to the vessel 62–1448 from Morgantina).
'threads' of the loop overlap and appear to be joined to a third, horizontal bar by a short vertical line, resulting in something resembling a Greek letter Ξ. The meaning of this symbol, if any, is unclear. One possibility would be that this was an attempt to symbolize a seal that held together the two ends of the thread which surrounds the word ἀκριβάζοντος, thereby mimicking the act of affixing the stamp to the body of the vessel. In addition to the two stamped measures, fragments of at least two additional Type–3 measures were discovered at the Aguglia farmhouse (Figure 26). The measures from the Aguglia farmhouse are important both in terms of further establishing the chronology of the Type–3 measures, as well as adding new evidence of these vessels’ distribution, both in terms of geography and of context. Unlike the known measures from Kamarina and Morgantina, which were recovered within their respective urban centers, these were found at a rural farmstead, situated some 11 kilometers away from the political center of Akrai.

IIb.4. Leontinoi.
At the site of Caracausi, located in the territory of ancient Leontinoi, fragments of at least two separate measures (Appendix I: L–1 and L–2) were found within a well–deposit. The deposit was dated by its excavators to the fourth century. Both vessels have cylindrical bodies and horizontal striations from top to bottom, resembling Type–1 measures. The excavators estimated that the better preserved of the two vessels (Appendix I: L–1) had an approximate volume of 0.65 liters.

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62 GRASSO et. al. (1989 nos. 647–648; pl. 16). According to MUSUMECI (1989, n. 40), many more measure fragments were found in the well deposit, but were not cataloged due to their fragmentary state.
IIb.5. Naxos.
Fragments of a single measure (Appendix I: N–1) have been identified at the coastal site of Naxos.\(^6^3\) This vessel, unique among Sicilian examples for being a black–gloss fine–ware vessel, has the same characteristic banding around most of the body below a well–defined collar just below its rim. It was found during excavations in a suburban area, located to the west of the city, across the Santa Venera river. The measure was recovered from within a votive deposit containing ceramics dating to the late–fifth and early–fourth century BCE. M.C. Lentini has identified this vessel as an Attic import, citing its stylistic affinity to contemporary Athenian measures.\(^6^4\) With a preserved height of 13.5cm and diameter (base) of 16.5cm, a reasonable estimate of this vessel’s capacity would be on the order of 3 liters, close to the 3–choinix measure that is well–attested in Athens from the fifth to first centuries BCE.

IIb.6. Apollonia.
Fragments of a large Type–3 measure (Appendix I: AP–1) were recovered in recent excavations at Monte di San Fratello (identified as ancient Apollonia), on the north coast of Sicily (Figure 27). The vessel has a well–preserved handle and sections of incised banding both around the middle and upper portions of its body. The measure shows clear traces, in the form of iron clamps, of having been repaired in antiquity. The vessel had an approximate capacity of 24L.\(^6^5\) The context from which the measure was recovered is important, as it was found in what the excavators identified as a mixed residential and commercial space, within a storeroom containing material that dated from

\(^{6^3}\) LENTINI (2001, 223–42, fig. 18; inv. 2572).
\(^{6^4}\) LENTINI (2001) cites Land and Crosby’s (1964) measures DM 29–36 as comparanda for the Naxos measure.
\(^{6^5}\) BONANNO and PERROTTA (2008, 39–54) give the exterior dimensions as diam. 34cm and height 30cm. With internal diameter of 32cm and height of 28.5cm, the volume may be calculated as 23.64L.
the third to first century BCE. While the latest numismatic material recovered from the room which contained the measure dates to the second half of the third century BCE, the latest ceramic material included sigillata and other late-republican wares.

*Ilii.7. Megara Hyblaia.*
Fragments of two measures, one large and one small, were reportedly discovered within a well inside the city. The well’s fill, including the measures, has been dated by Henri Treziny to the third century BCE.

**IIc. Synthesis – A Unified System.**
The preceding catalog leaves no doubt that during the third century BCE there was a florescence of ceramic dry measures across southeastern Sicily. The archaeological evidence leads us to conclude that measures of four standard types became widely available during the second quarter of the third century. Characterized by their cylindrical form and grooves incised around the exterior of the body, these vessels exhibit a high degree of uniformity in both form and decoration. Though the great majority of cataloged measures are represented by no more than a single fragment, sufficient numbers survive for which it is possible to make accurate estimates of size and capacity.

A typology was established above, but there remains the question of whether a volumetric relationship existed between the majority of the measures. From the extant evidence, it appears that in large part these measures belong to a coherent system of volumetric measurement that developed in the third century. From the outset, it is important to acknowledge that all the ancient measures exhibit some degree of variation

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66 Found along with the measure were four hopper-rubber lava millstones, one lava mortar, numerous jumbled bricks and limestone tesserae. BONANNO (2008) thinks these were placed here temporarily during a major renovation of the complex.
67 personal communication.
in size and capacity from the theoretical “standard.” This is to be expected given the
techniques of manufacturing terracotta vessels during the third century BCE. The
terracotta measures from Sicily show no sign that they were formed using a mould.
Rather, the interiors of many vessels display clear traces of having been thrown and
worked on a potter’s–wheel. Deviations in capacity of up to ten percent from the norm or
theoretical standard were considered acceptable by Mabel Lang and Dorothy Crosby,
when they were categorizing dry measures from the Athenian Agora according to ancient
volumetric standards.\footnote{LANG and CROSBY (1964, 48).}

By far the most common measures found in Sicily during the third century are
Type–1 vessels with a capacity of approximately 1 liter. The best preserved specimen
known to me is that recovered from the leveling fill above the north wing of the Central
Shops at Morgantina (Appendix I: M–6; Inv. 84–193), which dates to the second quarter
of the third century.\footnote{For discussion of the chronology of the North Wing of the Central Shops at Morgantina, see PR XII,
327–31; BELL (1993, 289–93).} These 1–liter measures are the smallest units known to me. On the
other end of the spectrum, the largest ceramic vessels hold approximately 32 liters.
Several examples of these large, 32–liter measures have been identified at each of the
principal archaeological sites under consideration–Morgantina, Kamarina, and Aguglia.
The multiplicity of these large measuring vessels suggests that 32 liters represented
another ancient unit of measure. In between the largest and smallest units are measures
with capacities that fall around 16 and 24 liters. These are consistently Type–3 and Type–
4 measures. To date only a handful of Type–2 measures have been identified, but these
too in several instances appear to have volumes that belong to the same volumetric
system. By far the most important is that which (Appendix I: M–2) was found alongside a
32–liter vessel (Appendix I: M–1) in the South Sanctuary at Morgantina. This pair stands out for having been recovered together in an archaeological context of primary use, implying a functional relationship between the two. In fact, the smaller measure holds about 2.75 liters or approximately one–twelfth of the capacity of the larger, 32–liter vessel.

Based on the surviving archaeological evidence, when the 32–liter measure is treated as a full–unit, many of the smaller measures fall into fractional categories (Figure 28), including three–fourths (24 liters), one–half (16 liters), one–twelfth (2.7 liters), one–sixteenth (2 liters) and one–thirty–second (1 liter). While it is certainly possible that a unit larger than 32 liters was employed in Sicily during the third century, there is no surviving material evidence of its existence. It seems reasonable to conclude that 32 liters was considered the largest amount that a ceramic measure could hold and still be functional. For larger units, standardized sacks may have been employed.

In an attempt to further elucidate the relationship between these measures, it is worthwhile to consider whether correspondence may be drawn to known ancient measures. For instance, the 1–liter measure may be identified as a choinix (χοίνιξ), a well–known unit of measure throughout the Greek world. Herodotus (7.187) mentions the choinix in regard to the daily grain–ration for a Persian soldier during Xerxes’ invasion of Greece in 480 BCE. As a point of comparison, Lang and Crosby identify over thirty choinix measures recovered from excavations in the Athenian Agora and arrive at a

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70 Appendix I: M–1, inv. 62–1447; M–3, inv. 62–1448.
71 Notably, similar fractional relationships have been observed for dry measures used in Ptolemaic Egypt; FOWLER (1983); SHELTON (1977).
72 On the use of sacks of standardized volume for the conveyance of grain in Egypt, see MAYERSON (1998, 189–94).
73 Regional variations existed for the choinix, which ranged in mainland Greece from 1.01L (Attica) to 1.1L (Aegina) and 1.52L (Boeotia, Laconia); MLASOWSKY (2012). In Ptolemaic Egypt the choinix measured approximately 0.82L.
theoretical capacity of roughly 1.01 liters for the Attic choinix. Though we have no extant references to the choinix as a unit of measure in Sicily, its use is attested in South Italy during the Hellenistic period.

It is unclear to what ancient unit of measure the 32–liter vessels corresponded. One possibility is the medimnos (μέδιμνος), a measure that appears to have been relatively common throughout the Greek world. Yet, while the term was widespread, it did not always refer to the same measure of volume. Different cities and different regions used different medimnoi. The historian Polybius refers on separate occasions to a Sicilian medimnos (2.15.1, 9.11a.3–4) and to an Attic medimnos (6.39.13), giving one the impression that the two were somehow distinct. The so–called Sicilian medimnos (Σικελικὸς μέδιμνος) is believed to have had a volume of ca. 52.25 liters. Yet most scholars accept Hultsch’s calculations for an Attic medimnos of about 52.53 liters, making it hardly distinct from its Sicilian counterpart.

In favor of identifying these 32–liter vessels as medimnos–measures is the fact that contemporary epigraphic sources from Sicily mention grain measured by the medimnos, the hemimedimnos (ἡμιμέδιμνος) or half–medimnos, and the hemiekteus (ἡμιεκτεῦς), which was equivalent to 1/12 of a full medimnos. This same relationship of 1:1/2:1/12 is exhibited among the measures at Morgantina. Yet, despite the apparent correspondence between the hypothetical relationships and those of the Morgantina

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74 But see also, VIEDEBANTT (1917), who argues for an Attic choinix of 0.96L and NISSEN (1886), who identifies an earlier, Solonian period, Attic choinix of 1.08L and a later one of 1.22L.
75 See, for instance, the so–called Heraclea Tablets (IG XIV 645), which record payments of rents from the leasing of sacred lands in choinices.
76 CORRETTI (2001); VIEDEBANTT (1931, 89–90).
77 HULTSCH (1882).
78 See, for instance, Entella Tablet A1, ll. 19–23; see also, AMPolo (2001, 93–96) and the so–called Financial Inscriptions from Tauromenion (IG XIV 423–430), for which see ARANIO–RUIZ and OLIVIERI (1965, no. I, ll. 25–34 and no. III, ll. 21–28).
measures, these identifications must inevitably remain speculation since for the moment we are placed in the difficult position of trying to reconcile the physical evidence with calculations derived from inconsistent textual sources. The identification and publication of more measures from Sicily and the rest of the Hellenistic world will surely clarify the relationship between the extant vessels and known ancient standards.

Before moving on, it is worth noting that the measures were discovered, and presumably used, in a wide variety of contexts, both public and private. The density of measures found in the agorai of Morgantina and Kamarina is not unexpected, given the commercial nature of the space. The concentration of measures in and around the north–wing of the Central Shops at Morgantina, coupled with the large number of bronze coins, points to the nature of exchange taking place in this series of rooms. Measures have also turned up in domestic contexts at several sites including Morgantina, Akrai, and possibly Apollonia. In these contexts, dry measures would have presumably served for the provisioning of foodstuffs (grain, legumes, etc.), a task central to the oikonomia of a well–run household. The measures found in the Aguglia farmhouse in the territory of Akrai demonstrate that these vessels were not restricted to urban centers, but also served a function within the agrarian landscape. It will be argued in the following section that their purpose was almost certainly related to the assessment and collection of agricultural taxes.

Intriguingly, a number of measures were discovered in sanctuaries dedicated to the worship of Demeter and Persephone at Morgantina.79 Sacred measures are attested

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79 *PR II*, 155–62; *WHITE* (1964, 261–79); *MS I*.
elsewhere in the Hellenistic world.\textsuperscript{80} It is tempting to speculate as to the use of these vessels in the day–to–day operation of the sanctuary, particularly in terms of tallying dedications made to the goddesses. If not an exact parallel to the situation at Morgantina, the Athenian _aparchai_ decree offers an instance when a sanctuary of Demeter received measurable payments of tribute in the form of grain.\textsuperscript{81} The measures may have also been used in assessing the rent owed to the sanctuary by the lessees of agricultural lands “owned” by the deity. Several stelai from Heraclea in South Italy record the letting of land sacred to Athena and Dionysus. In most cases, rents were assessed and paid to the sanctuary in grain.\textsuperscript{82} If, as Malcolm Bell has posited, the areas occupied by the sanctuaries to the north and south of the agora represent allotments made to Demeter equal to the allotments made to citizens, then the goddess may have also received allotments of agricultural land in the city’s _chora_.\textsuperscript{83} The picture that emerges is one in which dry measures were fully integrated within ancient society, from domestic to commercial and even religious contexts.\textsuperscript{84}

The preceding discussion served to illustrate the roughly contemporary adoption of standardized grain measures at several cities in southeastern Sicily. The widespread and contemporaneous adoption of a common standard—unprecedented in Sicily up until

\textsuperscript{80} A stone _sekoma_ table, reported by DUMONT and HOMOLLE (1871, 21–2; no. 419,88) from Ganos (Gaziköy) in Thrace bore cuttings for four different measures and was inscribed ἵσος | ἡμί(κυτεύς) | τρι(κυτσόλη) | κο(τύλη) | ἡ(μικυτσόλη). MAREK (2006, 332–35, no. 144) has recently published a large stone _sekoma_ table that was found during excavations in the sanctuary of Apollo at Kaunos. See also, _I.Delos_.1820: [-----]δ̣η[µ]οςΔιοδότου | Μαραθόνος, ἔπιμελητής | Δήλου γενόμενος, σήκωμα | στηρὸς ἡμεδίμνου Ἀπόλλων ἦµεδίμνου Ἀπόλλων[ɪ].

\textsuperscript{81} _IG_ I\textsuperscript{3} 78; FORNARA (1983, no.140); EVANS (2010, 127–8).

\textsuperscript{82} For the Heraclea Tablets: _IG_ XIV 645; The so–called Accounts of the Eleusinian Epistatai, an Athenian inscription from 329/8 BCE (IG II\textsuperscript{2} 1672, ll. 252ff.) records the rents paid in kind for short–term leases on land sacred to Demeter. Amounts paid are given in terms _medimnoi_, _choinikes_, and _hemiektia_.

\textsuperscript{83} BELL (2008, 155–59).

\textsuperscript{84} BAILEY (2011) has just completed a fascinating study of instruments of measurement (e.g. coins, prices, weights, capacity measures) within Roman society.
that point in time—required an exceptional political mandate. The intention and motivation behind this phenomenon will be discussed in the following sections.

III. Standardization, taxation, and the royal economy.

* Cicilia ae piu salme.  
  – Giovanni da Uzzano (early 15th century)  

[uniform measures] enhance administrative control over matters of taxation and economic development. At the same time, an impressive display of state power [is] required to enact the new [measurement] system in the first place. 

  – Theodore Porter

In this section, I will argue that the standardization of measures, documented in the preceding section, was first accomplished in service of the Hieronian tithe. In this context, the measures stamped with the term ἀκριβάζοντος (M–4, K–2, AK–4, AK–5) will be treated as evidence for the workings of a royal administration which has, to date, remained ill–defined. In this respect, consideration will be given to evidence for the administration of taxes within other Hellenistic kingdoms.

IIIa. Standardization.

Several possibilities may serve to explain the standardization of volumetric measures documented above. For instance, standardization may have come about as individual *poleis* independently aligned their local, civic standards with a regional, commercial standard as a means of facilitating commercial exchange. This is now seen as the motivation behind the Athenian decree of the late second century BCE (*IG II*2 1013), mandating the creation of new official weights and measures. 

Several scholars have

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85 PORTER (1995, 26).  
86 See MERRITT (1938, 127–31, no. 27), who publishes a fragment of the decree, originally part of the copy that was to be displayed in the Tholos in the Agora; cf. WOODHEAD (1997, no. 322, pl. 31).
concluded that the new standards were intended to coordinate Athenian commercial weights and measures with the Roman standard, as the timing of the decree corresponds to the height of Athenian trade with Rome and the Western Mediterranean.\textsuperscript{87}

Historical evidence suggests that widespread unification of measures on the scale observed in eastern Sicily was rarely achieved in the pre–modern world. In the case of third–century Sicily, historical and archaeological evidence suggest that the standardization of measures was symptomatic of greater institutional changes brought about by the development of infrastructure required for the administration of Hieron’s agricultural tithe. The commercial and economic implications, which are addressed later in this dissertation, must be understood as a product of standardization, not as the motivation. As was discussed in Chapter 1, the Hieronian \textit{dekate} was an agricultural tax collected in kind, the proceeds of which could be sold for cash or given as gifts.\textsuperscript{88} This was common practice for Hellenistic monarchs for whom agricultural taxes served as a principle means of generating revenue. Kings faced the challenge of how to collect taxes from their geographically expansive territories. This was true also for Hieron, though his kingdom was relatively small compared to that of the Seleucids or Ptolemites.

Hieron, like his Ptolemaic and Seleucid counterparts, would have presumably sought to extract his share of the kingdom’s produce in the most efficient and cost–effective manner, such that he was ensured the greatest possible returns on his bounty. For this reason alone, it was essential that a system of standardized measurement be both recognized and enforced throughout the kingdom. There were many practical reasons why taxation relied on the creation of unified standards. Common standards for

\textsuperscript{87} HABICH (1997, 291–92).
measuring volume would facilitate both the assessment and collection of an agricultural tithe by allowing for transparency on the part of both farmer and tax–collector. In principle, a standard both sponsored and enforced by the king would be vested with the fiduciary guarantee of his royal authority. A single, kingdom–wide standard would also increase the efficiency of assessment by reducing the need to make conversions between local, civic standards and royal, tax standards. The absence of a common standard would be stifling, as tax–collectors and royal authorities would be forced to make sense of a variety of local units of measure, not to mention variations in the actual vessels themselves.

Hieron needed to be certain that cities were not using smaller measures to avoid paying their share of the tithe. In a broader sense, unified measures allowed Hieron to collect reliable information about his kingdom’s productivity. Figures for annual amounts of grain sown and harvested could be given in a single, standard unit, reducing the potential for underreporting or misreporting of amounts due to errors in conversion. This was an essential benefit of a standard unit, as royal tax administration relied on the accurate reporting of amounts of grain sown and harvested each year.

If Hieron had the motivation for standardizing measures, he also had the prerequisite authority and resources to carry it out. From a theoretical standpoint, the authority to determine units of measure has historically rested with those who held sovereign power. Hector Vera has aptly described this sovereign right as the “monopoly

89 This idea has been met with general agreement in terms of the coinages struck by Hellenistic monarchs and the importance of communicating a coin’s essential value as a unit of exchange; see SHIPLEY (2000, 22).
90 ASHWORTH (2004, 1314).
91 Standard units would have also benefitted the individuals who came to Syracuse to bid on the right to collect the tithe grain. Without access to accurate data on annual harvests, tax–farmers would be less inclined to bid at auction, since inaccuracy or inconsistency in amounts reported and actual amounts harvested increased the risk of loss of revenue.
on the legitimate means of measure”. While the relationship between the sovereign and units of measurement has been thoroughly examined with regard to the medieval and modern state, it was also true for ancient states. A case in point are several Babylonian stone weights which are inscribed with the name of the king or sovereign. For instance, a well–known weight in the British Museum is identified by its inscription as a copy of an official weight that Nebuchadnezzar II (605–562 BCE) had commissioned based on a weight that had been made by the Sumerian ruler, Shulgi (ca. 2029–1982 BCE). The inscription reads,

One true mina. Property of Marduk–Shar–ilani; copy of a weight which Nebuchadnezzar, king of Babylon, son of Nabopolassar, king of Babylon, made according to a weight of Shulgi, a former king.

An inscribed weight of king Shulgi, now in the Louvre, conveys a similar message. It reads,

For the god Nanna, his lord,
Shulgi, mighty man, king of Ur, king of the four lands
Confirm[ed] (this stone weight to be) one–half mina.

At least three other inscribed weights, each confirmed by Shulgi using the same formula, are extant. In both the case of Nebuchadnezzar and Shulgi, the authenticity and validity of the physical weight is related to the person of the king. Moreover it is implicit in each case that the theoretical standard depends on the sovereign power of the king.

Hellenistic kings too exercised their prerogative to determine the units of account and measure within their kingdoms. This is best demonstrated in the standards they used

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92 VERA (2011, 121–35).
94 Louvre, AO 22187; Translation by FRAYNE (1997, 153–54, no. 50).
95 (1) a two–mina weight in Istanbul, see FRAYNE (1997, 154, no. 51); (2) a five–mina weight in the form of a duck, discovered in the excavations at Ur (U7825) and once housed in the National Museum of Iraq (IM 3580), but now missing following the looting of the museum in 2003; for inscription, see, FRAYNE 1997, 154–5, no. 52; (3) a duck–shaped weight now in the British Museum (BM 118552); for inscription, see, FRAYNE 1997, 155, no. 53.
for minting coinage. While many kings chose to follow Alexander in adopting the widely-used Attic standard (1 drachm = 4.36g) for their coinage, several, including the Attalids and Ptolemies, chose to create and enforce different weight standards within their kingdoms.

Aside from coinage, we know little about how Hellenistic kings dealt with unifying standards of measure across their kingdoms, a fact which makes the Sicilian measures all the more important. The Sicilian measures provide some insight into the process of standardization and the administration of a Hellenistic kingdom. In setting fixed units of measure, Hellenistic monarchs, like their royal predecessors, exercised their sovereign power over the cities subject to their authority. Hieron’s prerogative to define measures and mint coinage—and then to enforce those standards upon the member states within his kingdom—was a symbolic manifestation of his sovereignty. The physical measures were a tangible expression of his royal authority, much like the coinage struck bearing his name and portrait.

Standardization was not a particularly simple or organic operation, especially in the highly segmented political and geographic landscape of Early Hellenistic Sicily. The coeval appearance of standard measures at these cities is nothing less than remarkable. This is particularly true when one considers that for most of the medieval and early

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96 The author of the Aristotelian *Oeconomicus* (2.1345b) lists the minting of coinage as the first of four primary prerogatives of a king in a royal economy: πρῶτον μὲν τοῖς τὴν βασιλείαν ἵδωμεν. ἔστι δὲ αὕτη δύναμιν μὲν τὸ καθόλου, εἴδη δὲ ἐξοσαμένη τέσσαρα: περὶ νόμισμα, περὶ τὰ εἰσαγόμενα, περὶ τὰ εἰσαγόμενα, περὶ τὰ ἀναλόματα.

97 For ancient reference to “Alexander’s” standard of measure, see MANOV (2006, 27–34) who publishes three metal objects from the tomb of the Thracian king Seuthes III, each of which is inscribed with a number indicating the object’s weight in terms of tetradrachms of Alexander III (e.g. Σεοῦθου, ὀλκη τετράδραχμα Ἀλεξάνδρεια ΔΙΙΙ); cf. KITOV (2005, 39–54).
modern periods there was no common standard for measuring grain in Sicily.\textsuperscript{98} Between the thirteenth and sixteenth centuries, numerous kings and rulers attempted to unify the island’s measures for grain and other dry goods. It appears that not only did each of the island’s three geographic regions use different measures, but even within these regions measures varied from city to city.\textsuperscript{99} For instance, at the beginning of the sixteen century several different cities within the Val di Mazara, including Agrigento, Palermo, Polizzi, and Castellamare, are known to have used different \textit{salma}–measures.\textsuperscript{100} It was this multiplicity of measures which prompted the fifteenth–century merchant, Giovanni da Uzzano, to remark “Sicily has many \textit{salme}.”\textsuperscript{101} Despite efforts on the part of Frederick III (1296), Alfonso V (1434), and Ferdinand II of Aragon (1509), complete unification of measurement was not fully achieved until centuries later.\textsuperscript{102} S. Epstein has underscored the difficulty of the situation, noting that “[D]uring the late Middle Ages, neither of the forces that ordinarily increase market integration and act to standardize measurements—trade and a central political authority—was sufficiently strong to achieve anything like a complete unification of the Sicilian market.”\textsuperscript{103} Administrators found themselves in a drawn–out struggle with the local aristocracy, who fought to preserve their feudal rights to determine local units of weight and measure. As late as 1809, standardization of

\textsuperscript{98} EPSTEIN (1992, 120–22). A treaty of 1156 negotiated between William I and Genovese merchants makes provision for the royal curia at Messina to supply a standard measure (\textit{cisto}) to Genovese merchants; MATHEWS (1992, 76–7). The efforts of Charles I to standardize weights and measures during the thirteenth century were met with resistance; see RUNCIMAN (1958, 128).

\textsuperscript{99} For instance, the \textit{salma}, a basic unit of dry measure, was substantially larger (by nearly twenty percent) in the eastern half of the island than in the territories west of the river Salso; BACKMAN (1995, xix).

\textsuperscript{100} While the variation in the size of the salme used at Agrigento and that used at Palermo may be partially explained by factors of distance or the relative size of these two cities, it is far more remarkable that the smaller towns of Polizzi and Castellamare used measures different from neighboring Palermo, the largest political and commercial center in the region; see EPSTEIN (1992, 121, n. 114).

\textsuperscript{101} EPSTEIN (1992, 120).

\textsuperscript{102} In 1434, King Alfonso issued an edict “on the standardization of measurements,” which prescribed that the \textit{salma} of Catania be the common measure of grain used throughout the Val di Demone and Val di Noto. The edict appears to have had little success; see, EPSTEIN (1992, 121) and CORDOVA (1890, 42).

\textsuperscript{103} EPSTEIN (1992, 121).
measures across the island remained an elusive goal. In this year, officials were sent to the island by the ruling Bourbon monarch, Ferdinand III, to standardize measures. The great variety of measures encountered by Ferdinand’s technicians was detailed in a report entitled *Codice metrico–siculo*, which was submitted to the king in 1812. The Scottish author John Galt mentions the recent standardization in a travel narrative of the same year, where he writes,

> Almost every town in Sicily, and even various articles, had a different weight and measure, til his Sicilian Majesty, by a Decree dated the 31st December, 1809, ordered, that from the 1st of January, 1811, there should be an uniformity of Weights and Measures, throughout the island, upon the following metrological system.

Comparison with medieval and early–modern Sicily is illustrative for it underscores the role of a central authority in the unification of standards, regardless of the implicit benefits to trade and commercial exchange. The remarkable achievement of Hieron is highlighted by the fact that such uniformity of standards was not again achieved in this region until the nineteenth century.

One final piece of evidence to support the hypothesis that Hieron was the ultimate source behind the standardization are the measures stamped with the word ΑΚΡΙΒΑΖΟΝΤΟΣ. In the following section, I discuss the meaning of the word ΑΚΡΙΒΑΖΟΝΤΟΣ and argue that these measures offer precious insight into the operation of Hieron’s royal administration.

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104 EPSTEIN (1992, 122).
105 GALT (1812, 410).
**IIIb. The ἀκριβάζοντος Measures: Officials and Official Measures in Hellenistic Sicily.**

One prerequisite of standardization is the existence of a personnel charged with the maintenance and enforcement of standards. There is also the need for “official” or state–sponsored models (σηκώματα; sekomata), by which all other measures may be modeled or tested. At Athens, civic officials known as metronomoi (μετρονόμοι) were responsible for weights and measures. The earliest description of the office and its attendant duties is found in the Aristotelian Athenaión Politeia (51.2), written in the late fourth century BCE:

κληροῦνται δὲ καὶ μετρονόμοι ἵππες μὲν εἰς ἄστυ, εῦ δὲ εἰς Πειραιά. καὶ οὗτοι τῶν μέτρων καὶ τῶν σταθμῶν ἐπιμελοῦνται πάντων, ὡς οἱ πωλοῦντες χρήσονται δικαίως.

And the metronomoi are chosen by lot, five (to serve) in the city and five (to serve) in the Piraeus, and they are responsible for all weights and measures, ensuring that merchants use fair ones.

A late second–century decree found on the Athenian Acropolis (IG II² 1013) offers a fuller account of the responsibilities of these civic magistrates. Of particular importance are lines 7–12, describing the role of the metronomoi in the manufacture and enforcement of official measures that were used throughout the city and surrounding commercial areas,


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106 See also, VANDERPOOL (1968, 73–76). In addition to the metronomoi, there were many other individuals in service of Athens who were either directly or indirectly involved in the use and maintenance of official measures. This included the προμετρηταί, who were public slaves that are commonly connected with the measurement and distribution of grain in Athens. See, for instance, BEKKER (1814, 1.290.33–291.2): Προμετρηταί: ἀρχοντές τινες ἐνιαύσιοι ἦσαν, οἱ τῷ δικαίῳ μέτρῳ διαμετροῦντες τὰ ὀσπρια καὶ τοὺς πυροὺς ἐν τῇ ἁγορᾷ.
The magistrates whose legal responsibility it is shall make standard measures (σηκώματα) corresponding to the copies that have been made, for liquid measures, dry measures, and weights, and shall [compel those who] sell goods in the agora or in the workshops or the retail shops or the [winershops] / to use these measures and weights, measuring all liquid produce with the same [measure], and henceforth it shall not be allowed for any magistrate to make measures or weights [larger] or smaller than these.

The provisions for the official measures continues in the fifth section of the decree (ll. 37–43),


[So that] the measures and weights may remain for [future] time, [the person] appointed to [provide] the measures and weights, Diodorus son of Theophilus [of Halae], shall hand [them over] to the public slave [appointed] in the Skias (Tholos) / and to the one at Piraeus along with the overseer (?) And to the one at Eleusis; they shall preserve [them] and shall give copies of the [measures and weights] to the magistrates [and to] all [others] who need them, and they shall not be allowed to [alter? them] not to remove [anything from the] building provided except the leaden [and bronze] copies that have been made.

Many bronze and ceramic measures have been found in Athens with markers of their official status. Most commonly, this took the form of an inscription around the exterior of the vessel that read ‘ΔΕΜΟΣΙΩΝ’ or ‘ΔΕΜΟΣ’. 107 Official Athenian measures were also occasionally stamped with the head of Athena or a small double–bodied owl in a circular frame, recalling the iconography of the city’s silver coinage. 108

Based on surviving evidence, official measures in Athens appear to have served a

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107 For inscribed Athenian measures, see LANG and CROSBY (1964, 39–55). A similar approach was taken by the Elean officials responsible for the Panhellenic sanctuary at Olympia; HANDORT (1981) and SCHILBACH (1999). Standardization was not limited to measures, but also extended to weights and coinage. At Olympia the motivation for standardization was certainly commercial, allowing visitors from across the Greek world to participate in exchange based on a common and officially–endorsed set of standards.

primarily commercial role. The text of IG II\textsuperscript{2} 1013 is concerned with reducing the likelihood that fraudulent weights and measures were used for commercial transactions. The concentration of ceramic measures found in the excavations of the agora, the commercial center of the city, seems to confirm this.

Ptolemaic Egypt may serve as a better point of comparison for Hieronian Sicily, since like Hieron II, the Ptolemies were sovereign over an expansive territorial kingdom composed of both large urban centers and small rural villages. The advent of Hellenistic kingdoms brought about the need to collect taxes from a geographically expansive area and with it the need to establish common standards. There is extensive papyrological evidence from Ptolemaic Egypt for the existence of official measures and the magistrates responsible for their maintenance. During the reign of Ptolemy VIII (145–118 BCE), an official known as the \textit{basilikos grammateus} enforced the maintenance and use of official measures.\textsuperscript{109} This magistrate is known from much earlier texts as well, appearing in papyrological documents from the first half of the third century, during the reign of Ptolemy II. Scholars now believe that the office of \textit{basilikos grammateus} developed as an offshoot of a local, Egyptian official responsible for measuring land, eventually becoming responsible for the tax–farming administration in the late third and early second centuries BCE.\textsuperscript{110} It is particularly noteworthy that in the papyrological sources, standardized measures are often referenced in context of the administration of the various agricultural taxes paid to the Ptolemies.

Unlike Athens and Ptolemaic Egypt, Sicily has yet to yield any documentary evidence for officials acting in the capacity of a \textit{metronomos} or \textit{basilikos grammateus}

\textsuperscript{109} \textit{P. Tebt.} I.5, lines 85–92.
\textsuperscript{110} OATES (1995); ARMONI (2012).
during the third century BCE.\textsuperscript{111} Scholars such as Berve, Carcopino, and Bell have each posited the existence of a royal official charged with the assessment and collection of the Hieronian tithe. The stamped ΑΚΡΙΒΑΖΟΝΤΟΣ measures offer the first secure material evidence for the existence such an official.\textsuperscript{112}

In this case, archaeological evidence is able to shed light where the surviving literary record cannot. In fact, the best evidence for the existence of both official measures and magistrates responsible for maintaining standards within Hieronian Sicily are the four ceramic measures stamped with the word ΑΚΡΙΒΑΖΟΝΤΟΣ, discovered at Morgantina (M–4), Kamarina (K–2), and the farmhouse at Contrada Aguglia in the territory of Akrai (AK–3 and AK–4), three of which are stamped ΑΚΡΙΒΑΖΟΝΤΟΣ ΑΡΤΕΜΙΔΟΡΟΥ and the fourth ΑΚΡΙΒΑΖΟΝΤΟΣ alone.

The word ἀκριβάζοντος is either the masculine or neuter, genitive, active participle of the verb ἀκριβάζω, which may translate “to measure accurately or precisely.”\textsuperscript{113} The verb is known from only a handful of examples. Aside from the Sicilian measures, the next attestation appears in a first–century judicial papyrus from the Herakleopolites nome in Egypt (BGU 8, 1846), which records judgments (δικαιοδοτοῦ ἀκριβασαμένου) regarding the assessment and collection of taxes.\textsuperscript{114} The second word of the inscription, written in a smaller script and also in the genitive case, is the personal

\textsuperscript{111} The earliest reference to the office of metronomos in Sicily comes from an inscribed lead weight (SEG 50:1008) of the second century CE recovered in a shipwreck off the coast of Kamarina. The weight belonged to a set of lead weights destined for use in the agora of Kamarina. The weights are dated to 152 CE, based on reference to the fifteenth year of the reign of the emperor Antoninus Pius. For the text of the inscription, see DI STEFANO (1999, 267–69) and DI STEFANO, ODDONE, and SAVIO (1998, 195–211).
\textsuperscript{112} CARCOPINO (1919, 6–12); BERVE (1959, 53–54, 58); BELL (2007a, 194) suggests that the Greek title might have been oikonomos.
\textsuperscript{113} This reading was proposed by PELAGATTI (1970, 493); cf. FANTASIA (2004, 36). In epigraphic contexts, the adjective ἀκριβής is commonly used with reference to something that can be counted or measured and refers to the precision of the reckoning or measure.
\textsuperscript{114} SCHUBART and SCHÄFER (1933). Forms of the verb also appear in the Septuagint and in works of early Christian authors, generally with the meaning of “to know accurately,” as, for instance, Eusebius, Scr. Eccl., Theol., Demonstratio evangelica, 5.1.3.6.
name Ἀρτεμιδωρος. If the above reading of ἀκριβάζοντος is correct, this Artemidoros is likely to have been an official responsible for ensuring the accuracy of standardized measures.

The name Artemidoros appears here in the genitive case possibly as an abbreviation of the formula “ἐπὶ + personal genitive” (“in the time of ___”). This formula (with or without the ἐπὶ) appears frequently on bouleutic decrees and stamped amphora handles to indicate a date based on the tenure of an eponymous magistrate. The genitive active participle is more difficult to parse. The active voice suggests the subject of the verb is Artemidoros and not the measure itself. Thus, the participle may refer to the title of a heretofore unknown magistracy—ὁ ἀκριβάζων—as in, “[this vessel was approved] in the period when Artemidoros was serving as ἀκριβάζων.” Parallels for the use of the genitive active participle to refer to the title of a magistrate are found on stamped amphora handles from Chersonesos and Sinope.

Alternatively, the participle may refer to the authentication of the measuring vessel itself, as in, “when Artemidoros was serving as magistrate, he verified the accuracy [of this vessel].” In this case, the present tense is required by the genitive formula, as it refers to a present continuous state (i.e. the tenure of Artemidoros’s magistracy). In either case, the function of the stamp is evident. It served both as an

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115 Regarding the “ἐπὶ + personal genitive” formula, see SMYTH (1963,1689b). With particular reference to the formula as it appears on stamped amphora handles, GRACE (1934, 197ff).

116 In this case the gender of the participle would be masculine, since the standard word for measure in Greek, τὸ μέτρον, is neuter.

117 KATS (1985, 91–103), citing numerous examples from Chersonesos, demonstrates that in the case of the ἀστυνόμος, the genitive participle (ἀστυνόμουντος) regularly appears in place of the genitive of the noun (ἀστυνόμου). For a similar example from Sinope see, TSEKHMISTRENKO (1958, 62–63).

118 The title of the eponymous magistrate may be omitted from the dies used to stamp amphora handles, as, for instance, in the case of the priest of Helios on Rhodian amphorae, COX (1976, 149–151, n. 8.); cf. HABICHT (2002, 541–78). Another possible explanation for the use of the genitive is that offered by PELAGATTI (1970, 493), who considered the form to be possessive, as in “…of the one who measures accurately.” It should be noted that due to the fragmentary state of the stamp from Aguglia, Pelagatti was unable to read the name Artemidoros.
endorsement of the vessel’s accuracy and as an indication of the vessel’s official status, similar to the ‘ΔΕΜΟΣΙΟΝ’ or ‘ΔΕΜΟΣ’ inscriptions found on public measures from Athens, Corinth, and Olympia.\(^\text{119}\)

Turning now to the three vessels stamped with the inscription, \textit{ΑΚΡΙΒΑΣΟΝΤΟΣ ΑΡΤΕΜΙΔΟΡΟΥ}, it is evident that though all three were found in distinct locations around southeastern Sicily, all three share the characteristics of standardization. Collectively, the three stamped fragments exhibit a clear consistency of size, capacity, and fabric. Most importantly, distinctive smudging of the letters\(^\text{\textit{τ}}\)au and\(^\text{\textit{ε}}\)psilon in \textit{Ἀρτεμιδόρου}, visible on all three inscriptions, confirms that the same instrument was used to stamp all three vessels (Figure 29). This uniformity supports the hypothesis that all three measures were manufactured at a single location, according to a prescribed volumetric standard, and were subsequently distributed to the three sites around eastern Sicily. The reddish, micaceous clay (Figure 30) used to manufacture all three vessels suggests that they were produced somewhere in the region of Syracuse.\(^\text{120}\) Since all three stamped measures come from archaeological contexts securely dated to the third century BCE, their manufacture and use fall within the Hieronian period.

In the context of Hieron’s kingdom, it can be established that the stamped \textit{ἀκριβάζοντος} measures belonged to the administrative framework of the agricultural tithe. With regard to the Aguglia measures, Paola Pelagatti long ago suggested that the \textit{ἀκριβάζοντος} stamps implied the existence of a civic magistrate charged with enforcing


\(^{120}\text{Visual comparison with the fabric of ceramics known to have been produced at Morgantina suggests that the vessel is not a local product. The clay found around Morgantina is fine–grained and generally fires pale reddish brown (5YR }6/3–4\text{) to lighter yellowish brown (5YR }7/4\text{); Shelly Stone offers an updated discussion of local fabrics produced at Morgantina in }\text{MS VI.}\)
standards of measure, similar to the *metronomos* in Athens. This conclusion is supported by the discovery of grain measures stamped with names of civic magistrates from the Greek cities of Kytra and Tyras in the Black Sea region. The discovery of identical stamped measures from Morgantina and Kamarina, however, adds a new dimension to the story. The authority responsible for the ἀκριβάζοντος stamp can no longer be attributed to a civic magistrate whose jurisdiction was limited to a single polis. Rather, the jurisdiction of Artemidoros, if the above reading is correct, was geographically and politically broad, extending from Kamarina on the southern coast, up to Akrai in the Hyblaean range, and beyond to Morgantina, which lies at the western edge of the plain of Catania.

Parallels for this sort of magistrate with wide-ranging authority are best found within the royal administration that developed during the Hellenistic period in the courts of the Seleucids, Ptolemies, and Antigonids. During the third century BCE, the only conceivable source for such widespread authority in southeastern Sicily was the royal administration of Hieron II. Accordingly, the ἀκριβάζοντος stamps should be considered

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121 PELAGATTI (1970, 490–93 and 498–99) was the first to suggest a relationship between the stamped measure from Aguglia and the agricultural administration of Hieron’s kingdom, a proposal subsequently adopted by MANGANARO (1980, 434); cf. DUBOIS (1989, 117, no. 111).

122 For the Kytra measure (third century BCE), see MOLEV (2003, 846, pl. 4). For the Tyras measure (third century BCE), see TREISTER and VINOGRA DOV (1993, 531–32). This vessel was originally published by KLEYMAN (1989, 19–25). A much later grain measure (early sixth century CE), inscribed with the name of the individual who certified its validity (Εἰκοσι τε (σ)άρων στρατιωτικῶν ἑκοσι), is published by MANGANARO (2001, 149–56), who argues on prosopographical grounds that the measure is originally from Sicily.

123 For the structure of Ptolemaic royal administration with particular regard to agricultural administration, see MANNING (2003, 129–81). Regarding the Attalids, MÜLLER (2005, 355–84) has recently suggested that the term ἡμιόλος, mentioned in the text (line 44) of a royal letter from Eumenes II to the citizens of Toriaion, should be understood as the title of a financial administrator within the Attalid kingdom; cf. SEG 55.1428; see also, ALLEN (1983, 129–135). For the Seleucids, APE RGHIS (2004, 263–95) and CAPDETREY (2007).
evidence for the existence and activity of a royal magistrate responsible for enforcing the maintenance and use of official measures throughout the kingdom of Hieron II.  

**IIIc. The Dissemination of Official Measures in Service of the Tithe.**

Given the degree to which the member-states of the Hieronian kingdom were geographically isolated, it is clear that the dissemination of official measures played an important role in the adoption and enforcement of the standardization required by the agricultural tax. The process by which the independent *poleis* and their territories were brought to share the required standards of measure was almost certainly complex and unfortunately impossible to fully reconstruct. Nevertheless, based on the available archaeological evidence, some attempt can be made to reconstruct certain aspects of this process. The initial step likely involved the transmission of a message from the king himself to each polis, outlining the requisite adoption of the kingdom’s standards of weight and measure. This message may have taken the form of a royal letter or decree. Evidence of one such letter addressed from Hieron to the Syracusans survives and is now on display in the Museo Archeologico “Paolo Orsi” in Syracuse. In this fashion, Hieron may have also appointed royal officials to represent his interests in the allied or

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124 The name Artemidoros itself may further suggest that Hieron was ultimately the authority behind the ἀκριβῶςοντος stamps. According to Polybius (1.8.3), Hieron and a certain Artemidoros served together as military *archontes* during the Syracusans’ war against the Mamertines in the 270s BCE. While Hieron would go on to be acclaimed *basileus* by the Syracusans and their allies in 269 BCE, nothing more is heard of his co-archon Artemidoros. Given the importance of the tithe to the subsequent prosperity of the kingdom, it is tempting to posit a connection between the prominent individual of Polybius’s account and the Artemidoros who measures precisely. For the moment this suggestion remains conjectural, especially given the popularity of the name Artemidoros in Sicily; see, for instance, *IG* XIV 217 (= I.Akrai.2), a third-century inscription from Akrai that lists three different persons with the name Artemidoros; cf. *IG* XIV 421, a slightly later inscription from Tauromenion. See also *Lexicon of Greek Personal Names* IIIA 72–73. Regarding the early career of Hieron, see HOYOS (1985), ZAMBON (2008, 179–83).

125 *IG* XIV 7, col. 1, line 1; cf. MANGANARO (2005, 141–51). The means by which King Alfonso V attempted to unify measures across eastern Sicily is potentially instructive when considering the methods employed by Hieron. CORDOVA (1890, 42) notes that the constitution of Aidone included a transcript of an royal edict of Alfonso from the year 1434, stipulating that the city should adopt the common standard of the kingdom.
subject cities throughout the kingdom. This was a form of administration practiced by the Attalids kings.\textsuperscript{126}

The manufacture and distribution of official measures would have been a necessary complement to this initial legislative pronouncement. Official measures served many purposes. They could serve as σηκώματα, or standard models, from which the standard dimensions and volume could be assessed when manufacturing new measures. It is difficult to know whether standards were communicated by other means, such as by the definition of linear measurements. Mabel Lang long ago suggested that “laws introducing or enforcing measures of capacity must have included specifications of interior dimensions,” citing in support of her position the text of a fifth–century inscription found on the island of Thasos.\textsuperscript{127} This inscription, according to Lang, gives the interior dimensions for four standard measures and was intended to be placed in a public space, such as the agora of Thasos, where individuals could consult it. The principal problem with the position advocated by Lang is the extreme paucity of surviving evidence to corroborate it.\textsuperscript{128} There is, however, a relative wealth of archaeological, epigraphic, and papyrological evidence attesting to the use of σηκώματα to ensure the faithful transmission of volumetric standards.\textsuperscript{129} This is one of the explicit functions of the official Athenian measures described in \textit{IG II}² 1013. It seems reasonable to posit that σηκώματα were used to communicate the royal standards to the various member–states throughout the Hieronian kingdom.

\textsuperscript{127} LANG (1952, 18–31).
\textsuperscript{128} For a thorough rejection of Lang’s argument, see DE STE. CROIX (2004, 340–46).
\textsuperscript{129} DE STE. CROIX (2004, n. 8) lists two inscribed wine–measures from Chios and one from Thasos.
The stamped ἀκριβάζοντος Ἀρτεμιδώρου measures may have served as σηκώματα or could have been put to a different purpose. Based on their various find-spots, it seems likely that these vessels were used in the assessment and collection of the grain tithe. Furthermore, it is possible that these vessels, though officially endorsed, were used by private individuals. It was certainly the case in Late Hellenistic Athens that private individuals could possess officially endorsed measures. Such a situation is described in the following passage (IG II2 1013, ll. 63–67):

[τοῦ]— | ἐς ἄρχοντας χρῆσθαι τοῖς αὐτῶι μέτροι κεχαραμένωι τοῖς χαρακτήρι | μολυβδίν— | οἱ πρὸς τὸν ἐν τῇ σκιᾷ, μὴ πλείον πραττομένους τριοβόλους χρῆσθαι δὲ καὶ τὸ— | ὡς ἄρχας τοῖς προμετρησμένοις μέτροις, ἐὰν μὴ τὶς τῶιν πωλοῦντοιν ἢ ἄνωμένων | σφραγιστῶι μέτρωι χρῆται.

The officials (ἄρχοντας) shall use the same measure marked with a lead symbol corresponding to that in the Skias [i.e., Tholos], not charging more than three obols. The magistrates (ἄρχας), too, shall use the previously stamped measures unless anyone of the sellers and buyers uses a stamped measure.

The stamped ἀκριβάζοντος Ἀρτεμιδώρου measure found in the cistern of a farmhouse at Aguglia and that discovered in the vicinity of a large Hellenistic house at Morgantina both have good claim to being the possessions of private individuals. The stamped measure from Kamarina was found within the city’s agora, a location which is suggestive of public use. The fact that these large 32-liter measures turn up in private and public contexts suggest they served some purpose in the tithe administration. The proliferation of officially–endorsed measures would have greatly facilitated the assessment and collection of the grain tithe by allowing for greater transparency on the part of both farmers and tax–collectors. Papyrological evidence from Ptolemaic Egypt attests to the practice of disseminating official measures for the assessment and collection of an agricultural tax. The so–called Revenue Laws of Ptolemy II (263 and 259 BCE) document the distribution and use of official measures throughout the nomes of Egypt in
the assessment and collection of an agricultural tax related to the cult of the deified Arsinoë Philadelphus. A collection of receipts from the 150′s and 140′s BCE attest to the complexity of collection and shipment of grain to the royal granaries in Alexandria. In several receipts, for instance, it is clear that two measures are used in the transaction, the μέτρον δοχικόν and the μέτρον χαλχοῦν. The μέτρον δοχικόν, or “receiving measure,” appears in our papyrological sources to have been an official measure used by magistrates employed in collecting royal revenues. On several occasions, the receipts mention that the volume of the μέτρον δοχικόν is tested (συμβλέπειν) against that of a bronze measure (πρὸς τὸ χαλχοῦν) and with the aid of a leveling rod (σκυτάλη δικαία). The variety of controls alluded to in these receipts gives us an impression of the complexity of tax administration.

Widespread dissemination of officially–endorsed measures would also serve to minimize the likelihood of cheating on the part of both farmers and tax collectors. As a royal letter of Ptolemy VIII from 118 BCE (P.Tebt. I–5) makes clear, deception was possible, even on the part of officials. In this letter, Ptolemy responds to complaints made by farmers that royal tax officers were using measures larger than the official measures deposited in each nome. The steps taken to correct are outlined in the text:

καὶ ἔπει ὡς προσπέπτει προσπέπτει τοὺς πρὸς ταῖς στιολο(γίας) καὶ ἀντιγρ(αφείας) μείζοσι μέ[τροις] με[τροῖρα] τὰ εὐς τὰς αἰκάς εὐς ἐν ἑκάστῃ νομῷ ἀποδεδείδει[γι]μέγα χα(λκᾶ) ... μέτροις <παρηλλαγμένου> παραλλαγμένου[.]

130 See esp. cols. 25 and 40 in BINGEN 1952. See also, P. Hib. I.98, a receipt from 252 BCE, which records the shipment of 4,800 artabas of barley to the royal granaries in Alexandria. The receipt certifies that the grain was “justly measured” using a bronze measuring–vessel and leveling rod, which had been brought from Alexandria. The use of the μέτρον δοχικόν dates back to at least the middle decades of the third century BCE; for instance, P.Hib. 1.74 II.2.
132 P.Lille I.21
133 BELL (2007a, 190–93). The importance of trustworthy measures is emphasized time and again in documents such as IG II² 1013.
And since it sometimes happens that the sitologi and antigrapheis use larger measures than the correct bronze measures appointed in each nome […] in estimating dues to the State, and in consequence the cultivators are made to pay (more than the proper number of choinices), they [the King and Queen] have decreed that the strategi and the overseers of the revenues and the basilico-grammateis shall test the measures in the most thorough manner possible […] and the measures must not exceed the bronze (i.e. official) measure by more than the two […] allowed for errors. Those who disobey this decree are to be punished by death.

Faced with distrust among his tithe–paying subjects, Ptolemy responded by dispatching royal magistrates throughout the kingdom to test the accuracy of the measures used in each kome for the collection of agricultural taxes. Whether Hieron or his administrators faced similar problems is unknown, but he would have undoubtedly recognized the importance of emphasizing the trustworthiness of his administration. In the case of officially–endorsed instruments, there was an expectation of accuracy which rested on the authority of the monarch and his officials. This expectation undoubtedly extended even to those measures modeled on official versions. Some two centuries after Hieron, Cicero (Verr. 2.3.36–37) offers a vivid description of the frustration felt by many Sicilian farmers on account of the corrupt behavior of the Roman governor Verres and his tax–collectors. Rather than agree to an unfair tithe assessment, many farmers chose to let their entire harvest rot on the threshing floor. There is no reason to believe that punishments
for tampering with or misrepresenting officially–sanctioned measures were any less severe under Hieron than that imposed by Ptolemy VIII.  

Ptolemaic official measures were made of bronze, so far as papyrological sources relate. These were deposited in every nome and could be referred to when problems arose. A similar procedure was probably followed within the Hieronian kingdom as well though no evidence for the use of bronze measures survives today. The measures stamped ἀκριβάζοντος Ἀρτεμιδώρου are clearly evidence of distribution on the order of that recorded for Ptolemaic Egypt, as both the stamp and type of clay indicate manufacture at a single location. The use of metal for official measures has certain obvious advantages over terracotta, namely durability, yet terracotta offered advantages over bronze. Manufacturing official measures in terracotta allowed for wider distribution throughout the kingdom, given that they were relatively inexpensive and quick to produce. In addition to the stamped vessels, several other measures discovered at Morgantina (M–16, M–17, M–42) may be plausibly identified as imports, possibly from Syracuse. These were made with a clay that fired light to medium red, similar to that used for the ἀκριβάζοντος measures. This reddish clay is unlike that found locally at Morgantina and is generally recognized as a clay found in the south–eastern portion of the island, around Syracuse.

134 A legal rescript (Dig. 48.10.32), attributed to the third–century jurist Modestinus, records that “if a seller or a buyer tampers with the publically agreed measurements of wine, corn, or anything else, or deceives with malicious intention, he is sentenced to a fine double the value of the thing in question; and it was decreed by the deified Hadrian that those who have falsified weights or measures should be exiled to an island.”

135 It is worth mentioning that we are solely reliant on papyrology for the use of bronze measures in Ptolemaic Egypt, as no physical measures have yet been discovered or identified.

136 Because of the intrinsic value of the metal, bronze measures were generally restricted to the “official” sphere–generally limited to public and urban spaces.

137 M–42 is a fragment of a Type–3 or Type–4 measure, recovered during excavations of the East Granary. The archaeological context of the measure suggests that that vessel may have been used during the period while the building still functioned as a granary. The body of the measure was pierced by several small, circular holes (diam. 5mm), which may have been used for attaching a leveling rod.
A further element of the Hieronian tithe makes the widespread distribution of officially endorsed measures even more appealing. Based on the testimony of Cicero (Verr. 2.3.36–37), many scholars have argued that an essential aspect in the collection of the tithe during the Hieronian period was that the assessment of the tithe (the point at which 10% of the total harvest was calculated) took place at the threshing floor of each farmer’s estate and collection only proceeded after both parties agreed to the amount due.\textsuperscript{138} The benefits of conducting the assessment at the farmer’s threshing floor—as opposed to a central space like an agora or point of transshipment like a port—are manifold. Surely the principal advantage of this arrangement was that it discouraged deceitful behavior in the assessment and payment of the tithe, protecting the interests of farmer, tax–collector, and king. Upon the threshing floor, the annual harvest could be viewed in its totality, leaving little opportunity for farmers to pay less than was due to the king or for tax–collectors to take more than their fair share. In this context, the stamped ἀκριβάζοντος measures from the farmhouse at Aguglia are compelling evidence that the practice of assessing the tithe at the threshing floor originated in the Hieronian period. It is difficult to imagine a more plausible scenario to explain the presence of these “authenticated” measures in such a remote location.

IV. Conclusion:

The ἀκριβάζοντος Measures and the Territory of the Hieronian Kingdom.

Measures are the physical embodiment of an abstract idea. They are tangible evidence for the existence of a theoretical standard that was recognized by the communities in which they were used. While every measure from the Hieronian period

\textsuperscript{138} PRITCHARD (1970, 357–58); BELL (2007a, 190–93); CARCOPINO (1914, 5–12).
need not be treated as either an ‘official’ measure or somehow related to the Syracusan administration of the agricultural tithe, it is constructive to consider the large majority in terms of a metrological koine, one in which dry goods were bought and sold using measures of standard form and volume. The nearly contemporaneous and widespread appearance of measures around the second quarter of the third century argues strongly in favor of identifying the phenomenon as a direct result of a royal mandate. Hieron need not have invented new volumetric measures. It would have been easier to adopt the most widely accepted standard, as Alexander did with the Attic standard for his silver coinage.

As evidence for the consolidation of territories under the royal taxation structure, the distribution of the stamped measures can be used to determine the geographic extent of Hieron’s authority (Figure 31). Malcolm Bell has defended Morgantina’s inclusion in Hieron’s kingdom on the basis of archaeological and numismatic evidence recovered at the site.139 A similar conclusion may be drawn for Hellenistic Kamarina, despite the silence of ancient literary sources on the subject. Recent work in the city’s agora attests to thriving commercial activity as well as sustained economic contact with Syracuse for much of the Hieronian period, challenging the long–held notion that the city was slow to recover following the Roman siege of 258 BCE.140

139 BELL (1999; 2007a, esp. 195 n. 35) convincingly associates the monumental building program in the city’s agora with Hieron II’s patronage and the stable political environment fostered within the kingdom. The very large number of Hieronian coins found at Morgantina is suggestive of sustained economic and political contact with Syracuse during much of the third century; see HOLLOWAY (1965, 135–50); BELL (1984 and 1994); and MS II, nos. 363–68. But see, CAMPAGNA (2004, 155–156, n. 14) who has questioned the inclusion of Morgantina in the kingdom.

140 For a summary of archaeological material from Hellenistic and Roman Kamarina, see MATTIOLI (1995, 229–70) and DI STEFANO (2001/2002 and 2006, 157–76), where the post–258 BCE commercial revitalization of Kamarina’s agora is compared with Morgantina’s prosperity in the third century BCE LUCCHELLI and DI STEFANO (2004) provide a comprehensive catalogue of the numismatic finds from the agora, including the 265 Hieronian bronzes discovered in the course of excavations that comprise 89 percent of all third–century BCE coins and 37 percent of all numismatic finds from the agora between 1983 and 1995. Hieron provided the Romans with siege–engines during the siege of Kamarina in 258 BCE, making it unlikely that the city was part of his kingdom at the time of the siege; Diod. 23.9.5; cf.
When viewed within the framework of the agricultural tithe, the ἀκριβάζοντος Ἀρτεμιδώρου measures are evidence that the boundaries of Hieron’s kingdom should be drawn to encompass both Morgantina and Kamarina (Figure 32). The stamped measures provide an instrumental link between the available archaeological and literary evidence, closely associating the two cities with Akrai, whose position within Hieron’s kingdom is unassailable. Together, the three stamped measures shed new light on the political and administrative organization of southeastern Sicily during the reign of Hieron II (Figure 33).

This chapter has aimed to demonstrate the role of standardized dry measures in the operation of the Hieronian tithe. In doing so, I have also sought to shed light on larger questions related to the size and internal organization of the Hieronian kingdom. In the following chapter we move from the handheld to the monumental to ask how the tithe administration was manifested in the built environment of Hellenistic and Roman Sicily.

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ECKSTEIN (1980, 189–91). However, according to Diod. 23.9.4, a Carthaginian army had captured Kamarina by treachery only months before the Roman siege. Hieron may have been acting with the intention of regaining control of the city.
CHAPTER III: THE GRANARIES

I. Introduction.

Upon entering the Hellenistic city of Morgantina from its main gate at the southern end of the agora, one would have been immediately confronted by two long and imposing buildings flanking the approach into the marketplace (Figure 34). Constructed of heavy masonry blocks and fortified by a series of interior and exterior buttresses, these two buildings were almost certainly monumental granaries—large warehouses built to store the agricultural wealth of Morgantina and its territory. Their prominent location in the city–center surely reflected the importance of grain and agricultural production for the livelihood of the city, as indicated also by the intensification of activity in the hinterland around the city during the early Hellenistic period, which will be discussed in Chapter 4.

This chapter focuses on the two monumental granaries at Morgantina and considers their role within the social and political climate of the Hieronian kingdom. I begin with an analysis of the building’s surviving architectural features and justify their identification as granaries by comparing them with other ancient granaries. After a thorough overview of the buildings’ architecture, I will analyze the archaeological material associated with their construction, use, and abandonment. This discussion will establish a basic timeline for the various phases of the granaries, which can help to determine the rationale behind their construction. I will propose two plausible interpretations of the buildings and their function—that the granaries were built to meet a civic need or that their construction was related to the agricultural tax collected by Hieron II. In evaluating the evidence for the buildings’ function, discussion will turn to their capacity and whether this data may be used to address questions of productivity in the
region. Finally, I will discuss the abandonment of the granaries in light of changes in the organization of the grain tithe in Sicily following the absorption of the island into Rome’s expanding empire.

II. Architectural Form and Identification.

In this section, I present a detailed architectural survey of East and West Granaries followed by a broad survey of Hellenistic and Roman granaries. Arguments in favor of identifying both buildings as granaries rest largely upon analysis their architectural form. The two buildings must have served the same function as they share a similar architectural footprint, characterized most notably by a long and narrow form that is accented by alternating pairs of interior and exterior buttresses (Figure 35). In addition, both buildings were constructed with masonry walls of greater thickness than the average walls at Morgantina. Taken together, these features imply the buildings functioned as warehouses. Arguments in support of attributing a specific function as granary will be explicated in greater detail below.

Although excavation of the East Granary commenced three years following the partial excavation of the West Granary, it was the first to be identified as a granary. Initial identification of the East Granary was made in 1959 by Erik Sjöqvist, who noted that the size, location, and open interior plan made it a likely candidate for identification as a warehouse.141 He went on to suggest that the building was a storehouse for grain and specifically that it was associated with the agricultural produce collected by Hieron II. In

141 SJÖQVIST (PR IV, 131) makes the insightful association between the plan of the East Granary and that of the so-called Naval Arsenal of Philo at Piraeus, which no longer survives but is described in great detail in an inscription (IG II² 1688) detailing its construction; see also JEPPENSEN (1958, 69–101), LORENZEN (1964) and WINTER (2006, 149ff).
support of his identification, Sjöqvist cited a passage from Livy’s account of the Second Punic War where it is mentioned that a large amount of grain was, in fact, stored in the city (ubi frumenti magna vis...convecti erant).\textsuperscript{142}

Nearly three decades later, Malcolm Bell published the excavation and identification of the West Granary, which he found shared significant architectural details with the East Granary, most notably the pairs of interior buttresses.\textsuperscript{143} Bell proposed that these interior buttresses, given their spacing and location both in relation to one another and in relation to doors, served as piers on which sat large wooden beams that carried an elevated wooden floor. Grain, he suggests, would have been best stored on the elevated wooden floors, where it could be guarded from destruction by moisture or insects. Bell’s reconstruction drew on the description of monumental granaries found in the \poliorcetica of the third–century tactician Philo of Byzantium. In this work, written around the same time as the Morgantina granaries were constructed, Philo describes several types of granaries, including a type which he calls a \σιτοβολων that is distinguished by its elevated floor on which grain is stored.\textsuperscript{144} Bell was careful to point out that his reconstruction of the Morgantina granaries differed from that commonly applied to Roman military granaries in that he posited an elevated floor well above the height of an average person, more akin to a second story than the low, hip–level elevation of the wooden floors in most Roman examples.

The architectural similarities between the East Granary and Roman military granaries with stone foundations have previously been noted by Rickman in \textit{Roman}

\textsuperscript{142} Livy 24.36.10: Mureantiam primum prodito ab ipsis praesidio Romano recipit, ubi frumenti magna vis commeatueque omnis generis convecti erant Romanis. The passage refers to the capture of the city in 214 BCE by the Carthaginian commander Himilco and his troops, who seized Morgantina and expelled the Roman garrison stationed there with the assistance of some portion of the resident population.

\textsuperscript{143} \textit{PR} XII.

\textsuperscript{144} For more on \σιτοβολων, see \textit{GARLAN} (1974, 370, n. 11b).
Granaries and Store Buildings who cited, in particular, the military granaries excavated in the 1920s by Adolf Schulten in Spain at Renieblas and Castillejo (Figure 36). Since Rickman’s publication in 1971, many more Roman military granaries have come to light through excavation in former Roman provinces, including North Africa and Romania. Given their locations, these mostly date to the Roman Imperial period. These Roman military granaries and the Morgantina granaries share many of the same characteristic architectural features, including a long, rectangular form, thick masonry walls, and elevation of the floor surface.

The principal difference between the Morgantina granaries and their Roman counterparts is the method used to elevate the wooden floor. While the examples from Morgantina appear to have relied on heavy wooden beams to span the gap between interior buttresses, the Roman granaries instead were almost consistently built with low interior dwarf walls. These short walls, generally no greater than 1.5m in height, would have provided stability for the wooden timbers used for the elevated floor, reducing the distance that the boards needed to span. This unique feature of the Morgantina granaries may be a sign of their early date or perhaps reflect a regional preference. The granaries from Morgantina predate all known Roman military granaries and are easily one hundred years older than the earliest extant Roman examples at Valdevorrón and Castillejo in Spain, which are generally believed to belong to the period of Scipio’s campaigns in

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145 RICKMAN (1971, 251). For Renieblas, see SCHULTEN and GROLLER (1929); For Castillejo, SCHULTEN (1927, 207ff.). These and other Roman military granaries in Spain have received renewed attention from DOMINGUEZ (2009).
147 Various methods and arrangements for the positioning and distribution of these dwarf walls have been noted. The Roman granaries in Spain tend to have one or more long walls that run along the longitudinal axis of the building, while the stone–built granaries of Great Britain used shorter stretches of wall often arranged perpendicular to the long axis of the building.
134–133 BCE.\textsuperscript{148} Given the importance of Sicily in the formative stages of Roman overseas imperialism, the architectural design and tradition embodied by the Morgantina granaries probably influenced the design of later Roman military granaries.\textsuperscript{149}

Although there are many similarities between the Morgantina granaries and the later Roman military ones, the Morgantina granaries clearly belong to an earlier tradition of monumental storehouses for which the surviving text of Philo’s Poliorcetica is our best source of information. In his Poliorcetica (86.39–87.50) Philo offers a lengthy description of techniques for building two types of above-ground granaries (σιτοβολών), one built of stone and the other of timber. Several qualities of granary construction emphasized by Philo are present in the East and West Granaries. For instance, he emphasizes the importance of keeping grain dry and cool and recommends storing it in buildings with elevated floors and with walls that have been coated with a water-proofing treatment (he recommends a paste made of olive skins). It is also evident that Philo is describing a building that has a relatively fixed and narrow width but an unspecified length. The modular quality of Philo’s building allowed communities to construct granaries according to specific sets of variables, such as population size and availability of space within the city’s walls. The vital ratio is that between the width and the spacing of the vaults. This fixed ratio can be repeated ad infinitum, such that the volume of a granary is augmented by increasing the length and not the width of the building. A similar principle was applied in the construction of the Morgantina granaries, which appear to be based on a modular unit.\textsuperscript{150}

\textsuperscript{148} DOMINGUEZ (2006, 681); see also SCHULTEN (1927, 207ff).
\textsuperscript{149} BELL (1984/85, 507–09) was the first to suggest this, so far as I know.
\textsuperscript{150} That a module was used when laying out the buildings is suggested by the consistency of dimensions used within the individual buildings (e.g. size of exterior buttresses, spacing of interior buttress) as well as
It is in this same Hellenistic tradition that we should now be confidently placing the so-called “ arsenals ” of Pergamon (Figure 37). The Pergamene “ arsenals ” are perhaps the closest surviving parallels to the Morgantina granaries, both in terms of construction and date. The five long, rectangular buildings are situated at the highest point of the city’s acropolis, where they overlooked the city and its territory. Szalay and Boehinger date the earliest of these buildings (Arsenals I & II) to the first half of the third century BCE, during the reign of Philetaerus (282–263 BCE), the patriarch of the Attalid dynasty. The remaining three buildings were likely constructed within the latter half of the third century, either during the reign of Eumenes I (263–241 BCE) or his adoptive son Attalos I (241–197 BCE).

While the identification of these buildings as arsenals has been generally accepted, there are many good reasons to believe their primary function was the storage of grain rather than military implements. We know from epigraphic and literary sources that the Attalid kings put considerable energy toward accumulating large amounts of grain through agricultural taxation. Visibility and security would have undoubtedly been two of the key factors in determining where to store such massive quantities of grain. Accordingly, it makes sense that the Attalid kings would have stored grain within the city walls of Pergamon, where it would be safe and within reach. The location of the “ arsenals ,” at the highest point inside the city, would be ideal for granaries. Rickman has presented the most detailed case for identifying these buildings as granaries, drawing between the two buildings, such as the consistency in their width. DEUSSEN (1994, 232) suggests a unit of measure equal to 19.4 cm was applied to the layout of the East Granary.

151 Gifts of grain from Philetaerus to the citizens of Cyzicus, see OGIS 748; cf. M. Holleaux, Etudes II (Paris, 1938), 1–8 and AUSTIN (2006, no. 225). Eumenes II gave substantial gifts of grain (280,000 medimnoi) to the people of Rhodes in 161/60 BCE; Polybius 31.31.1–3 and, see also, BRINGMANN and VON STEUBEN (1995, 142–4). Around the same time, the Attalid king gave 160,000 medimnoi of grain to the Milesians; I.Milet (VI 3) 1039 I.6–7. Regarding both of these gifts, see THONEMANN (26–7), who interprets these major gifts as evidence that Eumenes was having trouble selling off his tax grain.
largely on architectural parallels the buildings share with Roman military granaries. What survives of the buildings themselves are the stone platforms upon which elevated wooden superstructures were erected, as described in Philo’s text. The interior dwarf walls and narrow vertical slits located along the lower masonry courses are unmistakable considerations made to provide for ventilation below a wooden floor. This would have been ideal for the storage of grains, but would present no immediate benefit for storing arms, such as the stone ballista munitions that were found in great abundance during the excavations atop the Pergamene acropolis. The overall proportions of the buildings, which emphasize length over width, are also very similar to those at Morgantina. Moreover, their location atop the highest point of the city surrounded by fortifications would be suitable for both protecting and displaying the agricultural wealth of the Attalid kingdom. Livy’s description of the Syracusan granaries, presumed to be those of Hieron II, makes it clear that they too were set apart on Ortygia and surrounded by fortifications.

The architectural similarities shared by the Pergamene and Morgantina granaries speak to the diffusion of the granary design, or at least its basic principles, outlined in Philo’s treatise. Moreover, the affinities to Philo demonstrate that—despite Morgantina’s rather remote situation—it enjoyed a connection to the same architectural design principles that were manifest in the architecture at Pergamon, a major urban center of the Hellenistic period and capital of the Attalid kingdom. One suspects that the Morgantina granaries were modeled on the monumental granaries at Syracuse mentioned by Livy (24.21.11–12), which are generally thought to have been built by Hieron II to store the proceeds of the tithe. At the same time, the granaries at Morgantina reflect a different approach to elevating the wooden floor than their counterparts at Pergamon, which

employ ranks of dwarf walls to create a stable platform for a wooden superstructure. The Morgantina granaries appear to have substituted the stone dwarf walls with heavy wooden beams that spanned the interior buttresses. It is difficult to identify the motivation behind this particular choice, but perhaps the decision to use wooden beams reflects the availability of excellent timber resources in eastern Sicily.

III. Architecture of the East Granary.

The East Granary has an overall length of 92.85m and width of 7.60–7.80m, including the exterior buttresses (Figure 38). The building is composed of six rooms (rooms A–F), each of uniform width (6.30m) but of varying lengths. It is clear from the masonry construction that the two largest rooms (rooms A and B) were built as part of a single unit, while the suite of rooms to the north (rooms C–F) were added in a separate construction campaign. The latter addition was built to match the same width–dimension and continued the same spacing of exterior buttresses, lending a visual unity to the whole exterior of the structure.

IIIa. Wall Construction.

The preserved walls are built of local limestone and follow a standard construction technique used throughout Morgantina, which employs larger cut stones for the exterior of walls and smaller rubble facing on the interior. The walls have a consistent thickness of 0.74–0.76m, which is roughly one–third wider than the typical wall at Morgantina. Both the walls and the buttresses are footed on a rubble foundation, which extends out beyond the width of the walls to a general distance of 0.20–0.30m. At their highest point (in the southeast corner of room A) the walls are preserved to a height of
2.75m. The substantial thickness of the walls, in addition to the large exterior buttresses, suggests the building had two stories. While no definite evidence was found to identify what construction technique was used for the upper story, parallels (both literary and architectural) discussed later in this section suggest that timber and reeds may have been used for the upper level.\textsuperscript{153}

\textit{IIIb. Buttresses.}

The most characteristic feature of the building’s architectural plan are certainly the alternating pairs of interior and exterior buttresses. The exterior buttresses are 0.70m wide and project 0.70m out from the surface of the wall. They run down the long sides of the building, set approximately 4.45m apart from one another. With few exceptions, the position of each exterior buttress on the western wall is mirrored by an exterior buttress on the east wall. A single exterior buttress was placed at the center of each of the short north and south walls. In the case of the north wall, the buttress was later enclosed by the construction of room C. These two buttresses have the same dimensions as those along the two long walls.

Pairs of interior buttress run along the length of rooms A and B.\textsuperscript{154} These measure 0.50m across and project 0.50m into the room. Interior buttresses are spaced at intervals of c. 4.65m and are also arranged in pairs along the long eastern and western walls.

Interior buttresses were also placed in the center of the short north and south walls, as

\textsuperscript{153} The original excavators believed that the building’s upper story was finished in mud brick and timber; See \textit{PR IV}, 130. While the use of timber seems certain, no traces of mud brick, either intact or disintegrated, was found during excavation of the building. Given that the stone masonry extends approximately one meter above the highest preserved exterior buttress, it seems more likely that the upper courses of the building were constructed of stone and timber.

\textsuperscript{154} For the use of interior buttresses in other Hellenistic architecture, see BERNARD (1973, 11, pl. 54) and POUNDER (1983).
well as in the center on both sides of the cross wall separating rooms A and B. There is no evidence for internal buttresses in rooms C, D, and E. A single interior buttress remains in room F, located approximately halfway along the western wall of the room. Given the pattern of pairing buttresses observed throughout the rest of the building, it is probably safe to reconstruct a similarly positioned interior buttress on the eastern wall of room F, which was damaged in antiquity, likely as a result of a landslide from the adjacent hillside. The absence of interior buttresses in rooms C, D, and E may be due to the fact that these rooms were of relatively small dimension and had rather substantial walls dividing them from one another. If the interior buttresses supported an elevated wooden floor, as Malcolm Bell first proposed, the longer divide walls between rooms C, D, E and F may have served a similar purpose, namely to support the heavy lateral beams of an elevated wooden floor.155

The buttresses appear to have been constructed in a common fashion using roughly uniform materials.156 The exterior buttresses, perhaps on account of their greater dimensions, tend to be formed of larger, more carefully cut blocks. The lowest course is generally formed by a long rectangular–shaped stone, resting on the foundations. These stones are set so that a portion of the body bites into the rubble face of the wall. Atop this is set a second rectangular–shaped stone, which is oriented vertically and set flush with the innermost surface of the lower stone. When this arrangement resulted in a gap between the face of the granary wall and the back of the vertical buttress–stone, the space was filled with rubble of similar size to that used on the inner face of the granary’s walls.

155 In the earliest publication of the granary, SJÖQVIST (PR IV, 130) proposed the interior buttresses, in addition to adding structural support for the walls, may have also served to subdivide the interior space of the long rooms.
156 Vertical blocks measure, on average, ca. 75–85 cm tall and horizontal 20–25 cm tall.
A clear example of this technique is visible in a section of the south wall of room A, where both interior and exterior buttresses employ a rubble packing (Figure 39). Above this was placed a second horizontal spanner stone, which bites into the vertical face of the wall providing added stability to the buttress. Given the poor state of preservation, it is impossible to know exactly how high the interior and exterior buttresses ran. The best–preserved interior buttresses are in Room A, the buttress on the end wall and the southern–most buttress on the eastern wall. These reach no higher than the second horizontal spanner and stand approximately 1 m above the present ground level inside the building. The best–preserved exterior buttress is found on the eastern wall of room C. It survives to a height of 2.35 m. This technique of constructing buttresses with alternating spanners and risers is found elsewhere at Morgantina.157

IIIc. Rooms A–F.

Looking at the ground plan of the entire building, one can see that a series of internal doorways facilitated movement between rooms C–F, while no such accommodations were made for rooms A and B. The following is a room by room analysis. As will be discussed more fully in the following section, it is possible to identify several modifications to the architecture of the East Granary. Some can be confidently associated with later phases of the building’s use, while others are more difficult to date.

Room A: 20.25m x 6.30m.

Room A is the southernmost and second largest room of the building. Portions of the western and southern walls are now missing. There are no preserved entrances into

157 Buttresses built using this technique have been documented inside the corridor (room 11) of the North Bath Complex, located at the corner of Plateia B and Stenopos W14. There, two buttresses were built to support the western wall of room 9; see, LUCORE (forthcoming).
the room, though it seems reasonable to conclude, by comparison with room B, that a
threshold was once located in the portion of wall that is now missing. A large terracotta
drainage conduit that now transects the eastern wall of the room is a later addition,
presumably installed to facilitate drainage of water, which accumulated between the
hillside and the east side of the building.

The walls in the southeast corner of the room are preserved to a height of 2.70m,
the highest point in the entire building. They extend 1.15m above the top of the room’s
tallest inner buttress and 0.93m above the tallest exterior buttress. Despite the missing
stretch of the western wall, it is possible to reconstruct four pairs of exterior buttresses
and three pairs of interior buttresses along the long walls. Room A is almost exactly one–
half the size of room B. This is reflected not only in its overall dimensions but also in the
arrangement and spacing of buttresses, which clearly followed a standard module.

Analysis of the wall construction at the point where rooms A and B meet suggests
that the two were designed and built as part of the same campaign. There is no evidence
of a threshold in the surviving masonry cross wall that runs between rooms A and B.
However, passage between the two rooms may have been possible at the level of the
elevated floor.

Room B: 40.05m x 6.30m.

Room B is the largest room of the building. It is almost exactly twice the length of
room A. Four entrances (1–4, counting from the north) are visible along the western wall.
Each measures 1.50m wide. Doorways 2–4 are spaced at regular intervals of 9.25m from
one another, while Doorway 1 is set only 5.5m from Doorway 2. The original threshold
stones appear to have been removed, leaving behind only the stone footings. Entrance 1
shows signs of modification, whereby the threshold was raised by 0.40m above the previous one, presumably to accommodate the rising level of the interior floor surface. The new threshold was constructed of large terracotta bricks. A narrow doorway, measuring 0.78 m wide, is located along the eastern wall of the room between the third and fourth interior buttress from the south. At a later point in the history of the building, this doorway was filled in with rubble and covered with plaster. Excavators found traces of a thick coat of hydraulic plaster at various points along the exterior of the eastern wall of Room B.

**Room C:** 4.0m x 6.30m.

The eastern and western walls of Room C abut the northern wall of Room B, but they do not bond with it. The room was entered either from the adjacent Room D to the north or from a doorway through the eastern wall. At some point, the latter was filled in with rubble and covered over with plaster, much in the fashion of the doorway in the eastern wall of Room B. There are no proper interior buttresses in room C, only that which was originally an exterior buttress on the north wall of room B and later enclosed by the construction of room C. It also appears as if the room had only one exterior buttress on the eastern wall without a corresponding buttress on the western wall.

Adjacent to the doorway in the eastern wall, excavators exposed a surface paved with a mixture of large terracotta bricks and stones. The installation of the rubble and brick floor appears to have preceded the blocking up of the doorway, since the plaster does not continue below the level of the top of the stones.

**Room D:** 6.40 m x 6.30 m.
Entrance into room D could be gained from both the adjacent rooms C and E, as well as through narrow doorways in the eastern (0.72m wide) and western (0.77m wide) walls. A threshold stone with cuttings for a door jamb survives in the entrance in the western wall. None of the doorways show signs of ever having been blocked or filled in at any point during the lifetime of the building.

**Room E: 4.60m x 6.30m.**

In addition to doorways leading into the adjacent rooms D and F, this room was equipped with a monumental entrance along its western side. Measuring 3.95m across, the entryway essentially spanned the entire length of the room. A threshold formed of cut stones ran between the two antae that project inward from the north and south. This threshold was filled in with rubble at a later point in time, sealing off entry from the west.

**Room F: 8.80m x 6.30m.**

This room could be entered from room E and from the outside of the building to the north. The doorway in the northern wall of Room F was originally 1.62m wide, but was later narrowed to 0.60m. The space to the north of room F was walled off at some point subsequent to the construction of the room, creating a closed space immediately to the north. This was presumably done to prevent outside access to the entrance in the northern wall of room F as well as to the narrow corridor that ran around the eastern side of the building. Perhaps given the length of the room, one pair of internal buttresses was placed at a midway point along the western and (presumably) eastern walls.

**IIId. Roof Construction.**

Little evidence of the building’s roof construction was discovered by excavators. This is perhaps partially due to spoliation and partially due to the secondary use of the
building as a center for ceramic production. Whatever the case, there is sufficient comparanda from other contemporary buildings at Morgantina to support a reconstruction of a gabled roof with a central ridgepole carrying Laconian–style terracotta roof tiles.

IIIe. Reconstruction of Elevated Floor.

My reconstruction follows the one first proposed by Malcolm Bell, which drew on the principles set forth in the Poliorcetica of Philo of Byzantium (Figure 40). That the building was designed to carry an elevated wooden floor on which grain and other agricultural materials could be stored seems to be the most plausible hypothesis, given the surviving architectural features. The building’s state of preservation makes any reconstruction necessarily hypothetical. Nevertheless, certain aspects can be reconstructed with greater confidence. For instance, can the height at which the wooden floor was elevated above the beaten earth surface of the granary floor be inferred from the extant architectural plan? Bell proposed that the floor must have been raised to a level above the height of an individual, very much unlike the typically low elevation of wooden floors in Roman military granaries. In his discussion of the building, Bell points out that the arrangement of the doors along the western wall of Room B would appear to preclude a floor level lower than the height of a human. Further evidence in support of a high wooden floor is found on the interior buttresses themselves. Several interior buttresses for which the upper horizontal blocks survive have visible cuttings that appear to have been made to receive another vertical stone above. Although we cannot be certain as to the height of the second vertical stone, it would necessarily have been itself surmounted by another horizontal block. If the interior buttresses projected to an elevation of two modules, each consisting of one vertical and one horizontal block, of the
same dimensions as those surviving examples, the timber beams of the wooden floor would be lifted to a height of at least 1.5 meters above the beaten earth floor level of the granary.

An alternative to a full second story would be a wooden floor elevated to a height of approximately one–half a full second story (Figure 40). In this scenario, the elevated floor would be more easily accessible—making the loading and unloading of grain easier—while still allowing for a sufficient space below for air circulation. An elevated floor at approximately 1.5 meters above grade would also bring the architecture of the East Granary into closer association with the granaries of Hellenistic Pergamon and those of Roman Republican Spain.

IV. The Archaeology of the East Granary.

IVa. History of Excavations.

The building that has come to be known as the East Granary was excavated over several campaigns. The full length of the building was exposed in 1959, when excavators working under the supervision of Carl Erik Östenberg dug a roughly ninety meter long trench parallel to the building’s long, western wall. Östenberg’s team also excavated the entirety of Rooms A and F and approximately one–third of Room B. In the following year, much of the remaining soil left by Östenberg was removed by two teams of excavators, working under the supervision of J. Philip McAleer and Dorothy Taylor. Their work essentially exposed the whole of the building. In 1961, the final stratification bank between Rooms C and D was excavated under the supervision of Donald White.
After nearly thirty years, excavations resumed inside the building, when in 1989 and 1992, Paul Deussen supervised the excavation of several small trenches located inside Rooms B, D, and F. In 2013, several additional saggis, located both inside and outside the building, were excavated under the supervision of Henry Sharp. These most recent excavations were intended to clarify remaining questions about the building’s chronology and stratigraphy. Previous publication of the East Granary excavations has been limited to a pair of preliminary reports in the *American Journal of Archaeology*.158 The following section aims to give a concise overview of the significant archaeological evidence associated with the major phases of the granary’s construction, use, and abandonment. A more detailed account of the archaeological material recovered in the excavation of the East Granary will be made available in the final publication of the building in the *Morgantina Studies* series.

**IVb. Construction.**

**IVb.1. Relative Chronology.**

The extensive excavations of 1959 and 1960 produced evidence of three distinct phases of construction. *Phase 1* comprised the construction of Rooms A and B, which were conceived and built during a single campaign. The suite of four smaller rooms (Rooms C–F) were added in *Phase 2*. *Phase 3* saw the addition of a short (1.5 m) stretch of wall immediately to the north of Room F along the same line as the building’s western facade. Once constructed, this short wall blocked access to the narrow passage that ran along the east side of the building. This space is referred to as Room G, although there is no evidence that this space was ever roofed.

158 For previous publication of the East Granary, see *PR IV*, 129–31; *PR V*, 277–78; *PR XII*, 323–4; DEUSSEN (1994, 231–35).
This rather straightforward sequence of construction is evident in the details of the wall construction. The chronological separation between *Phases 1* and *2* is evident at the point at which Rooms B and C meet. Unlike the juncture point between Rooms A and B, where the cross-wall was built such that it bonded with both the long eastern and western walls, the eastern and western walls of Room B and C do not bond where they meet. That the northern rooms were a later addition is also suggested by the fact that the northern wall of Room B (that which is shared with Room C) was built with an exterior buttress. It appears, therefore, that Rooms A and B were built as a single unit, complete with exterior buttresses on both the north and south short ends, and only after their completion did construction on Rooms C–F begin. A saggio excavated along the western wall of the building at this very point in 1960 demonstrated that the walls of Room C were built to simply abut the already completed walls of Room B. It was also observed that the foundations for Room C (and presumably for the three rooms to the north) were established some 40cm higher than the foundations of Room B (and presumably Room A), a further indication that construction of the northern suite of rooms was subsequent to the completion of Rooms A and B. Similarly, the wall built as part of *Phase 3* does not bond at the junction between Rooms F and G. This is evident from the portion of wall that is presently above ground and was further confirmed by the excavation of a saggio at this point along the exterior of the western wall in 1960, which found evidence that the stretch of wall forming the western side of Room G was added only after the exterior of Room F had been coated in a layer of plaster.

At some point in the early stages of the building process, portions of the adjacent East Hill were cut back, presumably to allow for the desired orientation of the building,
as well as to provide space between the hillside and the granary wall, a step necessary to allow for proper ventilation and drainage along the east side of the building.\textsuperscript{159} The available archaeological evidence does not allow one to determine with certainty whether this trimming occurred in two phases, co-terminus with the first two phases of construction, or in a single unified campaign, prior to \textit{Phase 1} of construction. Whether Rooms C–F were initially planned as part of the building or were only deemed necessary at some later point is obviously a distinction of some import for our understanding of how this building was originally conceived. The fact that the suite of rooms were added only after Rooms A and B were completed does not necessarily mean that they were not originally planned as part of the complex. In fact, there are many architectural details that suggest that these rooms were planned as part of the original building, including the coordination of the thickness of the walls, the width of the rooms, and even the spacing of the exterior buttresses with those of Rooms A and B.

Between the cutting back of the hillside and the construction of the walls, the builders appear to have constructed a platform of soil, which would become the beaten earth floor of the granary. This platform was leveled using a fill of the light yellow sandy soil and small bedrock fragments produced in the quarrying back of the hillside. Once this was completed, the builders appear to have burnt material across the entirety of the platform and in the process created a “baked” layer of soil some 3–5 centimeters deep. Evidence of this burnt and baked layer, easily identifiable by its medium red color, has been found at similar levels in both Rooms A and F, suggesting that the entire platform

\textsuperscript{159} Similar “trimming” occurred prior to the construction of the East Stoa, which lie to the north of the granary. Although excavations in and around the building have produced no definitive evidence for the reincorporation of the bedrock in the East Granary, it nevertheless seems a likelihood that a portion of the stone used to build the granary was quarried from the adjacent slopes of the East Hill. The quarrying of limestone along the Serra Orlando ridge occurred elsewhere, including along the portion of the East Hill immediately to the north, where the East Stoa was located.
was constructed in a single phase. That this burning did not take place after the building had been finished is made clear by the fact that the builder’s trench dug for the placement of the walls cut through the burnt surface. This is clearly visible in the southeast corner of Room A, where excavations in 2013 revealed evidence for the point at which the builder’s trench cut through the burnt layer on both the east and south sides of the room. The very same situation was documented by excavators working in Room F, along the east wall of the building. Burning the surface of the soil platform may have been a further measure to prevent moisture or insects from entering the building.

Once construction was completed, a thick coat of plaster was applied to the exterior of the building. Excavators found traces of this plaster at points along the granary’s eastern and western walls, as well as on the northern wall of Room F. It is noteworthy that the plaster not only extended down to the building’s foundations but was even found to have spilled over onto the ground at the level corresponding to the bottom of the builder’s trench. This discovery helps to clarify the sequence of construction, since it means that the walls were plastered prior to the infilling of the builder’s trench. It also serves to highlight the importance of the plaster coat, which clearly had a functional purpose beyond simply decoration. This plaster surface was almost certainly intended to serve as a type of waterproofing for the building. By running the line of plaster below ground level to the lowest foundation course, the builders may have been attempting to prevent water from collecting at the foundations and thereby undermining the structural integrity of the granary or compromising its precious contents.

IVb.2. Absolute Chronology.

While the relative phasing of the building’s construction is clearly in evidence, establishing absolute dates for any particular phase of construction is a more difficult
undertaking. From the 1959 and 1960 campaigns, the best evidence was collected from several small saggi dug inside of the building. These saggi were dug beneath the beaten-earth floor surface associated with the initial period of use and into a thick fill layer of hard-packed yellow soil that appears to have been used in construction Phases 1 and 2 to cover the building’s stone foundations. Traces of the packing layer, laid to a depth between 20 and 40 cm, have been identified in all six rooms of the complex. Moreover, the soil of the fill appears to have been rather carefully sifted, perhaps as a measure taken to reduce the number of inclusions, such that excavators found it to be largely deprived of diagnostic material that could be used for dating the building’s construction.

From two additional saggi dug below the beaten-earth surface of Room B in 1960, excavators recovered a handful of ceramic sherds, belonging to vessels that are datable to the late fourth and early third centuries BCE. In addition to these sherds, two third-century lamps (inv. 92–351, 92–365) were found in 1992, during excavations of a third saggio into the original floor packing at the north end of Room B. Additional diagnostic material was recovered from within the builder’s trench in the southeast corner of Room A during excavations in 2013, including most significantly a rim fragment belonging to a ribbed black-gloss bowl of third-century date (inv. 13–1; Figure 41). Altogether the ceramic material recovered from contexts associated with the construction of the building dates to the second half of the fourth century and early third century BCE. Certainly, the most conclusive piece of evidence, and that most narrowly dated, to come from within

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160 A saggio dug in 1992 at the threshold between Rooms E and F exposed what the excavator described as “a grey, gritty layer” over a yellow hard-packed stratum presumably representing the terra battuta floor of the third century BCE.
161 Similar yellow, sandy soil has been encountered by excavators elsewhere in the agora at Morgantina, particularly in the fill and leveling layers below the monuments associated with the Hieronian building program.
162 Unpublished material.
the packing fill of the original floor surface is a small bronze coin (inv. 59–1832; Figure 42) struck at Syracuse during the early Hieronian period (c. 276–269 BCE). The coin, of the type Persephone l. / Bull butting, l.; above, club; below, IE, is well–preserved, suggesting that it was not in circulation long before finding its way into the ground. The coin offers a secure *terminus post quem* for the construction of the building. This is in agreement with the initial date proposed by Sjöqvist, who dated the granary’s construction to the mid–third century BCE on account of the overwhelming number of Hieronian coins found within the building. While the conclusion is the same, the coin recovered from the packing fill is a more reliable piece of evidence.

**IVc. Use of the Building.**

Unlike the archaeological evidence associated with the building’s construction, which, although limited, lent itself to straightforward interpretation, the archaeological material and contexts associated with the building’s use are numerous and present a complex narrative of a long life, during which the building underwent at least one major transformation in function.

**IVc.1. Period I | Third Century BCE | Granary.**

As may be expected, the material evidence associated with the earliest, and most remote, period of activity is the least well represented in the archaeological record. Moreover, if the proposed reconstruction is correct, the absence of material associated with the building’s use as a granary poses no great problem of interpretation. The cereal contents and wooden superstructure upon which it rested would not have gone un–

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163 Unpublished material.
salvaged. This was almost certainly the case for Rooms A and B, where routine activity would have occurred on the elevated wooden floor. Excavations in the northern part of Room B exposed a number of small, shallow pits dug into the beaten-earth floor surface. It is not clear whether these enigmatic features belonged to the first period of use or are later interventions, to be associated with post–granary activity inside of the building.

Rooms C–F clearly belong to Period I, but again, the material assemblages associated with the use of these rooms during the third century is largely absent. We are left to interpret their function largely from inferences made from what little is known of contemporary granaries of the Hellenistic period. That these rooms served as the location of administrative activity associated with the movement of grain in and out of the building seems appropriate, judging from their relatively small size and from the activities that took place in other Hellenistic granaries, such as those in Egypt which belonged to the Ptolemaic tax administration.

**IVc.2. Period II | Second and First Centuries BCE | Post–Granary & Pottery.**

It is difficult to determine the exact moment when the building ceased to be used as a warehouse. Excavators found no evidence of a violent destruction (i.e. thick layer of ash and burnt soil and/or an extensive tile–fall), which would suggest that the building had been razed.

Given the number of times that Morgantina switched hands during the Second Punic War, it is reasonable to suspect that what cereal stores were held in the granaries were consumed or carried off by the occupying forces. Similarly, the heavy wooden timbers used for both the elevated floor and the roof were expensive resources that may have been stripped from the building and used for construction elsewhere. BELL (2007a) posits that these rooms may have held the records and contracts related to the Hieronian tithe administration. Royal granaries in Ptolemaic Egypt certainly served as administrative centers, where contracts and tax receipts were both produced and stored. Although the surviving stone inscriptions from Tauromenium were almost certainly intended for public display, they are clearly final annual accounts of a far more complex body of written documents of routine transactions none of which survives. For a description of the inscriptions, see FANTASIA (1999) and MANGANARO (1988).
was destroyed in a single event. Rather, the archaeological evidence suggests the building experienced gradual degradation over a long period, lasting perhaps several decades. As was posited above, the building was probably stripped of its contents and valuable architectural elements (timber beams, threshold stones, roof tiles) relatively soon after being abandoned. The most plausible historical scenario places the abandonment shortly after the Roman capture of the city in 211 BCE. In the wake of this event, the urban population appears to have drastically declined, likely to such a low number that maintenance of a monumental granary was no longer necessary.

A far more secure sign that the building no longer served as a granary was the conversion of the northern suite of rooms (C–F) into a pottery workshop. Based on a thorough examination of the ceramics produced by this potter, Shelley Stone dates the opening of the pottery to the years around 130/120 BCE.\(^{166}\) In this period, the floor level was raised by up to 40 cm in many of the rooms. This was most likely in response to rising ground levels to the west of the building as greater amounts of alluvial soil washed down from the upper agora.\(^{167}\) Unlike the well–sifted yellow soil used as a packing fill for the third–century floor level, this later packing fill was comprised of a more indiscriminate mixture of rubble, ceramics, terracotta fragments and soil. Accordingly, it contained a range of diagnostic material useful for establishing the *terminus post quem* for the raising of the floor level.

In the same period, several changes were made to limit access into the workshop. The large entrance at the west side of Room E was blocked up by a rubble wall. It may have also been at to this point when the short stretch of wall was added at the northeast

\(^{166}\) *MS VI*, Context IIC.
\(^{167}\) For discussion of the rising ground level in the agora during the early second century BCE, see *PR XII*, 326.
corner of Room F, enclosing the space north of the building, creating what I have referred
to as Room G.\textsuperscript{168} It was also at this time that the doorway in the north wall of Room F
was partially filled in to reduce the width of the entrance from 1.62m to 0.60m.
Afterwards, the only entrance into the workshop from the agora was through the small
doorway in the western wall of Room D. Here the threshold was raised to accommodate
the rise in the floor level, such that the present threshold stone, the only one to survive in
the building from antiquity, rests on a packing of soil similar to that found throughout the
room.\textsuperscript{169}

The most conspicuous renovation of this period was the addition of several kilns
in Room F (Figure 43). The kilns have been the subject of detailed analysis by Nonina
Cuomo di Caprio.\textsuperscript{170} According to Stone, the pottery remained in operation down into the
quarter century between 75 and 50 BCE, producing a range of Campana C forms and
mold–made lamps.\textsuperscript{171} While the pottery was in operation, the northern half of Room B
and much of the alleyway that ran behind the building were used as dumps for large
quantities of broken and misfired ceramics. A more detailed discussion of the ex–granary
pottery will be left for another time. For the present purpose, it is sufficient to simply
reiterate that the beginning of the pottery marks a definitive \textit{terminus} for the end of the

\textsuperscript{168} Although the date of this addition has not yet been established by archaeological excavation, a second–
century date is suggested not only by the fact that the short section of wall is footed far above the threshold
in the north wall of Room F but also by the fact that it was not plastered like the rest of the building and
was simply placed against the finished, plastered surface of Room F.
\textsuperscript{169} It is unclear whether this was the original threshold block of the third–century building or was added
during the second–century renovations. The fact that the block is broken in two pieces may argue in favor
of identifying it as the original block, since it is possible that the block was damaged when it was lifted
from its earlier footing.
\textsuperscript{170} MS III.
\textsuperscript{171} For a catalog of representative ceramics produced in the ex–granary pottery, see MS VI, Context IIC.
Stone’s criteria for the closing date of the ex–granary pottery is based on the presence of a few vessels he
describes as an “experimental” form of Republican red gloss, a technique which involves firing under
oxidizing conditions. More substantial amounts of red gloss ware, of a more advanced technique, were
discovered in association with the pottery installed in the so–called House of the Official, which Stone
suggests was a successor to the ex–granary pottery.
building’s use as a granary, datable with some confidence to the decade between 130 and 120 BCE. Although the building was almost certainly abandoned as a granary at a much earlier date, the installation of kilns in Room F and the use of Room B as a dump are clear indication that the building no longer served its original purpose.

IVc.3. Period III | Final Abandonment.

According to Stone’s analysis, the ex–granary pottery ceased to operate in the period around 75 to 50 BCE. It is difficult to say much about the building’s history following the closing of the pottery. Excavators found no evidence that the building was destroyed violently or suddenly in the late first century BCE, suggesting that it was not targeted in the violence that befell the city in the 30’s BCE.172 The narrow alleyway to the east of the building remained accessible at least down into the 40’s BCE, since it was sometime after 46 BCE that a small hoard (Figure 44) comprised of nine silver denarii and one bronze coin of Massalia was buried there (Figure 45).173 In this same period, it appears that at least one room (Room D) was used as a temporary shelter. A small makeshift hearth, formed by little more than a large circular terracotta pithos lid, was installed in the southwest corner of the room. The hearth was used for small–scale food preparation, judging from the scatter of ash, ceramics, and animal found in the immediate vicinity. In the decades following the violence of the 30’s BCE, the building appears to have been completely abandoned and may have been only visited by individuals in search

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173 For the hoard, see PR IV, 130; MS II, 175. The provenance of the hoard and its composition, which more closely resembles a small commercial hoard than a saving hoard, suggests the coins may have once belonged to the potter or someone associated with that space.
of architectural blocks. At some point, the building, or what remained of it, was covered by soil that slid down from the East Hill.

V. The Architecture of the West Granary.

Today only the footprint of the West Granary survives, as the building appears to have fallen victim to aggressive spoliation following its abandonment (Figure 46). The archaeological evidence is insufficient to securely date the period of spoliation, but many large cut–stone blocks of the type used for the upper courses of the granary’s walls are visible in the walls of the adjacent 17th century palazzo, suggesting the removal of stones may have continued well into recent centuries. Still, careful excavation has recovered enough of the building’s foundations to allow for a confident reconstruction of its plan and superstructure. The building measures 7.50m wide and is preserved to a length of 32.90m. The building’s full length is not known, as no cross–wall has been discovered terminating the southern end of the building and further excavation to the south is prevented by the presence of the 17th century palazzo. Recent analysis of the building’s orientation with respect to its topographic siting suggests the full length was closer to 40m. This reconstruction would bring the dimensions of the West Granary very close to those of Room B of the East Granary, suggesting that the two were, in fact, planned using the same module and proportions.

The building is located atop a natural limestone outcropping that rises dramatically on its eastern flank. This situation provided both a commanding position as well as an accessible point for traffic coming into the city from the surrounding *chora*. Atop its rocky promontory, the building would have dominated the landscape as one entered the city through the agora postern gate. The building’s orientation falls roughly
along a north–south axis, no doubt determined in part by the extent of the bedrock. It also corresponds to that of the East Granary, which ran along a roughly parallel axis. This coordination suggests that both granaries were planned as part of a contemporary building program.

**Va. Wall Construction.**

The walls are nowhere preserved to a height greater than 0.5m above the building’s foundations. Where it is possible to identify the technique of wall construction, it is evident that it corresponds to the one used for the East Granary, as well as many other public and private buildings at Morgantina. Larger blocks form an outer shell, which is lined on the interior face by smaller, rubble stones. There are no large ashlar–like cut stones, like those of the East Granary, still *in situ*. There is ample evidence that the exterior walls were coated in a thick, waterproof plaster, similar to that found on the exterior of the East Granary. At several points along the long western wall of the building, this plaster was found to extend below the building’s foundations, a sign that the builders were concerned with preventing water from entering the building (Figure 47).  

The surviving walls were exceptionally thick, averaging just under 1.0m across, suggesting that the ability to support a heavy load was a concern for the builders. It is possible that much of what remains is, in fact, the highest course of the building’s foundations. This would account for both the great thickness of the walls and for the lack of a more regularized construction using cut ashlar stones, as was used for the East

174 The continuation of plaster beneath the foundations along the western wall of the building has been used to determine that the granary extended for at least 32.90m. Even where it was discovered that the walls had been robbed out, traces of the plaster coating, still in its vertical orientation, have been discovered running up to the point where the seventeenth-century palazzo was built.

175 The average thickness of walls at Morgantina is approximately 0.67m.
Granary. By analogy with the construction materials and techniques used for the East Granary, it seems reasonable to conclude that the walls of the West Granary were also built of stone.

**Vb. Buttresses.**
Like its counterpart to the east, the building was outfitted with interior and exterior buttresses. These buttresses are no better preserved than the walls, only occasionally rising to 0.50 meters in height. On average, the interior buttresses measure 0.50 m in width and project 0.50 m into the building. Like those in the East Granary, the interior buttresses, which ran along the long eastern and western walls, were arranged in pairs across from one another and uniformly spaced at intervals of 3.80m. Exterior buttresses have an average width of ca. 1.0 m and projection of ca. 1.0 m. Unlike the exterior buttresses of the East Granary, the external buttresses on the West Granary appear to have been irregularly spaced. This impression may be due to the poor state of preservation. While three large buttresses have been identified on the western side of the building, only two have been identified on the eastern wall. The north, short wall of the building was supported with an exterior buttress, located at the approximate center–point of the wall.

**Vc. Entrance & Ramp.**
The only entrance into the building so far identified is a portal, 1.70m wide, in the short north wall between the central buttress and northwest corner of the building. No threshold block remains in situ, so, in 2011, the entrance was excavated to a depth of 0.30m to determine whether any evidence could be found for a threshold at the point
where the ramp met the wall. A vertical plaster surface running in line with the preserved rubble walls to the east and west confirms the original orientation of a threshold block, one which was later pried out and taken away. The presence of a single doorway at one of the building’s short ends differs from the arrangement of doors in the East Granary, which had at least six doorways in the long western wall. The single doorway is closer to the arrangement found in Roman military granaries.\(^{176}\) Locating the door in the north wall was a logical choice from a logistical standpoint, as it would have been the easiest means of approaching the building from the lower agora.

The doorway communicates with a wide, stone–paved ramp, which probably served to facilitate foot– or cart–traffic up to the building.\(^{177}\) The ramp was constructed of large limestone cobbles, which show only minimal sign of having been worked or cut. The full dimensions of the ramp are not known, but a well–preserved row of stones clearly represents the eastern extent of this pavement. The ramp presumably ran at a slight grade up from the so–called Theater Street, a narrow, beaten–earth path that connected the lower agora to the theater terrace, to the threshold of the granary.

Excavations in 2011 exposed three large limestone cobbles, which were found to be directly abutting the vertical plaster face of the now missing threshold. The soil below the ramp was supported by a retaining wall running up to the northeast corner of the granary. The wall, as preserved, measures ca. 10.30 m long and ca. 0.80 m wide.\(^{178}\) Its relationship with the ramp is clearly illustrated by the parallel orientation of the wall and the line of

\(^{176}\) RICKMAN (1971, 233–4).
\(^{177}\) Roman military granaries exhibit similar characteristics, with entrances generally located at the short ends of the building; see RICKMAN (ibid.), for discussion of Roman granaries entered on their short ends.
\(^{178}\) The 3.50 m portion closest to the building appears to have been robbed out during the construction of a second–century retaining wall.
stones forming the east side of the ramp (Figure 46).\textsuperscript{179} Both the ramp and the wall were built atop a layer of hard–packed, light yellow soil, similar to that used for the packing of the granary’s beaten earth floor. The retaining wall and ramp were built subsequent to the completion of the granary, as the thick plaster facing of building’s exterior surface is visible at the point where it abuts the north wall of the granary.

\textit{Vd. Roof Construction.}

The roof can be reconstructed with some confidence, given the heavy scatter of ceramic Laconian–style roof tiles found during the excavation of the building. These were certainly carried on a wooden superstructure that likely took the form of a gabled–roof with a central ridgepole. The 7.50 meter width of the building could have easily been spanned by roof timbers.\textsuperscript{180}

\textit{Ve. Reconstruction of the Elevated Floor.}

The presence of a pair of interior buttresses suggests that similar arrangements were made for an elevated wooden floor inside the West Granary. The absence of an interior buttress on the short, north wall of the building suggests that the elevated floor did not extend all the way to the threshold. Rather, it may have begun at the first pair of buttresses along the eastern and western walls, which are located roughly three meters from the entrance. If this reconstruction is correct, the area immediately inside the building may have served as a vestibule–like space, where grain was handled after being carried into the building or before it was withdrawn. In the East Granary there survives

\textsuperscript{179} A gap of 2.60 meters is maintained between the retaining wall and the eastern edge of the ramp.

\textsuperscript{180} Compare with the reconstruction of “Arsenal III” at Pergamon (39.00 x 8.00 m) in SZALAY and BOEHRINGER (1937, 18–23, pl. 43).
sufficient evidence to support a reconstruction of a wooden floor elevated to a height greater than 1.5 meters. No such evidence survives for the West Granary, although it may be inferred that the wooden floor was set at a similar elevation. However, if the elevated floor did not, in fact, begin until the first pair of interior buttresses, it could be argued that a wooden floor set at a slightly lower elevation could have been reached by a wooden ramp that spanned the space between the threshold and the first pair of interior buttresses. If the wooden floor was elevated at a height of 1m above the level of the threshold, the vertical and horizontal distance between the entrance and the first pair of interior buttresses could be spanned by a ramp with a grade of 18°. Despite the uncertainty surrounding the height at which the wooden floor was elevated, we can be certain that the floor was in fact elevated.

VI. The Archaeology of the West Granary.

VIa. History of Excavations.

Like its counterpart to the east, the West Granary was excavated over the course of several seasons, spanning nearly six decades. The granary was first exposed in 1956, when excavators working with Princeton University uncovered the northern end of the building. At the time, three years prior to the discovery of the East Granary, the West Granary was not recognized as such by its excavators and was left unidentified for much of the next three decades, despite having a similar architectural footprint to the East Granary. Excavations of the building resumed only in 1980 when excavators, under the direction of Malcolm Bell, dug a long trench across the building’s transverse axis,

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181 While not a particularly gentle slope, an 18° grade would still present a functional surface for moving grain up and down from the storage level. For comparison sake, the maximum grade for ramps given in the US Department of Labor’s OSHA Construction Guidelines (1926.451(e)(5)(iii)) is 20°.
locating both interior and exterior buttresses as well as an extensive tile fall and the 
granary’s original beaten–earth floor. Once identified as a monumental granary, work 
continued in the recently–named West Granary during the 1981 and 1982 seasons, as 
excavators attempted to locate the southern end of the building as well as to collect 
additional dating evidence for the building’s construction and abandonment. The results 
of the 1980–82 campaigns were published by Malcolm Bell in a preliminary report, in 
which the building is first identified as a monumental granary.182 In 2011, three 
additional trenches were excavated inside and immediately to the west of the West 
Granary for the purpose of collecting additional material that could be used to refine the 
chronology of the building’s construction (Figure 48). Numismatic evidence recovered 
from within the packing of the original floor surface during the 2011 season has lead to a 
down–dating of the building. A report of the activities from the 2011 excavations will be 
presented here.183

**VIa. Pre–granary Activity.**

Excavations in and around the building revealed evidence of activity predating the 
construction of the granary. At the earliest levels, excavators found a range of materials 
associated with the Castalluccian culture (c. 2000–1400 BCE), including worked stone

182 PR XII, 321–4.
183 The 2011 West Granary Excavation Project was carried out under the direction of Alex Walthall and 
with the permission of the Co–Directors of the American Excavations at Morgantina, Malcolm Bell and 
Carla Antonaccio, Arch. Enrico Caruso, Director of the Parco Archeologico Regionale di Morgantina, and 
Dott.ssa Carmela Bonanno, Director of the Servizio per i Beni Archeologici della Soprintendenza di Enna. 
Excavations were supervised by Hal Sharp and carried out by Nicole Brown (Princeton), Max 
Kuemmerlein (UVA), Katharine P.D. Huemoeller (Princeton), Daven Regan (Duke), Veronica Shi 
(Princeton), Randy Souza (UC–Berkeley), Aislinn Smalling (Princeton), and George Zaras (UVA). Steve 
Gavel and Simon Oswald (Princeton) supervised excavations elsewhere in the archaeological site. James F. 
Huemoeller served as Project Architect, Emanuele Galotta as Draftsman, and Emanuele Parisi as 
Conservator. The 2011 season was funded by the Department of Art & Archaeology at Princeton 
University.
flints, small bronze objects, and a large number of impasto spindle whorls. Similar artifact assemblages were found during excavations below the chthonic sanctuary, which lies immediately to the north of the granary. Although no traces of contemporary architecture have yet been identified in this area, the concentration of material may identify this area as a site of regular activity during the Bronze Age.

A few sherds from Archaic Greek vessels and a terracotta bust of the goddess Persephone (inv. 80–260) may indicate activity in the area during the late sixth century BCE. Additional evidence for pre–granary activity was discovered in 2011, when excavators working immediately to the west of the building uncovered a short stretch of rubble masonry belonging to an earlier wall or platform that was partially destroyed by the construction of the granary (Figure 49). The western wall of the granary runs across the earlier structure, of which only a single course of stonework survives. The early wall has a different orientation than the granary, almost true North–South. This earlier structure is poorly preserved and does not appear to extend beyond the small portion exposed by the 2011 excavations (Figure 50). Making the relative sequence of these two structures even clearer is the fact that the hydraulic plaster applied to the exterior of the granary runs over the top of the earlier masonry where it abuts the granary’s wall. At present, it is not possible to assign an absolute date to the structure or even identify its purpose with any certainty. Nevertheless, the scrappy remains are testament to architectural elaboration on the site that came to be occupied by the West Granary. At present, it is not possible to tell whether the earlier structure was intentionally demolished.

184 The most extensive Castallucian settlements discovered thus far in the area is on the Cittadella hill; for the settlements, see MS IV; LEIGHTON (2004); LEIGHTON and BARTOSIEWICZ (2012).
185 Two additional terracotta heads (inv. 81–43 and 81–47), belonging to figurines in the form of Persephone were also recovered from within the granary in an archaeological context predating the building’s construction. They may have originally come from the nearby Central Sanctuary. The heads belong to figurines of types produced in the late fifth or early fourth century BCE; see MS I for typology.
to make way for the granary or whether it was only by chance that the western wall of the building intersected it.

**VIIc. Construction.**

Excavations have revealed evidence that the construction of the West Granary resembled that of the East Granary, both in terms of building techniques and date. The foundations of the building’s eastern wall rest on a narrow outcropping of bedrock that runs in a roughly north–south line. The foundations for the western wall were set deeper, since there builders could not rely on bedrock.

A thick hydraulic plaster was applied to the building’s exterior, as was applied to the East Granary. Excavations in 1956 revealed that the plaster continued to belong the lowest foundation course, which means that the plaster coat was applied prior to the backfilling of the builder’s trench.

The granary had a beaten–earth floor comprised of medium–yellow, fine–grained, silty soil, which overlay a hard–packed leveling fill of light yellow, sandy soil. This packing layer contained a notable concentration of small, pebble–sized plaster fragments (Figure 51). Whether this was due to unintentional mixing during the building’s construction or was, in fact, intentionally added to the leveling fill, perhaps as a desiccant, is unclear. Where this leveling fill was completely excavated, it was found to have a depth of ca. 30 cm. It is from the leveling fill that the most reliable evidence for dating the building’s construction was recovered (Figure 52). As was found to be the case in the East Granary, the subfloor packing in the West Granary contained few inclusions and

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186 In the 2011 excavation below the floor surface, excavators exposed what appear to be two discernible strata of leveling fill.
very little in the way of diagnostic material. Nevertheless, sufficient amounts of ceramic and numismatic material were recovered to reliably date the building’s construction to the middle decades of the third century BCE.

Within the gesso-rich packing layer, excavators recovered two bronze coins, one struck at Syracuse between the final decade of the fourth century and the first decade of the third century BCE (inv. 80–281) and a second (inv. 11–35) struck at the South Italian city of Rhegium sometime between 260 and 215 BCE (Figure 53). It is this second coin, still in fairly good condition, that provides a secure terminus post quem of 260 BCE for the building’s construction. This discovery has allowed for a significant departure from previous speculation about the building’s date, down-dating construction by roughly forty years.\(^{187}\) More importantly, it serves to situate the building within the monumental building program that transformed the city’s agora over the course of the third century. By analyzing the West Granary in relation to the other elements of the building program, especially the East Granary, we can better understand its siting and construction.

**VId. Use.**

Excavators found little evidence of activity on the beaten earth floor that could be plausibly associated with the period of the building’s use as a granary. Again, one wonders whether the sheer absence of material on the floor is not, in fact, confirmation that there was an elevated wooden superstructure.

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\(^{187}\) See *PR* XII, 321–324). The previous date was based on the discovery of the other, earlier bronze coin recovered from the fill-layer below the granary’s beaten-earth floor. The coin in question (inv. 80–281) is of the type Head of Persephone l./ Bull butting l.; above and below, dolphins, which was struck at Syracuse during the reign of Agathokles.
**Vie. Abandonment and Destruction.**

The abandonment of the building is well understood, as evidence for the last stages of the building’s life has come to light from various contexts. The building ceased to function as a granary or warehouse shortly after the capture of the city in 211 BCE. Prior to its demolition, the building appears to have served as a temporary shelter for squatters, whose presence is attested by scatters of animal bones and pottery, as well as the construction of two small hearths between the second and fourth interior buttresses of the western wall. Significantly, excavators found that both hearths rest directly on top of the beaten-earth floor, suggesting that little time had passed between the abandonment of the building and its occupation by squatters. These were not substantial installations, but essentially makeshift features built from reused roof tiles, broken pottery, and small stones. Their function as cooking hearths is indicated by their proximity to deposits of broken cooking vessels, ash, and animal bones (bird and ovicaprid). Within the larger of the two hearths, excavators found a mass of olive pits mixed within an ash layer. It is unclear whether these pits were thrown in as fuel or simply discarded in the hearth’s central chamber.  

A layer of fallen roof tiles covered much of the excavated area inside the building. Excavators found no evidence to suggest that the building was destroyed in the violence surrounding the Roman siege of 211 BCE. Rather, it appears as if the granary remained standing for at most a decade before its roof collapsed and its walls were reduced to their foundations. The latest material recovered from beneath the collapsed roof dates to the late-third century. This includes, most notably, a bronze coin of the short-lived reign of the Syracusan *basileus* Hieronymus (215–214 BCE; inv. 80–282) and two Roman coins.

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188 For olive pits as a source of fuel, see WILSON (2012, 150).
bronzes of the post–semilibral standard (214–212 BCE; inv. 82–8 and 82–272), all of which were found resting flat on the surface of the granary’s beaten–earth floor. In all, the evidence from within the building confirms that the period encapsulating both the abandonment of the granary and its use as a temporary shelter appears to have lasted no longer than a decade, as no second–century materials were recovered from beneath the layer of collapsed roof–tiles. A bronze coin of Catana (inv. 81–35) struck in the period between 210 and 195 BCE was found in the stratum of soil that accumulated immediately above the tile fall. These small bronzes appear to have reached Morgantina in great numbers in the decades between 210 and 190 BCE. In a period when ceramic evidence does not offer much help in establishing a precise chronology, this coin offers valuable corroboration for abandonment by the end of the third century BCE.

By the middle of the second century the building was certainly no longer functioning as a warehouse and may have been largely reduced to its foundations. It is at this point in time that a series of walls were built to enclose the area immediately to the northwest, which included a collection of buildings that have been identified as a sanctuary complex. The southernmost of these new walls, built to enclose the sacred area to the south, cut across the large ramp leading to granary, rendering it obsolete. Thus the construction of the temenos wall marks the definitive abandonment of the granary. It is possible to date the construction of the temenos wall by the material found within an intentional fill dumped in the space between the temenos wall and the retaining wall of the granary ramp at the time of construction of the later wall. The ceramic and numismatic material from this fill points to a date in the first half of the second century
BCE. The absence of Campana C from the fill is a further indication that the construction of the temenos wall belongs to the first half of the second century.

The incorporation of the granary within the sanctuary’s temenos may have been the event that led to the building’s demolition down to its foundations. At some point in time afterwards, several walls were built over the granary. Their orientation and rough masonry construction suggests that the new walls are contemporaneous with one another and may belong to the larger sanctuary complex. One of the walls, a stretch of which was exposed by excavations in 2011, was found to rest immediately on top of the third–century tile fall, suggesting that it was built not long after the reduction of the granary to its foundations. Whatever their date, the construction of these three walls marks a clear terminus for the reduction of the granary down to its foundations.\(^{189}\) In some portions of the building, excavators found that the walls had been robbed out completely.\(^{190}\) While the majority of the spoliation may have taken place in antiquity, the archaeological evidence suggests that the removal of stones may have continued well into recent centuries. In at least two locations where significant portions of the western wall were robbed out, excavators found quantities of lead–glazed sherds from vessels of post–antique date. Moreover, many large cut–stone blocks of the type used for the foundation courses of the granary’s walls are visible in the walls of the adjacent seventeenth–century palazzo.

\(^{189}\) The stretch of wall excavated in 2011 was found to rest immediately on top of the collapsed tile fall layer covering the granary floor.

\(^{190}\) PR XII, 321–4.
VII. Whose Grain Was It? Royal or Civic Granaries at Morgantina.

Once completed, the granaries redefined the surrounding landscape. Framing the principal entrance to the city’s agora, these monuments created a broad corridor through which individuals entering and exiting the city would pass. At just over 92 meters in length, and standing perhaps as much as six meters in elevation, the East Granary was undoubtedly the dominant architectural feature of the lower agora. The West Granary, located only 45 meters away, formed a pendant with its matching buttressed walls. Rising from its foundations on an already high limestone outcropping, the West Granary, though less than one–half the length of its counterpart, would have provided an equally arresting visual statement, looming over the lower agora and blocking views beyond.

That such prominent locations in the city’s political and commercial center were given over to these buildings was certainly the product of careful and deliberate planning. This is evident not only in the parallel arrangement of the buildings, but also in the great lengths taken by the architects and construction crews to secure the desired siting for the buildings. Significant portions of bedrock were cut back from the East Hill to accommodate the East Granary and a large terrace wall was added to support the ramp leading up to the West Granary. The internal chronological evidence recovered in their excavation serves to demonstrate that both granaries are, in fact, contemporary with the monumental building program in the city’s agora. Their date, coupled with their deliberate siting, suggests the granaries were planned along with the other monuments, perhaps even considered essential features of the new agora.\textsuperscript{191} And, like so many of the

\textsuperscript{191} PR XII, 338–40. The overall coordination of the siting for the buildings in the agora has lead Bell to suggest that the entire building program was the design of a single architect.
other monuments in the agora, the ultimate source for the design of the granaries may very well have been Syracuse.\(^{192}\)

Their location within the city certainly reflects practical considerations for bringing large amounts of grain into the urban center. Situated next to what was presumably the principal gate used by individuals entering the city from the south and east, their placement reduced the need to haul cartloads of grain through the city’s main avenue. Their practical siting within the urban landscape, however, should not distract from the ultimately impractical task of bringing in grain from the countryside to fill these warehouses. Even at the minimum capacity estimates, the sheer weight and volume of the grain stored in these buildings necessitated a significant investment in time and energy to transfer it from the surrounding countryside to the city. At an elevation of ca. 550 m above sea level, the grain would have to have been hauled up from fields located anywhere from 125 to 275 m below. This expectation of an annual commitment of the time, energy, and resources needed to haul grain into the city cannot be overlooked in considering the greater message of these buildings and the decision to build them within the urban center.

The following section will consider possible reasons that may have compelled the citizens of Morgantina to do so. Coupled with their imposing scale, the siting of these buildings was clearly intended as a powerful statement of prosperity and stability. The content of this message and its intended audience depends, in part, on the patron of the granaries and ultimately on who owned their precious contents. Given their date,

\(^{192}\) DEUSSEN (1994, 232–3) alludes to the possibility of a Syracusan prototype, namely the royal granaries on Ortygia mentioned by Livy (24.21.11–12). Syracuse has been considered the inspiration for other architecture at Morgantina during this period, most notably the West Baths; see LUCORE (2009; 2010). Scholars have also identified Syracusan influence in the artwork of the period found at Morgantina. Among others, MS I for terracottas; PHILLIPS (1960) for Hellenistic mosaics.
monumentality, and location within the agora, the options are limited to civic or royal. That is, either they were intended to store grain for use by the community or they were intended to store the tithe grain owed to Hieron.

As civic monuments, the granaries may have stood as statements of the city’s prosperity. Their immense scale expressed the idea of plentitude and of surplus, whether or not they were actually full. The thick, well–buttressed walls, while ultimately a structural element of the building, conveyed the idea of security, an assurance that the community would be cared for in times of need. Their position might be read as a statement to outsiders, who, upon entering the agora, were confronted with an imposing reminder of the city’s wealth. For citizens looking down from the city’s assembly space, the granaries framed the view and focused one’s gaze out into the fertile territory below (Figure 54). In this way, the granaries stood in metonymic relationship to the source of the city’s wealth—its grain.

As royal monuments, the granaries could be interpreted as projections of Hieron’s royal authority at the far western edge of his kingdom. Taken in this light, their impressive size and location were an unmistakable statement of the king’s resources and his prerogative to take his share of Morgantina’s agricultural produce. As the locations of tax collection, the granaries were the places of an administrative ritual where the power dynamic between Hieron and his “allies” was played out on a regular basis. For citizens looking down from the city’s assembly space, royal granaries were a not so subtle reminder of the limits of civic autonomy within Hieron’s kingdom.

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VIIia. The Case for Civic Granaries.

As civic monuments, the granaries would have presumably been built to serve a narrow range of civic functions. Among the most likely purposes would be for communal storage in anticipation of food shortage or in anticipation of a lengthy siege.

If drought throughout the territory resulted in widespread decreases in productivity or even crop failure, grain could be released from the civic stockpiles—and most likely sold at below–market rates—to stymie the impacts of food shortage during the fall and winter as well as to be used as seed in the early spring. Communal strategies for alleviating the burden of food shocks are well–attested for the Hellenistic period. A common strategy was the creation of a sitonion, a fund used to purchase grain for distribution among the community in times of food crisis, resulting either from local shortages due to crop failure or drastic increases in the market price of grain due to crop failures across larger regions or in grain–producing zones. The funds, it seems, were generally used to purchase grain on the market, as much as was possible or necessary, given the size of the fund and the size of the population. Distribution would normally be made in fixed amounts and sold at subsidized prices, well below market rates. With the exception of the Samian law of ca. 260/200 BCE, there is little surviving evidence to suggest that free grain was given away on a regular basis before the late first century BCE. Like many other civic institutions of the period, sitonia tended to rely on the beneficence of wealthy community members who, having been elected to the office

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194 For general review of epigraphic attestations of the sitonion at various locations in the Mediterranean, see FANTASIA (1989); for specific discussion of the Samian grain fund, FANTASIA (1998); and the so–called Sitophylake inscriptions from Tauromenium, FANTASIA (1999). GARNSEY (1988) remains the most synoptic treatment of famine and food shortage in the ancient Mediterranean.

195 On this point, see GARGOLA (1992, 17–8). Subsidized grain distributions at Rome first occurred following the Gracchan law of 123 BCE, when fixed amounts of grain (5 modii per month) was sold at reduced rates (Plutarch, C. Gracc.6); free distributions are not recorded until the lex Clodia frumentaria of 58 BCE.
responsible for overseeing the maintenance of the grain fund and grain supply (often referred to as σιτοφύλακες, σιτώναι, or σιτοθέται), were expected to expend their private wealth, if necessary, for the public good.

The majority of well–documented sitonia funds, such as those of Delos or Histiaea, are known to us from surviving honorific inscriptions that mention the service of particular individuals who helped supply the city with cheap grain in times of shortage.\textsuperscript{196} In the case of the Samian law, the actual decree, which specifies how the fund is to be established and how distributions are to be made, survives.\textsuperscript{197} In the case of the fund from Tauromenium in Sicily, we have portions of the inscribed archive, which records the movement of agricultural produce and cash in and out of the fund over a period of nearly two centuries.\textsuperscript{198} In no instance, so far as I am aware, has the physical granary used to store the grain or other agricultural produce purchased with sitonia funds been identified. The inscriptions from Tauromenium certainly imply the existence of a substantial storeroom from which both cash and produce (in this case, beans and millet) were withdrawn and deposited.\textsuperscript{199} Nevertheless, judging from how we tend to think such grain funds were administered, the long–term storage of grain and other produce does not

\textsuperscript{196} For both inscriptions, see Reger (1994), 119–22.
\textsuperscript{197} On the Samian law, Syll.\textsuperscript{3} 976; SEG 40:735. The date of the law is a matter of some disagreement. A date in the late third century BCE has been long accepted by many scholars, as for instance, WIEGAND and WILAMOWITZ–MOELLENDORFF (1904), AUSTIN (2005, no. 135) and GARGOLA (1992). More recently, TRACY (1990) has argued that the decree dates much earlier in the century, ca. 260 BCE.\textsuperscript{198} FANTASIA (1999). And, on the date of the inscriptions, see MANGANARO (1988).
\textsuperscript{199} While the primary deposit being recorded is apparently bronze coinage measured in units of talents and litrai, the inscriptions also record the movement of beans and millet in and out of these accounts. The storage of these goods necessarily implies the existence of a space large enough to hold them. The largest preserved amount to be found on the inscriptions is just under 2,950 medimnoi of beans (kyamoi). This is not an insubstantial amount, representing anywhere from 30%–65% of the expected capacity of the West Granary. The exact amount given is 2,949 medimnoi and 1 hemiekteus; IG XIV 428, ll. 12–13. FANTASIA (1999) hypothesizes that the beans were a form of rent payment made by tenants who were leasing public or sacred lands. He cites the well–known tablets from Heraclea and Locri as comparanda. ARANGO–RUIZ and OLIVARI (1965) observed that in the four cases where a deposit of money is recorded and the text is sufficiently well–preserved (i.e 1.3, 5.12, 9.2–3) there is a withdraw of beans in the same month, which both they and Fantasia take to be evidence for the sale of beans.
appear to have been a priority. Rather, the administrative mechanisms of many of the known sitonia funds only took effect after cheap grain was needed by a community, suggesting that in most cases the grain purchased with the fund was distributed as quickly as possible—making large-scale stockpiling of grain unnecessary. In light of the above discussion, the Morgantina granaries appear almost too grandiose for the purpose of emergency grain disbursements. Their monumentality—both in terms of their size and construction—suggests these buildings were intended for far more regular use.

A second possibility is that the granaries were intended to serve as stockpiles in the event of a siege. This was presumably the intended function of the monumental granaries described by Philo of Byzantium in his poliorcetica. Here their impressive size may have communicated a sense of security to the community. The timing of their construction, however, suggests otherwise, since during the middle decades of the third century Morgantina was enjoying the peace and protection brought about by Hieron’s treaty with the Romans. Moreover, if we consider their construction in the context of the building program, Morgantina appears less like a city preparing for a long siege than one enjoying newfound wealth through architectural aggrandizement. The size of the granaries and the timing of their construction suggest that they should not be identified as civic storehouses built in anticipation of agricultural or political crisis. If not, were they instead manifestations of a royal policy dictated by Hieron?

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200 GARGOLA (1992, 17) finds that, except in rare instances, the total amount of grain purchased and distributed by Hellenistic sitonia funds was small. For instance, he calculates that the total amount of grain purchased with the annual funds available from the Samian sitonian fund was around 1,000 medimnoi of wheat. This would amount to only one–quarter of the capacity of the smaller West Granary at Morgantina. For amounts of grain supplied by Hellenistic sitonia, see MIGEOTTE (1990 and 1991).
VIIib. The Case for Royal Granaries.

As royal monuments, the granaries would have been built to hold the grain and agricultural produce owed as tithe by Morgantina to Hieron II. Within the administrative structure of the kingdom, the buildings may have served as depots where cultivators from the surrounding territory could deposit their tithe grain with royal officials, charged with regulating the collection and payment of taxes due to Hieron. The collection of tithe grain at an intermediate center served several purposes. First, it offered greater administrative control over the kingdom. Granaries served as regional headquarters for officials responsible for overseeing the proper administration of the tithe. Such officials—either sent from Syracuse or recruited from the local elite—would have been tasked with ensuring that proper amounts were collected, issuing receipts, overseeing the extensive archives undoubtedly generated by the tithe administration, and resolving disputes between tax collectors and cultivators.\(^{201}\) Once collection was complete, grain could have been immediately sent down to Syracuse or stockpiled and disbursed in smaller amounts, as needed. Second, large storage facilities outside of Syracuse gave Hieron more flexibility if grain was sent to destinations other than Syracuse. Third, the granaries offered increased visibility of Hieron’s royal administration at remote locations such as Morgantina; they gave the impression of greater immediacy of royal presence and control.

The granaries could have also served as locations where Hieronian officials could have purchased additional grain from allied communities, grain that was either freely sold as expendable surplus by cultivators or sold as part of mandatory purchases of additional grain. Mandatory purchases above the amount collected as tithe from Sicilian

\(^{201}\) BELL (2011, 197) has posited that the granaries may have also served to house the extensive records and contracts required by the tithe administration.
communities are attested during the second and first centuries BCE, when the island was under Roman administration.\textsuperscript{202} Like so many other aspects of the Roman tithe administration in Sicily, it is possible that the practice of purchasing additional grain first began during the Hieronian period and was simply retained by the Romans.\textsuperscript{203} This practice will be discussed in greater detail in the following chapter. For the present discussion, it is sufficient to say that the granaries would have served as the ideal location for this activity. The great number of Hieronian bronze coins found at Morgantina may represent official payments for additional grain collected or purchased by royal officials operating out of the East Granary.\textsuperscript{204}

Livy (24.21.12) refers to monumental, fortified granaries on the island of Ortygia, which were seized by a certain Andranodoros following the assassination of Hieronymus. Although Livy refers to these buildings as horrea publica, the well–fortified warehouses are almost certainly to be identified as royal granaries built to hold the tithe grain collected by Hieron II.\textsuperscript{205} One suspects that they served as the model for Morgantina’s granaries.

Although all too little is known about royal granaries of the Hellenistic period, they were undoubtedly an essential architectural and administrative feature of the royal capitals and major urban centers of the kingdoms of the Successors. The Ptolemaic granaries at Alexandria are known from documentary papyri, although their precise

\textsuperscript{202} For the collection and purchase of additional grain during the Roman period, see PRITCHARD (1971, 226). The collection of additional tithes will be discussed at greater length in Chapter 4.
\textsuperscript{203} CRAWFORD (1987, 43) argues that this was the case, based on circulation patterns of Roman denarii in Sicily during the early second century BCE.
\textsuperscript{204} For the total number of Hieronian coinage found in excavations at Morgantina between 1955 and 1982, see Morgantina Studies II, nos. 324, 360–368. The subject will be discussed in greater detail in Chapter 4.
\textsuperscript{205} See, for instance, PR XII, 324, n. 44. The large grain shipments reportedly sent by Hieron to, among others, Rome and Carthage would certainly have required substantial warehouses in Syracuse. Hieron’s shipments of grain are discussed in greater detail in Chapter 4.
locations and architectural form remain in question.\textsuperscript{206} Livy (31.23.5–7) refers to the destruction of royal granaries belonging to Philip V at Chalcis by the Roman army under the command of C. Claudius in 200 BCE:

\[\textit{progressi inde ad frequentia aedificiiis loca custodibus interfectis refractaque porta ceteram multitudinem armatorum acceperunt. inde in totam urbem discursum est aucto etiam tumultu quod circa forum ignis tectis iniectus erat. conflagrarunt et horrea regia et armamentarium cum ingenti appareatu machinarum tormentorumque.}\]

The Romans then advanced to the center of the city, and killing the guards and breaking down the gates they admitted the rest of their forces. Dispersing in all directions they filled the city with tumult, and, to add to the confusion, the buildings around the forum were set on fire. They burnt the king’s granaries and the arsenal with an immense number of military engines and artillery.

The passage reveals that the granaries were located not only near the city’s agora (referred to as the forum by Livy) but also to royal arsenals, where siege machines were kept. Moreover, these royal granaries were located not in the capital of Philip’s kingdom but at Chalcis, a city of great strategic significance for Philip’s kingdom, which he considered to be one of the three “fetters” of Greece.\textsuperscript{207}

The Pergamene “ arsenals” are undoubtedly the closest parallels to the Morgantina granaries, in terms of their construction, siting, and date.\textsuperscript{208} The overall proportions of the buildings, which emphasize length over width, are also very similar to those at Morgantina. The five long, rectangular buildings are situated at the highest point of the city’s acropolis, where they overlooked the city and its territory, much like the granaries

\textsuperscript{206} For instance, \textit{P. Tebt. 703.70–87} (third century BCE) and \textit{BGU 1742} (first century BCE), both of which refer to shipments of state grain to Alexandria.
\textsuperscript{207} Polybius 18.10–11.
\textsuperscript{208} SZALAY and BOEHRINGER (1937) date the earliest of these buildings (Arsenals I & II) to the first half of the third century BCE, during the reign of Philaeterus (282–263 BCE), the patriarch of the Attalid dynasty. According to Szalay and Boehringer, the remaining three buildings were likely constructed within the latter half of the third century, either during the reign of Eumenes I (263–241 BCE) or his adoptive son Attalos I (241–197 BCE).
at Morgantina. The siting of these buildings at the highest point of the Pergamene citadel, surrounded by fortified walls, and within the precinct identified as the *basileia*, where the royal palace and audience halls were also located, suggests the buildings were intended to convey a message of royal power and authority. Livy’s description of the Syracusan granaries (24.21.12) indicated that they, like the Pergamene warehouses, were set apart from the city and surrounded by fortifications.

**VIIc. Granaries within the Hieronian Kingdom.**

How did the granaries fit into the larger picture of Hieronian administration and, more specifically, in terms of the standardization and dissemination of official measures discussed in Chapter Two? To better understand how they may have functioned within Hieron’s kingdom, we may look to the contemporary situation in Hellenistic Egypt. From Egypt, we possess a wealth of documentary papyri that help to demonstrate that the Ptolemies maintained their own network of royal granaries stretching from Alexandria down through Upper Egypt. These granaries served as regional collection points for the Ptolemaic grain tax and were used to move grain from the interior to the capital at Alexandria. Transit receipts composed by royal officials operating out of these state granaries attest to energetic transport of tax grain along the Nile river. We possess the greatest amount of information regarding the role of state granaries in the Thebaid, where we have found large numbers of tax receipts. As many scholars have observed, the collection of grain taxes appears to have differed in the details of operation from region

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209 For discussion of the locations of the arsenals on the Pergamene acropolis, see SZALAY and BOEHRINGER (1937).
210 MAYERSON (1998, 190); YOUTIE (1950,100)
211 PACKMAN (1968).
Thus, we must be cautious to avoid making generalizations based on the evidence from a single region.

Based on surviving tax receipts, it appears that in certain regions of Egypt cultivators paid their grain taxes in installments, receiving receipt of the transaction signed and countersigned by state officials at each payment. The receipts document payments made over several months, beginning immediately after the harvest and running to the end of the regnal year. Receipts from the royal granary at Diospolis Magna reveal that cultivators frequently paid taxes in several installments of small amounts of grain. Zola Packman, who published these receipts, suggests that the amounts paid at any one moment tended to fall around amounts that could be carried by a single or pair of donkeys.

The next step involved moving the grain from the regional granaries to the (presumably enormous) granaries in Alexandria. The Ptolemaic granary receipts make it clear that cultivators were responsible only for conveying tax grain to the state granaries. Once deposited, the grain became the responsibility of the state, and royal officials were

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212 MANNING (2012).
213 PACKMAN (1968, 54–59) publishes a collection of tax receipts from the state granary at Diospolis Magna that were written on pottery fragments. Seventeen of the 107 ostraka recorded multiple payments made for a single tax in a single year. She concludes (55), “it seems fairly certain that installment paying was the regular, rather than the exceptional, practice for the payers of royal grain taxes, and it is probably safe to assume that single payments, even by taxpayers to whom no other published receipts were issued in the same year, are ordinarily only installments towards the total amount of one year’s tax.” Packman observes that between 164 to 153 BCE, the granary official responsible for writing and signing receipts served terms from one to four years. During the same period there was one or more officials responsible for countersigning the receipt. Packman (46) observes a fluidity of bureaucratic activity in the granary receipts, suggesting that the customary titles of σιτολογος, for the individual responsible for writing granary receipts, and αντιγραφευς, for the official responsible for countersigning receipts, did not necessarily apply in practice as documented in the Diospolis Magna receipts.
214 MANNING 2003, 59.
215 PACKMAN (1968, 58–9). Packman calculates individual payments recorded at Diospolis Magna had a mean size of 21 artabs and a median size of 12 artabs. As many scholars have noted, the size of the artaba varied, depending on the number of smaller units used to compose the measure. DUNCAN–JONES (1976) provides the most detailed analysis of the size of the artaba.
from that point on responsible for arranging its transport to the capital at Alexandria. A fairly clear picture of the network of grain-transport vessels up and down the Nile emerges from surviving transit receipts, which record the movement of requisitioned grain from the royal granaries that served as regional storage hubs to the central state granary in Alexandria (εἰς ἀλεξάντρεαν εἰς τὸ βασιλεῖκόν). A demonstrative example of such a transit receipt is P.Lille I 21, dating to the middle of the second century BCE. It records that

Year 26, Mecheir 25. Herakleides, responsible captain of the barge of Herakleitos, of 3500 artabae burden, acknowledges that he has loaded up at the harbour at Ptolemais, for conveyance to Alexandria to the royal granary, from the produce of the 25th year, through Herakleodoros, who controls for the royal scribe the granary at Pyrrheia, four hundred forty eight artabae of – – – wheat, i.e. 448, by the receiving measure tested with the bronze measure and with a fair smoothing–rod. And I make no complaint.

As is evident from the example above, granary receipts from Ptolemaic Egypt attest to a complex administrative network involving farmers, merchants, local officials, and royal magistrates. While the exact details may not directly correspond to the situation in Hieronian Sicily, the receipts nevertheless suggest the magnitude of organization and participation required by Hieron’s agricultural policies. Given their size and arrangement, the northernmost suite of rooms in the East Granary (Rooms C–F) could have served as administrative offices associated with the collection of the tithe. There, the great quantity of contracts, planting reports, and other tax documents could be stored and consulted by

216 According to MANNING (1998, 190), during the Ptolemaic period, the state organized large convoys of pack animals to convey grain from regional granaries to transshipment points, such as harbors, where it could be transported to Alexandria. In addition, Manning finds evidence to suggest that this grain transport was organized as a form of state liturgy, and was thus required of private owners of mules and other draft animals.

217 P.Lille I 21. Dated 24 March 155 BCE or 21 March 144 BCE; for commentary, see CLARYSSE and HAUBEN (1991, 55–7, no. 2). For similar transit accounts mentioning shipments to the royal granaries in Alexandria, see P.Lille I 22–23; P.Sorb. inv. 689.
interested parties should disputes arise over amounts paid or owed.\textsuperscript{218} In addition to 
serving practical administrative functions, granaries in regional centers would help to 
establish a royal presence outside of the capital. As locations of bureaucratic activity, the 
granaries would have acted as nodes in the network of information gathering and 
communication that was essential for the operation of a royal administration beyond the 
collection of agricultural taxes. For instance, in addition to collecting the grain taxes paid 
by individual cultivators, royal granaries in Ptolemaic Egypt were also locations where 
state payments could be made at the local level.\textsuperscript{219} They thus acted as outposts of royal 
authority and bureaucracy throughout the Ptolemaic kingdom. Concerning the role of 
granaries in extending royal control over a kingdom, Vandorpe arrives at a similar 
conclusion regarding the expansion of royal granaries into the Thebaid region under the 
Ptolemies, concluding that “[t]he development of the granaries in the Pathyrites perfectly 
well illustrate the extent to which the crown controlled the troublesome area of the 
Thebaid.”\textsuperscript{220} If comparison with contemporary Ptolemaic granaries offers any indication 
of how the Morgantina granaries may have functioned within the Hieronian kingdom, it 
is clear that they could have served as vital administrative centers.

The construction of not one, but two monumental granaries within a single 
generation certainly marks a significant departure from previous policy at Morgantina, 
which has produced no earlier evidence for public or communal storage. The date, scale, 
and prominent siting of these buildings suggest they were the architectural manifestation 
of Hieronian policy, rather than an articulation of civic need. Moreover, the granaries’ 
association with the monumental building program of the mid–third century lends further

\textsuperscript{218} BELL (2011, 197). 
\textsuperscript{219} MANNING (2010, 156). 
\textsuperscript{220} VANDORPE (2000, 420).
credence to their identification as royal warehouses for tithe grain. Sponsorship of architectural projects was a popular image–building practice among Hellenistic monarchs and Hieron was no stranger to this practice. The granaries were, after all, architectural adornments for the city’s agora, both in terms of their scale and in their innovative design. In many ways, the construction of the granaries may be seen as an implicit recognition of Morgantina’s importance in the region. At the same time, the construction of the granaries may have helped established Morgantina as an important administrative center in the region, certainly if individuals from surrounding areas were required to travel to the urban center in order to pay taxes and drop off grain. This increased activity related to the tithe administration would have undoubtedly boosted the local economy by bringing more people into the urban center on a routine basis than may have otherwise been the case.

Yet, despite the manifold benefits for the community that we may attribute to the building, if the granaries were indeed intended to hold the grain owed to Hieron by the community, the message they conveyed was inevitably more to the power and glory of Hieron than that of the community. In this vein, we should not discount the more abstract function of these buildings–namely their role in projecting Hieron’s authority. Framing the principal entrance to the city’s agora, the granaries stood as an unmistakable expression of royal power at the far western edge of the kingdom. They were, if nothing else, a conspicuous reminder of Hieron’s royal prerogative to collect his share of Morgantina’s agricultural resources.

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221 DEUSSEN (1994, 234) has even suggested that the East Granary was itself a gift from Hieron to Morgantina, “to set an exemplum for the enactment of the Lex Hieronica and the collection practice of the tithe.”

222 See LEHMLER (2005) for discussion of the architectural projects sponsored by Hieron at Syracuse.
VIII. Capacity, Population and Purpose.

One way of contextualizing the Morgantina granaries is to calculate their capacities to hold dry grains. Quantifying the limits of storage should allow for reasonable discussion of their relationship to taxation, local food supply, and agricultural production in the region. Much work remains to be done on these subjects, both in terms of Morgantina specifically and Sicily more generally.

As discrete units of volume, the granaries provide a unique window into cereal productivity and land–use in the territory of Morgantina during the third century BCE. Determining the volume of the granaries could allow for estimates to be made as to the total amount of area under cultivation in the territory of Morgantina for the period that the granaries were in use. The size of the granaries, and therefore their capacity, almost certainly corresponded to the specific purpose for which they were built.

Of course, the specific purpose for which the granaries were built is (and will likely remain) a question difficult to definitively answer. If the granaries were built to store grain that would be distributed to the community in the event of a food shortage, their capacity should bear some relation to the city’s population in the middle of the third century. In this scenario, the size of the urban population multiplied by the length of time distributions were intended to last were surely two of the principal parameters used to determine the size of the granaries. This is a difficult hypothesis to test as we have no definitive statistics for the city’s population at the time of their construction. Thus, we should be cautious to avoid circular arguments by using the estimated capacity of the granaries to “confirm” prior estimates of the city’s population or vice–versa.
The same danger is present in treating the granaries as royal warehouses for tithe grain, despite there being good reasons to believe they were built to hold the grain owed to Hieron by the community. In this scenario, we may determine the approximate amount of grain that the citizens of Morgantina were expected to turn over to Hieron, by calculating the volumes of these two granaries. From this amount, one could then arrive at an estimate of the total productivity for the territory by multiplying their capacity by a magnitude of ten.

All calculations from this point forward are necessarily impressionistic. Yet if we remain conscious of the pitfalls that accompany such speculative work, we stand to learn a great deal about agricultural productivity in the territory of Morgantina, since even when working with approximate figures, we can begin to establish the parameters, the highs and lows, of what is possible. It is in the discussions that will hopefully follow this dissertation, whether in critiquing the method or garnering additional data–sets for analysis, that refinements to the method will be made.

**VIIIa. Capacity of the Morgantina Granaries.**

Let us begin with the most secure evidence available—the granaries themselves. At its greatest exterior dimensions, the East Granary measures 92.85m in length and 7.8m in width. The maximum interior area of the building that could be used for storage is approximately 85m by 6m or 510m², assuming for the moment that the elevated floor ran across the entirety of the building’s interior. Determining the surface area of the West Granary is more problematic since the southern end has never been discovered and was likely destroyed by the construction of the seventeenth–century palazzo, which now rests on top of the very location where the ancient building once stood. Despite this
inconvenience, there is good reason to believe that the building was the same length as Room B of the East Granary and was thus originally just over 40m in length. Its interior width has been documented through several excavations to be ca. 5.4m. Given these dimensions, the West Granary may be said to have a maximum interior surface area of 216m². The combined surface area of the two granaries was, at most, 726m². This number represents an upper limit. The actual area available for storage was almost certainly smaller, although we cannot say by how much.

The next step in estimating the building’s capacity requires that we supply figures for several unknown factors, including the height of the walls above the elevated floor, the height at which grain was piled, and the method used to store the grain. Chart 1 offers a range of upper and lower amounts for the volumetric capacity of each granary according to the various parameters outlined in the following section. These estimates are solely intended to give an impression of the possibilities inherent in the size and capacity of these buildings. Their value derives not from any implied precision but rather from the fact that they are a starting point from which we can begin an informed interrogation of the granaries’ relationship to populations, taxes, and agricultural productivity.

We can begin by considering the various methods for storing grain in above-ground granaries, of which there are (and were in antiquity) three principal methods—in sacks, loose in piles, and within large bins. Each method has its advantages and

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223 Calculations will be carried out using the specific qualities of un–hulled wheat, which has an average weight of 0.79g per liter. Calculations regarding the storage of barley will be cited in the footnotes, when relevant. Barley, which has an average weight of 0.62g per liter, is a less dense grain compared to wheat. It also possesses fewer calories by volume than wheat.
disadvantages and all three are potentially viable storage options for the Morgantina granaries.

Grain piled loose on the elevated floor of the granaries is the most basic method. The advantage of storing grain in this way was that it could be easily monitored and regulated in terms of ambient temperature, moisture content, and infestation by pests (rodents, insects, etc.). Loose grain stored in such large quantities does have the disadvantage that it is liable to flow when piled to a height greater than its angle of repose, which for grains of wheat is 28°. One could envision grain stored in sloping piles in the center of the room, with a ridge—the highest point of the pile—running along the long axis of the building. This would lead to greater pressure on the floors than on the walls of the building. Alternatively, grain could be placed in sloping piles against the walls, leaving an access corridor down the center of the building. Grain stored in this fashion would place greater force on the walls than on the floors, at least along the center line of the building. The heavy masonry construction appears to anticipate the lateral thrust of grain and future structural analysis of the building may help to determine the amount of lateral force that the walls could withstand before buckling out.

When calculating the capacity of a space in which grains are stored loose and upon a horizontal surface, it is necessary to take into account the angle of repose, or the maximum angle of slope relative to the horizontal plane a granular material can withstand before sliding. The angle is measured on a range between 0° and 90° and will change depending on the type of material being piled. For barley, the angle of repose is generally calculated to 30°, a slightly steeper angle than wheat. These angles are for dry grains. Wet grains would have a slightly greater angle of repose.

Structural limitations allow for upper limits to be placed on the height at which grain was stored in the Morgantina granaries. It is the horizontal thrust of massive quantities of grain, more so than the vertical pressure, that acts as a limiting factor. The buildings’ characteristic interior and exterior buttresses were clearly designed with this purpose in mind. Unsurprisingly, the horizontal pressure increases with depth. This pressure exerted by grain is called the Equivalent Fluid Density (EFD) and varies according to the type of grain. To calculate the lateral force applied to a wall, one multiplies the depth of grain by the specific EFD for the type of grain, which for HRS wheat is 24 lbs. per cubic foot; HELLEVANG (1998). Thus, when wheat is stacked to a depth of six feet, the lateral pressure exerted at the bottom of the pile is equivalent to 144 pounds per square foot (EFD x Depth; 24 x 6 = 144). At this depth, the total force exerted on the wall is 432 pounds per linear foot (144 x 6 / 2).

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224 When calculating the capacity of a space in which grains are stored loose and upon a horizontal surface, it is necessary to take into account the angle of repose, or the maximum angle of slope relative to the horizontal plane a granular material can withstand before sliding. The angle is measured on a range between 0° and 90° and will change depending on the type of material being piled. For barley, the angle of repose is generally calculated to 30°, a slightly steeper angle than wheat. These angles are for dry grains. Wet grains would have a slightly greater angle of repose.

225 Structural limitations allow for upper limits to be placed on the height at which grain was stored in the Morgantina granaries. It is the horizontal thrust of massive quantities of grain, more so than the vertical pressure, that acts as a limiting factor. The buildings’ characteristic interior and exterior buttresses were clearly designed with this purpose in mind. Unsurprisingly, the horizontal pressure increases with depth. This pressure exerted by grain is called the Equivalent Fluid Density (EFD) and varies according to the type of grain. To calculate the lateral force applied to a wall, one multiplies the depth of grain by the specific EFD for the type of grain, which for HRS wheat is 24 lbs. per cubic foot; HELLEVANG (1998). Thus, when wheat is stacked to a depth of six feet, the lateral pressure exerted at the bottom of the pile is equivalent to 144 pounds per square foot (EFD x Depth; 24 x 6 = 144). At this depth, the total force exerted on the wall is 432 pounds per linear foot (144 x 6 / 2).
A second option is that the grain was stored in large bins, made of wood or another organic material. Rickman suggests that wooden bins were standard in Roman military granaries. According to his reconstruction, wooden bins ran along the sides of the building leaving a central aisle down the center of the building. He cites the presence of buttresses down the long walls as support for his position, suggesting that they would have helped to check the strong lateral thrust of the grain. The use of bins as Rickman reconstructs them would allow for an open passageway, making access to grain conceivably easier, but would reduce the total area over which grain could be stored. Yet, if properly reinforced, bins would allow grain to be piled to a height sufficient to offset the losses in the amount of floor space to be left free for access. In the same fashion, a series of large wicker or reed containers lining the walls of the building may have been an alternative to wooden bins. Large wicker containers, cylindrical in form and some with capacities of over 1,000L, were used to store cereals in Sicily well into the early 20th century.

A third option is that grain was stored in sacks. The advantages of using sacks included ease of transportation and handling. Sacks could be stacked to a greater height than loose grain without the problems of flow or extreme lateral thrust. There were also administrative advantages to using sacks. If the sacks came in standardized sizes, as must have been the case, they would allow for greater efficiency in the assessment of amounts stored within the granaries as well as those being deposited or withdrawn. Philip Mayerson has presented a persuasive case for the use of standardized sacks for the storage and transport of tax–grain in Egypt during the Ptolemaic period. Given the

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226 RICKMAN (1971, 236–7, fig. 47).
widespread emergence of standardized terracotta measures in Sicily during this period, it seems altogether possible that similar steps were taken to standardize storage in larger units, namely sacks. Whether individual farmers carried their grain to the granaries in sacks or it was transferred to standardized sacks at the granary itself, the use of standardized sacks would have made large-scale storage and processing altogether more efficient.

Given that many uncertainties surround the method by which grain was stored in the Morgantina granaries, I have opted to estimate their capacity using several, ultimately arbitrary, figures. First, the amount of floor space over which grain was stored. Since the two buildings share an interior width of approximately 6m, that figure will serve as the upper limit, while 4m will serve as the lower limit, allowing for a 2m wide aisle down the center of the building. The second variable is the height at which the grain was stored. Here, too, I have opted to estimate using two fixed amounts, 1.5m and 2m, as if grain was stored at a level plane. While imperfect, this method simplifies calculations and allows for a general impression of the volumetric capacity of these buildings. Chart 1 summarizes the calculations made, based on these variables for area and height of storage.
Taken together, the estimated capacity of the Morgantina granaries ranges from approximately 750,000 to 1,500,000 liters, based on the aforementioned structural and practical considerations. These numbers reflect, I believe, reasonable upper– and lower– limits for the storage capabilities of the two buildings. They are not, however, precise measurements of capacity.

One important factor to consider is that, whether or not these buildings were ever filled to capacity (whatever that may have been), those responsible for their construction—whether the citizens of Morgantina or Hieron II—considered their size and capacity to be reasonable for the purpose they were intended to serve. In other words,
their size was not determined arbitrarily but almost certainly reflects a calculated choice. For this very reason, the above estimates are valuable, since, even if they are not precise measures of the buildings’ joint capacity, they can offer some insight into the intended purpose of the grain held within the buildings. But can knowing the approximate capacity of the buildings help us determine their intended purpose, whether as storerooms for civic use or for grain owed to Hieron?

**VIIIb. Capacity and Population.**

Let us first consider a possible civic function, in which we might contextualize their capacity in terms of nutritional value and the potential carrying capacity for the population of Morgantina during the mid–third century. Several methods have been advanced to estimate the urban population of third–century Morgantina, namely the population residing within the city walls on the Serra Orlando ridge as well as those living on the Cittadella Hill. It was undoubtedly at this moment, between ca. 300 and 211 BCE, that the urban demographic reached its peak. Although large portions of the ancient city remain unexcavated, population growth may be reasonably inferred from greater residential presence at the outskirts of the city. This is most evident in the reoccupation of the Cittadella over a century after the hill was largely abandoned. Residential quarters identified on Papa Hill and Contrada Drago, which date to the third century, would appear to reflect a rather high density of occupation across the city.

On the high end, Shelley Stone has estimated that the pre–211 population of Morgantina was on the order of 10,000 individuals at its height.\(^{228}\) Stone arrived at this number by calculating the approximate inhabited area of the site and dividing that

\(^{228}\) *MS* VI, 16, n.36
number by 40 (m²), an estimated unit of population density. This is a demographic formula developed by G. Story for estimating population densities of ancient Roman cities. Stone used Story’s formula for first–century Pompeii, since the walled area of the two cities was roughly equivalent.\textsuperscript{229} Another method would be to extrapolate demographic data from the number of household lots contained within the city walls. Taking this approach, Malcolm Bell arrived at an estimate of 6,000 individuals for the population of third–century Morgantina, by multiplying the maximum number of standard lots that would fit on the Serra Orlando ridge, roughly 1,200 in total, by 5, which he took as an average number of people per lot or household.\textsuperscript{230} Stone’s figures seem too large, even at the height of the city’s prosperity. If, for argument’s sake, we accept Bell’s proposal of 6,000 for the city’s population, how then do these demographic figures fit with the evidence from the granaries? As is outlined in Chart 1, the capacity of the buildings ranged anywhere from c. 700,000 liters to c. 1,500,00 liters of grain.\textsuperscript{231} How do these figures translate in terms of carrying capacity?

The first step is to establish how much grain a person consumed on average. Estimates of cereal consumption in the ancient world tend to fall around the figure of 212 kg/person/year, based on work conducted by Foxhall and Forbes that correlated ancient

\textsuperscript{229} STOREY (1997, 101–30).
\textsuperscript{230} BELL (2006, 121, n. 23). This number may be further refined by removing from the equation all the lots that fall on terrain too steep for construction or are otherwise known to have non–residential architecture. Still another means of estimating the city’s population would be to extrapolate numbers from buildings that were intended to accommodate large groups of people, such as the city’s theater, ekklesiasterion, and bouleuterion. All three were built in the middle of the third century and thus we might reasonably expect that their sizes, and hence capacities, offer accurate reflections of the contemporary population size.
\textsuperscript{231} The minimum here is the sum of the East Granary, with surface area of 240m², and West Granary, with surface area of 160m², when grain piled to a uniform height of 1.5 meters. The maximum figure is calculated as the sum of the East Granary, with surface area of 510m², and West Granary, with surface area of 160m², when grain piled to a uniform height of 2.0 meters.
testimonia with modern statistics of consumption among Greek peasants. They concluded that on average an ancient Greek adult male required about 3,350 cal/day and an adult female roughly 2,450 cal/day. Gallant adapted these numbers slightly, offering a range of estimates for each member of the household that reflects presumed changes in caloric intake over the span of an individual’s life. However, as Foxhall, Forbes, and many others have rightly observed, the ancient diet did not consist of grains alone. Rather, it is likely that grains made up around 65–70% of the caloric requirements. So, if we accept the figure of 2,900 cal/day as the average caloric intake needed for subsistence, we arrive at a number around 1,885 calories from cereals assuming that 65% of the diet was made up of cereals.

Taking the figure of 1,885 cal/day (657,000 cal./year) as a baseline, the granaries—when filled to capacity—would have held enough grain to feed anywhere from 2,402 to 6,006 adult males for one year. The true carrying capacity would again be subject to variability depending on several factors including the number of women, adolescents, and children consuming the grain, the type of grain stored within, as well as what percentage of the daily caloric requirements that were being met by grains. The upper carrying capacity of approximately 6,000 people is not far off from the population estimate offered by Bell. This is if we assume that the grain stored within the buildings

232 FOXHALL and FORBES (1982). This study forms the basis of many later inquiries into the ancient diet, including notably GARNSEY (1984, 1988a), GARNSEY, GALLANT and RATHBONE (1984), GALLANT (1991). Ancient sources collected by Foxhall and Forbes often cite the figure of one choinix of grain as a daily ration. Containing roughly 2,800 calories, a choinix of wheat would have been more than required for an adult male, if their caloric intake was met with only 65% from grain (= 1,950 cal/day). At this rate, an adult male would consume 5.3 medimnoi of wheat alone (1 medimnos = c. 40 kg of wheat), or roughly 3.5 medimnoi, assuming wheat made up only 65% of the caloric intake.

233 See, for instance, GALLANT (1991); Reger (1994, 87).

234 This is the number given by GALLANT (1991) and followed by Reger (1994, 87).

235 Taking the number 657,000 calories, as the standard amount of calories from grains consumed by an adult male in a twelve–month period.
was intended for consumption throughout the entire year, for instance during an extended siege or long-term food crisis. If, however, we assume the grain was intended to serve as an emergency reserve consumed over a shorter period of time (e.g. four months) as appears to have been common practice among Hellenistic communities, the estimated stores could support a much larger population, perhaps closer to the 10,000 individuals that Shelley Stone has estimated for third-century Morgantina. Thus, it would appear that the granaries could hold enough grain to potentially feed the whole of the city’s estimated population for upwards of a year.

The capacity of the granaries accords well with the proposed population figures for third-century Morgantina, but what about the capacity in terms of the tithe owed by Morgantina to Hieron? Are we dealing with a figure too large to be considered only ten-percent of the territory’s annual production?

**VIIIc. Capacity and Tithe.**

Using the same upper and lower figures, can we determine whether these buildings were instead intended to hold the tithe owed to Hieron by the surrounding community. It may be useful when speaking of the tithe to convert the amounts from modern units of measurement, namely liters, into ancient units, of which the *medimnos* seems most appropriate. As was discussed in Chapter 2, the “Sicilian *medimnos*” is generally thought to have contained roughly 52.25L.\(^{236}\) Using this figure, the combined capacity of the granaries comes out to roughly 14,354 *medimnoi* at their lower-limit and 28,709 *medimnoi* at their upper-limit.

\(^{236}\) CORRETTI (2001); VIEDEBANTT (1931, 89–90).
There is unfortunately little evidence for the amount of grain paid in tax to Hieron during the third century. The best evidence we are left with are the references to gifts of grain given by Hieron to the Romans, which were most likely comprised of the grain he collected in taxes. The largest recorded gift of grain made by Hieron occurred after the Roman defeat at Cannae in 216 BCE, when he sent his grain–fleet to Ostia carrying 300,000 \textit{modii} of wheat and 200,000 \textit{modii} of barley. Allowing for minor variation between the volume of wheat and barley, this amounts to roughly 4.5 million liters of grain or approximately 86,125 \textit{medimnoi}, which is close to three times the amount of grain contained within the Morgantina granaries at their upper capacity.

These figures may also be compared to the amounts of grain reportedly paid by Sicilian towns during the Late Republican period, as mentioned in Cicero’s Verrine Orations. Recent scholarship has rightly brought attention to the unreliability of Cicero’s figures given the polemical quality of his speeches. Compounding the potential for inaccuracy is the fact that in many cases the amounts reportedly paid by cities are greater than the amount owed in tithe. For instance, in 73 BCE the citizens of Herbita were compelled to pay the tithe collector almost three times the amount that had been bid on as the tithe.\footnote{Cicero, \textit{Verr.} iii.32; also, PRITCHARD (1971, 232). This is only one of more than a dozen cases where Cicero reports that corruption on the part of Verres or tax collectors lead to cities being forced to pay more grain than ten percent of annual production; see, \textit{Verr.} iii.43.103.} Keeping in mind these potential inaccuracies, there are nevertheless fruitful parallels to be drawn from comparisons between the amount of grain that the granaries at Morgantina could potentially hold and the amounts given by Cicero for communities in the first century BCE (Chart 2).
The estimated capacity of the Morgantina granaries, at both the low and high estimates, falls within the range of the amounts reportedly paid by Sicilian communities during the governorship of Gaius Verres. It is generally believed that during the same period the total amount of grain paid in tithe by Sicilian communities came to approximately 3,000,000 *modii* or roughly 500,000 *medimnoi*. Taking this figures at face value, as an accurate reflection of the order of magnitude of grain collected as tithe, the capacity of Morgantina’s granaries represents anywhere from 3% to 6% of the total tithe. Here too, it is difficult to know what to think of these figures in relationship to one another, given the relative degree of uncertainty in their accuracy. However, if we consider the amount of area controlled by Morgantina (ca. 300 km²) in relation to the total area of the island (25,711 km²), we find that the city and its territory occupied not much more than 1% of the total area of the island. More work needs to be done to refine the amount of area available for cultivation of cereals around Morgantina, but by the broadest measure the

<table>
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<th>Estimated Capacity of Morgantina Granaries (in medimnoi)</th>
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<tr>
<td>lower-limit</td>
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<td>14,354</td>
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<td>upper-limit</td>
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<td>28,709</td>
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<th>Amounts mentioned by Cicero*</th>
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<tr>
<td>Etna:</td>
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<tr>
<td>50,000</td>
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<td>ii.44.106</td>
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<td>Leonini:</td>
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<td>36,000</td>
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<td>ii.46.110; 49.116</td>
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<td>Halaea:</td>
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<td>Herbita: [71 BCE]</td>
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<td>8,500</td>
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<td>iii.32</td>
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<td>Henna:</td>
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<td>8,200</td>
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<td>ii.42.100</td>
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<td>Thermiae:</td>
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<td>8,000</td>
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<td>ii.42.99</td>
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<td>Petra:</td>
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<td>3,000</td>
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<td>ii.39.90</td>
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<td>Herbita: [73 BCE]</td>
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<td>3,000</td>
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<td>iii.32</td>
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<td>833</td>
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<td>Amestraus:</td>
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<td>800</td>
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<td>ii.39.89</td>
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<td>Diocles Phimes of Panhormus:</td>
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<td>654</td>
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<td>ii.40.93</td>
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*Figures given in modii by Cicero have been converted into medimnoi, using the conversion rate of 6 modii to 1 medimnos.
estimated capacity of the Morgantina granaries could have been suited for the amount owed by the city as tithe to Hieron.

**VIIIId. Tithe and Territories.**

Assuming for the moment that the grain held in the granaries was, in fact, Morgantina’s annual tithe, it is possible to take the upper and lower figures and make projections about the total amount of grain produced in the territory as well as the amount of land necessary to produce that grain. Again, the purpose of such an exercise is simply to offer preliminary observations on the subject. As with estimating the capacity of the granaries, the calculations and figures are ultimately speculative and are intended only to give a sense of scale.

For the purpose of the following, it will be assumed that the joint capacity of the Morgantina granaries represents 10% of the total production within the territory. It will also be assumed that the granaries were filled with wheat alone, which has a different weight, volume, and average yield than barley, the other principal crop grown in Sicily. Accordingly, the projected area required to fill the granaries to capacity will be calculated according to specific qualities of wheat and is thus open to refinements based on calculations reflecting the qualities of barley or other non–cereal crops.\(^{238}\) If the agricultural tithe of the Morgantinoi amounted to anywhere between 14,354 and 28,709 *medimnoi*, then the total annual production must have been on the order of 143,540 to

\(^{238}\) It would be wrong to believe that the citizens of Morgantina practiced only mono–culture, production of wheat, or bi–culture, wheat and barley. Literary and archaeological evidence agree that Sicily, in general, and Morgantina, in particular, benefitted from a diversity of agriculture. Still, there are many prudent reasons to believe that wheat was the predominant crop in the region, not the least being its nutritional and economic value, the latter of which will be addressed in Chapter 4. Barley, too, was a favored agricultural product, due in part to its durability given the hot, arid summers of central Sicily. GALLO (1989, 38–42) makes a strong case for the widespread production and consumption of barley on the island, even throughout the Hellenistic and Roman periods, when wheat is generally believed to have been the focus of agricultural production.
287,090 *medimnoi*, which for ease of calculation can be rounded to 145,000 and 290,000 *medimnoi*. How do these figures translate in terms of the amount of land necessary to produce this much grain?

To determine the area of land required to produce almost 300,000 *medimnoi* of wheat, we must first determine the average yield of the land. For this we are fortunate to have both ancient and early modern testimony. Based on the available ancient *testimonia*, discussed at length by authors such as Paul Erdkamp, Peter Garnsey, and Richard Saller, I believe average returns of 8:1–10:1 for wheat in the region of southeastern Sicily are reasonable figures.\(^{239}\) Useful in this respect are figures recorded for early–modern crop yields in Sicily.\(^{240}\) Between the years 1270 and 1501, grain yields as reported around the island averaged 8–10:1 for wheat and 10:1 for barley.\(^{241}\) These figures are remarkably close to Cicero’s general forecast of returns from the island around the middle of the first century BCE, including the oft–cited and repudiated figure of 10:1 returns on wheat from the *ager Leontini*. The harvest to sown ratio tells us about productivity, but what about average amounts sown per field? With so many unknown factors surrounding the issue of how much grain was sown and the amount of land devoted to cereal production, I have decided to base the following calculations for the territory of Morgantina on the figure of 625 kilograms per hectare (625 kg/ha) that Garnsey proposed as the average yield for

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\(^{239}\) ERDKAMP (2005, 216); GARNSEY and SALLER (1987, 80); GARNSEY (1988, 101). PRITCHARD (1972, 650), following Carcopino, suggests that the 8:1 to 10:1 yields given by Cicero for the *ager Leontini* may have been close to an island–wide average.

\(^{240}\) BARBARGALLO (1904, 477–504); PRATT and FUNNELL (1997, 194–207).

\(^{241}\) EPSTEIN (2003, 275); see also BRESC (1986, 123–125), who summarizes records from the three maserie in the region outside of Palermo (San Marino) that give crop–yields for wheat and barley for the years 1373 and 1378. We may be relatively comfortable in using this data, since it appears that the ancient Mediterranean climate was not drastically different from that today. Many scholars agree that the modern climate may serve as a reliable proxy for ancient conditions; see, for instance, DEANGELIS (2000); PERRY (1997); RACKHAM (1996); REALE and DIRMEYER (2000). Furthermore, research suggests that prior to the introduction of chemical fertilizers into regular agricultural practice following the Second World War, the agrarian landscape of central Sicily was not substantially different from that of the preceding two millennia; BETHEMONT and PELLENTIER (1983, 191–92).
Attica and Lemnos during the fifth century BCE. Starting with the lower figure of 145,000 medimnoi for the total productive capacity of the territory of Morgantina and using the figure of 625 kg/ha, when 1 medimnos weighs about 40 kg, we arrive at a total required land–use of 9,280 ha or 92.8 km². For the higher amount, the required land–use would be roughly twice the size, on the order of 18,560 ha or 185.6 km². This is a substantial amount of land to be cultivated and would have presumably required quite a large work force. Nevertheless, both numbers fall well within 300 km², which is the minimum size of the city’s territorial extent proposed by Steven Thompson. These numbers are also not far off from the figures given by Cicero for production in the ager Leontini during the first century BCE. Cicero claims that 30,000 iugera of the ager Leontini was sewn with wheat, producing roughly 300,000 medimnoi annually. When compared with the calculations made for Morgantina, we find that the expected size and productivity for the two territories comes fairly close, since 30,000 iugera translates to approximately 75.75 km², which is not far off from the projected amount of land under cultivation (ca 92.8–185 km²) in the territory of Morgantina. Future survey work in the chora around Morgantina should shed new light on the size and extent of the city’s territory during the third century BCE.

IX. Conclusion: Sicilian Granaries in the Roman Period.

Archaeological evidence recovered from within the two granaries supports the conclusion that both buildings were abandoned in the years immediately following the

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243 For instance, if we assume that the “average” holding in the area was roughly 50 iugera (ca. 12.5 ha), the territory required by the yield projection would translate to roughly 1,500 farmers. This does not even take into account the fact that farms of 50 iugera would almost certainly not have devoted 100% of land to cereal production.
244 THOMPSON (1999, 495–6).
capture of the city in 211 BCE. Excavators found traces of brief squatter occupation at a level just below the collapsed roof of the West Granary. Since no material dating to the second century was found below the tile–fall, the granary’s abandonment and collapse most plausibly dates to the last decade of the third century. Similarly, the presence of a small hoard of late third–century bronze coins, coupled with an accumulation of ceramic debris, in Room B of the East Granary points to an equally early terminus for its abandonment as a warehouse. It is striking that there was no evidence recovered in either of the granaries to suggest the buildings were destroyed during the siege of 211 BCE, an event which lead to well–documented destruction elsewhere in the city. Rather, the abandonment of the granaries appears to have been the result of other factors, such as the large–scale depopulation of the urban center and changes in the methods and policies of tax collection.

The abandonment of the granaries at Morgantina in the late third or early second century was the result of broader changes that were occurring both within the city and throughout the island. The urban population, judging from the historical and archaeological record, seems to have diminished significantly following the city’s capture in 211 BCE. We can only speculate as to the treatment of the remaining population by the five hundred mercenaries of Moercius, who received the city from the Romans, but the archaeological evidence suggests that entire neighborhoods, such as that on top of Papa Hill, were largely abandoned around the turn of the century and were not re–inhabited. The transformation of many public buildings in the city’s agora, including the East Granary, into spaces for industrial activity has been taken as further evidence of

245 *PR* XII, 316.
246 On the nearly wholesale abandonment of the Papa Hill neighborhood, see WALTHALL (forthcoming).
the dissolution of the former civic organization which had existed during the Hieronian period. A diminished population and breakdown in civic organization may help to explain the abandonment of the granaries as storehouses for the city’s tithe grain. What cereal stores remained following the city’s capture were surely consumed and the granaries were likely stripped for building materials.

In addition to these local factors, their abandonment may also be symptomatic of changes occurring on a larger, island-wide scale, namely the re-organization of the tithe to accommodate the Roman market. The granaries at Morgantina were vestiges of an administrative infrastructure that was rendered partially obsolete by the establishment of Roman political authority over the island in the aftermath of the Second Punic War. How did the imposition of Roman administration affect the production of grain in Sicily? Livy makes it abundantly clear that Roman interests in revitalizing the agrarian landscape in Sicily and ensuring grain shipments north to Rome began immediately upon the expulsion of the Carthaginians from the island in 210 BCE. Three passages from books twenty–six and twenty–seven of his History give an indication of the post–war efforts taken by M. Valerius Laevinus, who served as consul for Sicily in 210 and then was given proconsular powers over the island in the following year. Livy writes that, as consul, Laevinus,

\[\ldots\text{coegissetque Siculos positis tandem armis ad agrum colendum animos convertere, ut esset non incolarum modo alimento frugifera insula, sed urbis Romae atque Italiae, id quod multis saepe tempestatibus fecerat, amonam leveret.}\]

\ldots compelled the Sicilians to lay down their arms at last and turn their attention to tilling the soil, so that the island might not only produce food enough for the inhabitants, but might relieve the grain market of the city of Rome and of Italy, as it had done on many occasions. (26.40.15–16).

Soon after this, the consul sent a report to the Senate to the effect that,
neminem Carthaginensem in Sicilia esse; neminem Siculum non esse; qui fugati metu inde aferunt, omnes in urbes, in agros suos reductos arare, serere; desertam recoli terram, tandem frugiferam ipsis cultoribus populoque Romano pace ac bello fidissimum annonae subsidium.

there was not a Carthaginian in Sicily, that not a Sicilian was absent; that those who had been absent, banished by their fears, had all been brought back to their cities, to their lands, and were ploughing and sowing, a deserted land was again under cultivation, productive at last for the farmers themselves and for the Roman people in peace and in war a most dependable source of grain. (27.5.4–5).

And the next year, Valerius was again in Sicily where he reportedly,

provinciam peragrabat, ut viseret agros cultaque ab incultis notaret et perinde dominos laudaret castigaretque. ita tantum ea cura frumenti provenit ut et Romam mitteret et Catinam conveyeret unde exercitui qui ad Tarentum aestiva acturus esset posset praebiri.

roamed around his province in order to visit the farms and to distinguish between cultivated and uncultivated lands, and to praise or upbraid the owners accordingly. So, owing to such diligence, such a crop of grain was produced that he sent grain to Rome and also transported it to Catania, whence it could be supplied to the army, which was to have its summer camp near Tarentum. (27.8.18–19).

These passages reveal not only Rome’s interest in revitalizing the island’s agricultural base, primarily for the benefit of Roman citizen and soldier populations (populoque Romano pace ac bello fidissimum annonae subsidium), but also hint at broader, structural changes occurring in the movement of grain on the island.

The organization of the tithe administration under Hieron appears to have set limitations on the movement of grain. For instance, Hieron used the proceeds of the tithe as a source of revenue and capital. This meant that grain could be stored in the royal granaries at Syracuse until such time when he decided to sell it (generating revenue) or give it away as gifts (generating symbolic capital as a euergetes). Judging from the organization of the Ptolemies’ network of royal granaries, it seems reasonable to assume that Hieron would also find it advantageous to create sub–regional points of collection
and storage throughout his kingdom. The construction and use of the granaries at Morgantina reflected such a need for sub-regional collection and storage of grain.

In contrast, once the island and its agricultural resources fell to Rome with its insatiable demand for grain, there was no longer any need to systematically stockpile grain in Sicily, especially at locations around the island’s interior. Rather, tithe grain was brought immediately to ports where it could be loaded onto ships and sent off to Ostia or Brundisium. This renewed focus on the coastal cities of Sicily is reflected in Cicero’s account of the tithe administration during the Late Republic. According to Cicero, Verres had issued a proclamation that all tithe grain was to be brought to a harbor or navigable river (deportatio ad aquam) by the first of August. The archaeological record reflects the growing importance of the cities along the north and east coast of the island, which flourished during the second and first centuries BCE, undoubtedly due to their role in supplying Rome with Sicilian grain.

The next chapter turns to address the movement of grain on the island in terms of taxation and trade. It will be argued that the administrative policies developed during the reign of Hieron II to bring about an efficient taxation regime (standardization of measure, creation of regional collection points for tax grain, etc.) in turn shaped economic activity in eastern Sicily. As was the case with the Morgantina granaries, Chapter Four will address the material changes that resulted from broader administrative policies pursued by Hieron and the Romans.

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247 The Romans may have also discouraged or forbade Sicilian cities from stockpiling large amounts of grain, which could be used during a siege.
249 For instance, see PERKINS (2012) who discusses the role of Panormus in supplying grain to Rome and the socio-economic impacts on the surrounding region.
CHAPTER IV: THE MARKET

I. Tax as Institution: Hieronian Tithe Administration & New Institutional Economics.

Chapters Two and Three focused on the archaeological evidence related to the policies designed to extract agricultural resources from Hieron’s kingdom. The present chapter deals with the impact of these policies on the Sicilian communities subject to the tithe. Scholarly attention has tended to privilege the beneficiaries of the tithe, with discussion, more often than not, centered on estimating the quantity of Sicilian grain reaching Rome and the resulting implications that these figures have on modern conjectures about the urban population of the capital during the late Republic and early Empire. The social, political, and economic realities experienced by the tithe–paying communities have been a far less compelling subject of inquiry. Such limited engagement with the subject from the perspective of those who actually paid it is undoubtedly a consequence of several factors, not the least being the relative paucity of surviving literary or documentary sources that deal with the subject. Somewhat paradoxically, it is perhaps the engrossing detail presented in our principal source on the subject, Cicero’s third speech (De frumento) against Gaius Verres, that has contributed as much if not more to our general indifference on the matter.

Cicero paints a disturbing picture of the tithe administration during the governorship of Gaius Verres (73–70 BCE). Overtaxed, unfairly fined, and unjustly punished, some farmers chose to abandon their fields, others let their grain rot on threshing floors, and even a few chose death, rather than suffer at the hands of Verres and his henchmen. In only three years the island’s overall productivity dramatically decreased.
Although Cicero constructs his argument around the plight of the Sicilian farmer, he is nevertheless careful to remind his audience that what was truly at stake,

\[ \text{cumvero perditis profligatisque sociis vectigalia populi Romani sint diminuta, res frumentaria, comnetaus, copiae, salus urbis atque exercitu in nostrorum in posteritatem istius avaritia interierit, saltem populi Romani commoda respicite si sociis fidelissimis prospicere non laboratis. (2 Verr. 3.127)} \]

But when our allies are oppressed and ruined, and the revenues of the Roman people diminished at the same time—when our supplies of grain and provisions, our wealth, and the safety of the city and of our armies for the future is destroyed by his avarice, at least have a regard to the advantage of the Roman people, if you have no anxiety to show your regard for our most faithful allies. (Transl. Yonge, adapted).

Cicero’s message is clear: when Sicilian farmers failed to produce, it was the Romans who suffered.

No such detailed account survives to elucidate the treatment of tithe–paying communities during the third century. If we take Cicero at his word, the tithe administration reached its absolute nadir during the governorship of Verres, whose greed and mismanagement had upset a precious equilibrium that had long defined the relationship between Rome and the tithe–paying cities of Sicily.\(^{250}\) It seems reasonable then to expect that a fairly stable relationship existed between the farmers and Hieron’s royal administration. The system must have worked well enough to have been sufficiently attractive for the Romans. And, while the few literary references to Hieron’s rule might lead one to conclude that his reign marked the zenith of life as a Sicilian farmer, particularly when juxtaposed with the situation that developed under Verres, we should not forget that even under Hieron we are dealing with an administrative system designed to extract resources from a politically subordinate population. There can be no

\(^{250}\) So much so that in 71 BCE, the Sicilian communities were not able to collectively supply the additional 800,000 modii requisitioned by the Senate and were instead forced to buy that amount from Verres himself, who had been stockpiling grain; Verr. 2.3.177–9; see also PRITCHARD (1971, 236).
doubt that the burden of Hieron’s tithe was acutely felt by some portion of the kingdom’s population.

Even still, there is reason to believe that for some communities the tithe system produced a certain set of conditions that was somehow qualitatively better under Hieron than under Roman rule. The obvious test case is Syracuse, which certainly benefitted as the seat of Hieron’s court and the commercial hub of his kingdom but later struggled to recover following the siege and capture in 212 BCE.\textsuperscript{251} As the locus of political power shifted north to Rome in the late third and early second centuries, a corresponding shift occurred in Sicily as many cities on the island’s north coast, such as Tyndari and Halaesa, enjoyed moments of great civic prosperity during the first few centuries of Roman rule.\textsuperscript{252}

To achieve greater detail in our picture of the ways in which Hieron’s tithe was experienced by communities in the third–century BCE, it will again be profitable to address the question through the material record. The construction of monumental granaries, appearance of standardized measures, and arrival of the host of officials and personnel that surely accompanied the tithe administration, were of course all palpable expressions of royal power and authority over the communities that belonged to the kingdom. What follows then is an attempt to define what might be most broadly described as the economic impacts of the tithe on the communities involved. Archaeological data lends itself quite well to such an analysis, as material evidence can be treated with some confidence as indicators of economic activity. For instance, coin finds may reveal patterns of circulation and degrees of monetization, imported ceramics might tell us about inter–regional trade networks and market integration, and architecture,

\textsuperscript{251} On the slow recovery of Syracuse, Livy 29.1.
\textsuperscript{252} For the basics, see WILSON (1990, 17–32).
both public and private, can signify the accumulation of wealth as well as index social stratification.

The theoretical framework in which such evidence will be interpreted is provided by a new development in the field of economic history. Since the 1990’s, there has been growing engagement among archaeologists and ancient historians with the economic theories advanced by Douglass North and proponents of New Institutional Economics.\(^{253}\) The emphasis on the role of institutions in shaping economic behavior has found many advocates wishing to better understand the structure of the economy and economic performance in the ancient Mediterranean.\(^{254}\) As Peter Bang and others have noted, the neo–institutional approach, which developed as a partial critique of neo–classical theory, is a decidedly well–suited framework for dealing with the ancient Mediterranean economy. In offering a flexible interpretive model, NIE has been praised by some scholars as an alternate route to approach the ancient economy, outside of the traditional modernist–primitivist dichotomy.\(^{255}\)

A fundamental tenent of the NIE approach is the concept of transaction costs, which are conceived of as barriers that prevent individuals from full engagement with market exchange and other economic activities. Transaction costs help to shape the topography of behavior, economic or otherwise, and thus play a vital role in decision–making. Just as mountains can be daunting obstacles to the traveller, obscuring views and discouraging freedom of passage across a landscape, so too can transaction costs prevent an actor from engaging in, and even recognizing, certain types of economic behavior. Transaction costs can take many forms, ranging from the abstract (e.g. asymmetries of

\(^{254}\) Among others, KEHOE (2007, 29–52).
\(^{255}\) On this point, LO CASCIO (2009, 218–9).
information) to the mundane (e.g. costs of transporting goods to and from markets). With reference to the impact of asymmetry of information on the performance of markets, Peter Bang summarizes, “imperfections, irregularities and asymmetries in trading conditions enhance friction and hence transaction costs, the costs of conducting business. When these are high, it will often be either be very difficult, even outright impossible, or at least prohibitively expensive to synchronize developments in markets more closely”. Bang goes on to highlight the particular value of an institutional approach to the study of the ancient (Roman) economy, suggesting that,

By suspending the automatic belief in the achievement of economic or ecological equilibrium, institutional economics provides the conceptual tools which enable the historian to transcend the contradiction in Adam Smith’s original understanding of markets. Transaction cost analysis makes it possible to explore how a set of institutions, constrained by pre–industrial technology and dominated by agrarian aristocratic interests, affected the workings of markets in the Roman world and shaped the character of economic integration in particular ways.

Advocates of New Institutionalism have already made lasting contribution to the study of the ancient Mediterranean economy, perhaps none more valuable than revealing the flexibility of the neo–institutional approach with regards to engaging with a range of questions, data sets and time periods. In this regard, Hellenistic and Roman Sicily stand as rich fields of investigation. Neo–institutional analysis has yet to be applied with regard to the nexus of institutions and economy in the region of southeastern Sicily subject to Hieron II. What changes accompanied the formation and consolidation of the kingdom? What followed after the dissolution of the kingdom and the incorporation of the territories belonging to the former kingdom within Rome’s provincial administration?

256 BANG (2009, 58).
257 Ibid., 59.
We might consider whether the institution of Hieron’s monarchy played a part in defining and determining the economic performance of the region. I argued in Chapter Two that the consolidation of Hieron II’s political authority in southeastern Sicily, a process which brought a number of semi-autonomous cities under his sovereignty, was instrumental to the political and military stability of the region. It seems almost without question that the period of stability, in turn, influenced economic performance in the region. To develop the idea further, one might begin with the legal or contractual foundations of Hieron’s political authority, which consisted principally of the contractual relationships forged between the king and his semi-autonomous ‘allies’ and in the details of his relationship with the Romans, as defined by the 264 BCE treaty with Rome. In establishing the political boundaries of the Hieronian kingdom, the treaty provided a largely inviolate barrier against the military violence that devastated much of western Sicily during the long decades of the First and Second Punic Wars. It could then be reasonably argued that the resulting peace allowed communities to cultivate their territories, free from threat of violence, which in turn lead to improved agricultural productivity and prosperity.\footnote{For a thoughtful exposition of this point, see BELL (2011). The relationship forged between Hieron and the tithe-paying cities might be considered in terms of its contractual nature, according to which Hieron was to ensure the security of his allies in return for a share of their annual agricultural produce and forfeiture of some degree of local, civic autonomy. From the perspective of the individual communities, this contract freed them (to a degree) from the burdens associated with the wartime violence, allowing community members to allocate time and resources elsewhere.} One might develop the idea further, arguing that the central political organization further reduced transaction costs by unifying a diverse group of cities under a single authority.\footnote{On the role of the state, NORTH (1976).} The incorporation of these communities within the political and administrative institutions of the Hieronian kingdom allowed for greater access to and participation in regional and inter-regional exchange. Such was the
conclusion reached by Stephan Epstein with regard to the role of the state in facilitating trade in Medieval Sicily.\textsuperscript{260}

The remainder of the chapter will focus on clarifying the institution of the annual grain tithe and its role in shaping economic activity in southeastern Sicily both during and after the reign of Hieron II. How can we go about gauging the relationship between the tithe and the ancient economy? Given the general silence of literary and documentary sources for the time and place, we are left to rely heavily on material evidence when attempting to gauge the relationship between the tithe and economic activity in Hieronian Sicily. When possible, I try to incorporate (within reason) a broad range of documentary evidence, ethnographic research, and historical data, which is germane to the discussion at hand, though not necessarily proximate in either chronological or geographic terms. As an interpretive strategy, I will develop and test a model that posits that the tax administration lead to increased market integration in southeastern Sicily. Approaching the issue within the broader framework of a model offers the greater flexibility to interpret and explain the available data.

II. A Model for Market Integration.

IIA. The Model.

The model that I intend to develop may be summarized by the following: Hieron’s tax administration facilitated market integration among the tithe–paying communities subject to his authority. The need for efficient taxation lead to the creation

\textsuperscript{260} EPSTEIN (1992, 123) states “The state could provide a unified institutional setting in which trade could operate freely and was subject to clearly defined, non–arbitrary and contained exactions.”
of a complex administrative infrastructure designed to swiftly move goods, people, and information throughout the Hieronian kingdom. While this network was intended to facilitate the extraction of resources from the agriculturally productive areas of his kingdom, it had the added effect of linking grain–producing communities in the interior to the island’s largest urban market at Syracuse, as well as with international markets around the Mediterranean that were served by merchants and traders intending to bring back cheap grain from Sicily. I will argue that Hieron’s efforts to profit from the sale of his tithe–grain generated greater ‘international’ demand for Sicilian grain and raised Syracuse’s profile as a major Mediterranean port for purchase of grain during the third century BCE. The increased demand for Sicilian grain was met when Sicilian communities on the island’s interior sold agricultural surplus to agents operating between the interior and coast. This “piggyback” trade, on top of the existing tithe infrastructure, lead to increased income and wealth for a portion of the population as well as concomitant changes in patterns of land tenure.

In the following sections, I expand upon the two basic tenents of the model. First, I develop a case in support of associating market integration as a by–product of the policies designed to facilitate the extraction of agricultural taxes. Second, I present evidence for the participation of agrarian communities in market exchange, drawing on evidence for such behavior from ancient Mediterranean societies, as well as on ethnographic data collected by researchers studying modern and early–modern agrarian communities elsewhere in the world. Finally, I test various aspects of this model by taking Morgantina as a case study, addressing evidence for changes in wealth and land tenure which were contemporaneous with the consolidation of Hieron’s authority in the
region. Using numismatic data recovered from two commercial spaces in the city’s agora, I demonstrate that the arrival of bronze coinage to the city from mints on the coast can be plausibly associated with market exchange driven by demand for grain. If correct, this model would help to explain how policy and political institutions helped to shape both the nature of exchange and the direction of trade.

IIB. Hieron’s tax administration facilitated market integration.

The integration of markets is a topic of immense concern to economists and economic historians of ancient and modern economies alike. There is no standard definition of market integration, nor common method for analyzing or determining the “integration of markets.” Drawing from Paul Erdkamp’s analysis of market integration for grain in the Roman Mediterranean, I take the position that market integration can be measured by the degree to which the surplus grain grown in agriculturally productive areas is made available to those areas where there is greater demand than supply. Integration occurs in southeast Sicily during the third century as a result of several factors. First, the creation and enforcement of an annual tithe entailed de facto the regular transfer of surplus grain from areas of high supply to areas of high demand. Second, Hieron’s efforts to sell his own tithe–grain encouraged mercantile presence in Sicily and increased overall demand for Sicilian grain on the Mediterranean market. Third, the tithe infrastructure created or strengthened commercial links between cities on the interior and those on the coast. Fourth, the royal policy of standardization facilitated inter–state exchange by reducing transaction costs related to asymmetry of information. It should be

261 For concise summary of the variety of definitions and methods for analyzing market integration, see McNerw (1996, 1).
noted at the outset that I am in no way arguing that Hieron aimed to support market integration or economic performance within his kingdom, beyond an abiding awareness that increased productivity in his kingdom lead to greater amounts of grain due as tithe. It is clear that from the perspective of the royal administration the ultimate goal was to facilitate the efficient assessment and collection of tax–grain. The coincidental developments in market integration and economic exchange witnessed by the communities in southeast Sicily were just that—coincidental.

IIB.1. Generating Demand.
All things considered, it was probably not all that difficult to generate demand for a staple such as grain. Grain formed the principal source of nutrition for the majority of the Mediterranean’s population. Coupled with the unpredictable nature of the Mediterranean climate, one had a recipe for scarcity of supply, driven by instability of regional productivity. As Keith Hopkins put it, “sharp inter–annual fluctuations of rainfall created local gluts and local shortages and stimulated unpredictable flows of surplus stables to unpredictable markets.” Such regional instability meant that on a pan–Mediterranean level, demand for grain was on the whole inelastic. Local supply shortages resulting from crop failure or poor harvests further served to drive the development of markets and Mediterranean–wide trading networks. By the Hellenistic period grain trade in the Mediterranean was fairly well–developed. The third and second centuries are particularly rich in evidence documenting the activity of individuals invested in supplying grain to meet the demands of the market. From cities across the Aegean, we get a glimpse into the world of these individuals from honorary decrees.

262 HOPKINS (1980, 103); see also ERDKAMP (2005, 144–7); HALSTEAD and JONES (1989, 54).
264 See CASSON (1954).
praising individuals like Agathokles of Rhodes, who sold grain below market prices during times of shortage and famine.\textsuperscript{265} From the perspective of a supplier, Hieron was in a privileged position. Not only was he guaranteed the annual proceeds of the grain tithe, but his kingdom, while limited in size, extended over a region that enjoyed a high degree of inter–annual stability both in terms of rainfall and crop yield.

Flush with his annual tithe grain, Hieron too engaged with the market through a combination of sales and gifts. This was standard practice for a Hellenistic king, who generated revenue in cash as well as political capital through sales and gift of the agriculture they collected in taxation from their kingdoms.\textsuperscript{266} Gifts of grain served many purposes, not the least to highlight Hieron’s status as a generous benefactor. On several occasions Hieron reportedly made substantial gifts of grain to major Mediterranean powers, including the Romans, Carthaginians, and the Ptolemies.\textsuperscript{267} Such gifts may have been part of a larger political strategy to establish his position amidst the growing power of Rome and Carthage.\textsuperscript{268}

\begin{itemize}
\item Syll.\textsuperscript{3} 354: Ephesians honor Agathokles of Rhodes (c. 300 BCE) for selling grain below market–price.
\item Syll.\textsuperscript{3} 495: Olbians honor Protagoras (late 3\textsuperscript{rd} – early 2\textsuperscript{nd} BCE) for, among other things, selling grain below market rates on several occasions when the citizens were suffering from a shortage (ll. 23–34, 59–84). \textit{IG XI} 627: Delians honor a merchant from Byzantium (3\textsuperscript{rd} BCE) for selling 500 \textit{medimnoi} of grain to the community at below market rates.
\item BRINGMANN (2001)
\item Hieron reportedly sent large quantities of grain to the Romans on several occasions: Diodorus 23.8.1 (262 BCE, siege of Agrigentum); 24.1.4 (250 BCE, siege of Lilybaeum); 25.14 (220’s BCE, during Celtic War); Grain to Carthaginians: Polybius 1.83.2–4. Grain to Ptolemy III: Athenaeus, Deipn. 5.206e–209c. Grain to Athenian: Athenaeus, Deipn. 5. 209b.
\item This is what Peter Garnsey termed “corn diplomacy;” GARNSEY (1988, 183–185); cf. ECKSTEIN (1980). For his only known visit to Rome (237 BCE), Hieron reportedly brought 200,000 \textit{modii} of grain for distribution to the Roman people; Eutropius (3.1–3). For Hieron’s visit see also, MANUWALD (2011, 41–5). According to Livy (22.37), Hieron sent 300,000 \textit{modii} of wheat and 200,000 \textit{modii} of barley to Rome in 216 BCE, following the Battle of Lake Trasimene. In addition to grain, Hieron’s envoys also reportedly delivered a golden statue of Victory, weighing 220 pounds, and 1,000 archers and slingers to serve as auxiliaries. Later that year, Hieron responded to a request for aid made by the Roman propraetor in Sicily, T. Otacilius, by supplying the Roman legions fighting in Sicily and Sardinia with money and enough grain for six months (Livy 23.15.5). In the following year (215 BCE), Hieron reportedly sent another 200,000 \textit{modii} of wheat and 100,000 \textit{modii} of barley to the Roman legions stationed at Tarentum (Livy 23.38).
\end{itemize}
There were undoubtedly practical, economic reasons for such extravagance. Such behavior helped to advertise both the quality and quantity of his grain to potential customers and consumers. Like all Hellenistic monarchs, Hieron needed to find a way to convert his resources into useful capital. Gifts translated into recognition of status, beloved of monarchs, but Hellenistic kingdoms were not run on glory alone. Hieron needed cash too and sales of tithe–grain must have been a major source of revenue as it was for the Ptolemies and Seleucids. We should not underestimate the importance of efforts aimed at highlighting the type and quality of grain available for sale by the king. Preference for certain agricultural products, associated with particular locations or regions, is well attested in the works of Greek and Roman authors. If currently scholarly opinions on the issue are correct, the Hellenistic period saw an increased demand by urban populations for the hard durum wheat (*triticum durum*) cultivated in Sicily over other grains such as barley and soft, bread wheat.

While Hieron appears to have actively employed his grain fleet to transport royal gifts around the Mediterranean, the bulk of his actual sales most likely took place in Syracuse itself. There Hieron could sell tithe–grain to merchants, who would themselves

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269 We know that on at least one occasion, the Romans repaid Hieron for the grain he had supplied them in the previous year. Diodorus (25.14) reports that the Romans paid Hieron for the grain he has sent during the Celtic War.

270 CASSON (1950 173–8) suggests that increasing market share was a clear motivation behind many of the gifts of grain made by Hellenistic kings to cities, such as Athens, Delos, and Rhodes. He makes a particularly strong case for the grain given by the Numidian king Massinissa to Delos in 180/79 BCE, arguing that Massinissa’s gift represents a “first move” in an attempt to curry favor with the merchants who were once supplied by Hieron II. See also BRINGMANN (2001).

271 For instance, Pliny (*NH* 18.12) describes different regional varieties of wheat, ranking them by the qualities of whiteness and weight.

272 WILSON (1983/84). On the Hellenistic preference for wheat over barley, see CASSON (1950). With reference to Ptolemaic Egypt, THOMPSON (2008, 268–9), suggests that the near complete abandonment of the endogenous, and once popular (Herodotus 2.77.3–5), *Triticum monococcum*, in favor of *triticum durum* over the course of the third and second centuries was likely the result of both the increased royal support for its cultivation by the Ptolemies as well as preference for the harder grain among the urban and rural populations of Egypt; for Ptolemaic support of agriculture see also CRAWFORD (1979) and BERLIN ET AL. (2003).
transport grain to foreign markets. This arrangement guaranteed revenue for Hieron, while passing on all the risks associated with long-distance maritime trade onto the merchants themselves. Claire Préaux suggested the Ptolemies pursued a similar practice of marketing grain to merchants operating out of Alexandria.

Hieron needed to make Syracuse an attractive destination for merchants. This was surely the motivation behind the decision to grant Rhodian merchants freedom from customs–taxes (ἀτέλεια) at all ports within his kingdom, following the earthquake of 227/6 BCE. Diodorus (26.8) is explicit that it was Rhodian grain ships which were exempt from Hieron’s customs duties. Of course, Sicily was not a new destination on the Mediterranean trade circuit, but had been a major source of grain for merchants supplying foreign markets for centuries. The unparalleled position that Syracuse achieved as the principal destination for merchants seeking Sicilian grain was no doubt due to a combination of factors. Some can be identified as intrinsic elements of Hieronian policy, such as the emphasis placed on Syracuse as the seat of his royal court and as the administrative and commercial center for the collection and sale of tithe–grain. Extrinsic

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273 For Sicilian grain to Athens during the reign of Hieron II, see OLIVER (2007, 247–9), who cites two Athenian honorary decrees from middle decades of the third–century, which attest to the presence of Athenian sitonai in Sicily. One decree (SEG 3.92b, ll. 3–6), dating to the year 250/49 BCE, specifically mentions sitonai stopping in Syracuse. Shipments of Sicilian grain arriving into Athens may also be attested in two additional inscriptions dated to the late 330’s BCE (IG II² 408) and 302/1 BCE (IG II² 499, ll. 14–17).

274 PRÉAUX (1939, 150ff).

275 Polybius 5.88.7. On the deleterious effects of customs duties on market integration, see BANG (2006) 69–70.

276 For exports of grain to Rome prior to Punic Wars, see GALLO (1992). For shipments to Greece, see FANTASIA (1993) and NENCI (1993) with particular focus on Akragas. Thucydides (3.86) suggests that one reason the Athenians sent ships to Sicily in 427 BCE was to prevent shipments of Sicilian grain to the Peloponnese. Demosthenes (56.9) mentions a large shipment of Sicilian grain which, upon its arrival at the Piraeus, drove down the price of wheat throughout the city. WESTLAKE (1960) believed that regular import of Sicilian grain was essential to the well–being of Athens. But see RATHBONE (1983, 50), who calls into question the island’s reputation as a long–time supplier of grain to mainland Greece.

277 Based on more circumstantial evidence we might also expect there were also large numbers of Italian, North African, and Sicilian (particularly Syracusean) merchants engaged in buying and transporting Hieron’s grain to more favorable markets across the Mediterranean.
factors played a no less forceful role in establishing Syracuse as the foremost Sicilian port of its day. The violence wrought by the Romans and Carthaginians during the First Punic War undoubtedly played its part.\(^{278}\)

While a significant quantity of the tithe was surely purchased by merchants intending to unload the grain on foreign, non–Sicilian markets, it is also possible that a portion of the tithe–grain was sold to meet internal demand within the kingdom. By the middle of the third century, Syracuse undoubtedly maintained the island’s largest urban population, which may have required more grain than its hinterland could supply.\(^{279}\) This would certainly not be unprecedented practice for a Hellenistic monarch. There is evidence that the Ptolemies took steps to ensure that internal demand at major urban centers within Egypt was met.\(^{280}\)

According to my model, Hieron’s activities as a major grain supplier generated interest in Sicilian grain and lead to increased trade relations with foreign markets and the merchants who supplied them. Foreign demand for grain, particularly the *triticum durum* grown in Sicily, was likely to have been inelastic, considering the needs of the Mediterranean’s population as a whole. By encouraging merchants to purchase grain at Syracuse, the Hieronian policy fostered market participation of others who possessed surplus grain by strengthening ties to the agents supplying Mediterranean–wide markets.

\(^{278}\) Apart from the general violence across much of western Sicily, the destruction and depopulation that occurred at several of the island’s major port cities was undoubtedly a destabilizing blow to maritime trade networks. For instance, Zonaras (19.14–15) relays that the siege of Agrigento (ca. 262–258 BCE) ended with widespread destruction inflicted by the Romans upon the city and its inhabitants, several thousand of whom (Diod. 23.9.1, reports 25,000 persons) were sold into slavery.

\(^{279}\) BELOCH (1886, 281) estimated the population of Syracuse had reached 200,000 people by 300 BCE. Evidence for this includes royal purchases of grain, in addition to that collected as tithe, and the imposition of tariffs on grain imported from areas outside of their kingdom. The latter restriction is implied by the text of an inscription from Samothrace (Syll.3 502; ca. 228–225 BCE), in which the citizens of Samothrace ask Ptolemy III Euergetes for permission to purchase grain duty–free from the Chersonese. Samothrace was as that point in time a foreign possession of the Ptolemies. We might reasonably infer from this text that the Ptolemies intended the urban populations within their kingdom to purchase Egyptian grain. See BAGNALL (1978).
IIB.2. Connecting the Dots.

The next step in the model develops the idea that in creating an efficient tax administration, Hieronian policy shaped conditions for integrating communities on the interior with markets on the coast. The strengthening of ties between Producer and Consumer, in turn, reduced transaction costs associated with the sale of surplus grain.

Conceivably, most efforts taken by Hieron to increase the efficiency and effectiveness of his tax administration could have also had the subsidiary result of fostering ties between producers with consumers. A principal driver in this phenomenon was investment in infrastructure required to physically transport grain from sites of production to royal granaries at Syracuse. This may have been accomplished through the construction and maintenance of roads, development of a riverine transport system, creation of a network of royal granaries similar to that found in Ptolemaic Egypt.281

From the neo–institutional perspective, connections were also fostered on account of policies designed to increase the oversight of tax–collection, such as the mandatory reporting of information related to planting and harvest.282 Connections were also fostered by the institution of tax farming. Tax–farming was a well–developed practice on mainland Greece (at least in Athens) since at least the fourth century.283 The Athenian model was adopted and subsequently adapted by Hellenistic monarchs to meet the particular conditions and needs of royal administration. Reliance on tax–farming later became a key feature of the Roman administrative system during the mid and late–Republic.284

281 These are all aspects of the Hellenistic administrative system for which we remain woefully uninformed. On roads in the vicinity of Morgantina, see HOLLOWAY (1963).
282 SCRAMUZZA (1937, 237).
284 BADIAN (1972); for decline in tax–farming during early Principate, see LO CASCIO (2008, 630–46).
From the perspective of a Hellenistic king, the tax–farming structure brought many advantages, such as reducing costs and overhead associated with transportation. Perhaps most importantly, it guaranteed a steady and reliable revenue stream, which was essential for the continued operation of the kingdom. Hieron took a small loss in revenue (that percentage collected by the tax–farmer over what was bid) for assurance of payment.285

The Hieronian system relied on a high degree of transparency and reciprocity between the tithe–paying cities and Hieron’s royal administration.286 As was discussed in Chapter 1, we are fairly certain that during the third century the rights to collect the grain tithe were annually auctioned at Syracuse.287 Efficient collection and proper bidding could only take place if reporting of prior yields and acreage under seed was accurate and trustworthy. The centralized political organization of the tithe and tax–farming system encouraged a much greater degree of transparency regarding agricultural practice and productivity that would not have necessarily existed in a situation where all cities enjoyed complete autonomy. Whether or not the information was acted upon, wealthy individuals interested in bidding on the rights to collect tithes were able to learn about the productivity of a community like Morgantina. While we may not be able to quantitatively measure the impact of such policies on the degree of connectivity between communities in the interior and those on the coast, we are not beyond the qualitative judgment that in

286 BELL (2011)
287 On the public auction in third–century Egypt, see AUSTIN (2006, 522, no. 296 = BINGEN 1952, col. 34): The royal scribes shall notify [to the] tax farmers within 10 days of the [opening of the public auction] the number of vineyards or of orchards [in] each nome, the [number] of aruras they contain, [and] the number of vineyards or of orchards, belonging to persons on [the tax list], which paid taxes to the temples before the [22nd] year.
reducing asymmetry of information the system reduced a major impediment to interstate trade.

A system organized around tax farming, which is predicated on the profit-driven behavior of private individuals, must have shaped the nature of market interaction on many levels. Those capable of purchasing the right to collect the agricultural tithe did so with the expectation that total production would be higher than the amount initially bid and hence yield a profit. In practice, tax farmers in Hieronian Sicily operated as de facto grain merchants, who profited by selling the percentage of grain which they collected. Such wealthy individuals, who were capable of not only providing securities to back their bids but also of mobilizing the resources necessary to transport large amounts of grain from the interior to the coast, may have also sought to further profit by purchasing surplus grain from farmers in the interior and selling it on the coast where they were more likely to obtain a higher market price. This quality of the Hieronian tax administration to utilize the resources of tax farmers made it easier for individuals engaged in the collection and transport of tithe–grain to bring additional grain to market.

IIC. Unifying the Instruments of Exchange.

IIC.1. Weights & Measures.

Chapter Two explored the process of metrological integration that occurred in southeastern Sicily during the reign of Hieron II. It was concluded that the standardization of volumetric measurement documented at several sites in the region was the result of a royal policy aimed at facilitating the collection of the agricultural tax. It has long been recognized that with standardization comes attendant economic benefits.288

288 CURTIS (1998, 547–49); GEERTZ (1978, 28–32); GEERTZ ET AL. (1979, 137–8).
The value of the units is further reinforced by a strong central administration which served to validate their accuracy. On a local scale, the use of common units of measure can lower transaction costs by reducing asymmetries of information between buyer and seller. On a regional scale, it seems reasonable to conclude that the greater the size of the metrological koine, the greater the distances over which commodities are likely to travel. Producers benefit by conforming to the standards used by larger consumer markets, making it easier to participate in market exchange with larger consumers. Thomas Figueira has proposed that this was the motivation behind the widespread adoption of the Athenian metrological standard by its Aegean ‘allies’ during the fifth century. A similar interpretation has been offered for the late second–century Athenian decree (IG II² 1013) mandating the creation of new official weights and measures. By the late second century, it was now the Athenians who saw the benefit in coordinating its commercial weights and measures with a stronger trading partner, namely Rome. With reference to modern markets, but nevertheless applicable to pre–modern transactions are Peter Swann’s observations about how recognized units of measurement can contribute to healthy markets. Swann writes,

improvements in measurement can help to reduce the transaction costs between suppliers and customers in a market economy. One of the most common sources of market failure is asymmetric information between buyers and sellers, where the buyer cannot distinguish good products from bad and therefore does not buy. Often this arises because measurement is difficult or expensive. As measurement improves and becomes cheaper, then buyers can measure any product

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289 VERA (2008, 139–40), provides a useful summary. See also, IWAHASHI (2004, 96–8).
290 In this regard, LAWALL (1997) suggests the proliferation of trademarks on Chian and Mendean amphoras around ca. 430/25 BCE may be due to increased trade with Athens and the need to communicate the capacity in terms of the Attic standard. See also, LAWALL (2011).
292 MERRITT (1938, 127–31, no. 27), who publishes a fragment of the decree that was originally part of the copy displayed in the Tholos; cf. WOODHEAD (1997, no. 322, pl. 31).
293 HABICHT (1997, 291–92), notes the timing of the decree corresponds to the height of Athenian trade with Rome and the Western Mediterranean.
characteristics they wish to, and that eliminates the asymmetric information and reduces the transaction costs.\(^{295}\)

Returning to third–century Sicily, it is also worth noting the potential incompatibility of Hieronian measures with those used outside of the kingdom. Not much can be said with regard to this question, given the current shortage of evidence from elsewhere in Sicily. There is also the problem that, while tentative identification can be offered, we do not know the ancient names of the various measures. Nevertheless, the lack of correspondence with contemporary Attic measures, for instance, highlights the fact that while metrological consolidation could facilitate intra–regional trade and exchange, it could at the same time hinder inter–regional trade, by creating new transaction costs related to conversion between standards.

\textit{IIIC.2. Coinage.}

There seems to have been as similar phenomenon of unification with respect to the types of coinage circulating throughout the kingdom. The consolidation of the region under a single monetary zone would have facilitated trade and exchange to an even greater degree than the standardization of measures. As with the standardized measures, we are left to reconstruct the monetary situation within the Hieronian kingdom using material evidence as our primary resource and, when possible, drawing on parallels from the monetary policies pursued by other Hellenistic kings.

There are several reasons to believe that Hieronian policy lead to increased use of the royal coinage struck during his reign. The first reason is simply that when we look “on the ground,” there appears to have been a significant increase in the amount of coinage struck and placed in circulation over that of previous generations. Whatever the

\(^{295}\) SWANN (2009, iv).
reason, Hieron’s royal mint at Syracuse struck a prolific amount of coinage, which circulated widely and in great amounts throughout much of the third century. The two most prevalent denominations (Figure 55) are found across the island and beyond, but in the greatest concentration around southeastern Sicily. Each denomination can be divided into two series, for which numismatist have convincingly established relative chronologies. Absolute chronologies for these series remain an elusive goal. The larger of the two denominations had the portrait of Hieron on the obverse and image of a cavalryman on the reverse (from here on, Hieron/Horseman). On the earlier of the two Hieron/Horseman series, the king is depicted wearing a laurel crown or wreath, while in the later series he wears a diadem. A horseman remained the reverse image in both series and on both series Hieron’s name appears on the reverse in the genitive form without royal title.\(^{296}\) The smaller denomination bronze coin to circulate in great numbers had the head of Poseidon on the obverse and an ornamental trident on the reverse (from here on, Poseidon/Trident). The iconography of the Poseidon/Trident coins remains essentially the same between the earlier and later series. The later series was struck on a smaller, lighter flan, making it easily distinguishable from the earlier large-flan series.

This is not the proper place for a full survey of the literature related to the chronology and metrology of Hieron II’s coinage. For my purposes, it is enough to emphasize that these coins were struck in abundant numbers. Several thousand known examples of these bronzes have been published in archaeological reports and tens of

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\(^{296}\) Seemingly later examples of the second “diademed” series, depict Hieron as distinctly older than on earlier examples. This apparent aging of the portrait corresponds in general to a diminishing quality in the style of the horseman image.
thousands more entered private collections in the early twentieth century. Further adding to the picture of large production numbers is the yet unquantifiable total number of dies used in the production of these coins. No less than fifty–three obverse dies have been identified for the laureate Hieron/Horseman coinage alone. By even the most conservative estimate, the surviving number of dies could reflect total production well above one hundred thousand coins. The number of surviving Poseidon/Trident coins suggests that total production was well above that of the Hieron/Horseman coins.

The general picture is largely confirmed when we look at the numismatic evidence recovered during archaeological excavations at Morgantina in particular. On account of its long history of excavation, more than 15,000 coins have been recovered at Morgantina, spanning roughly a five–hundred year period between the fifth century BCE and first century CE. A brief survey of the total coin finds recovered at the site reveal a dramatic increase in the number of bronze coinage reaching the city during the Hieronian period (Chart 3).

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297 In the *Notizie degli scavi per antichità* for 1929 Paolo Orsi published a brief note (p. 429) in which he reported the discovery of a hoard containing roughly 60,000 Poseidon/Trident coins (series unspecified) that was reportedly found in an amphora off the coast of Agrigento (IGCH 2222). Of this staggering number, only 60 specimens were consigned to the archaeological museum in Syracuse. The remainder presumably were dispersed into the market.

298 This is based on the number of different marks that have been identified for the laureate series. These are almost exclusively symbols, such as a *bucranium* or a quiver, and universally appear on the coins’ obverse. CARROCCIO (2000, 261, n. 6) lists all fifty–three known symbols. Mint marks made on the diademed series coins are mostly alphabetic–either single letters (N, Φ) or ligatures of multiple letters (ΑΓ, ΜΙ)–and presently number around thirty. The alphabetic marks on the diademed series appear almost universally on the reverse of the coins. In addition to the alphabetic mint marks on the reverse dies of the diademed series, seventeen mint marks (in the form of symbols) have also been identified on the obverse dies used. In most instances, if a diademed series coin has a symbol mint mark on the obverse it also has an alphabetic mark on its reverse. In only one instance have I been able to identify corresponding mint marks of the two Hieron/Horseman series. These are the *Obv. fillet / Rev. AP* (alpha rho) ligature; *MS II* 363c and 366a. If mint marks were in fact intended to distinguish a particular batch of coins or mint master responsible for issuing a particular series, it is possible that this correspondence marks the transitional point in production between the two Hieron/Horseman types.

299 Based on totals found in *MS II*, as well as unpublished coins recovered in excavations at the site between 1982 and 2011.
There is little reason to doubt that a similar influx of bronze was reaching all the communities in between Morgantina and Syracuse at the same moment. While Morgantina may be exceptional, on account of its long excavation history, it can nevertheless serve as a reliable case-study for patterns of circulation and monetization in eastern Sicily. Given its central location and modest size, there is no reason to believe that other cities within Hieron’s kingdom did not enjoy similar patterns of circulation and exchange. In fact, totals reported from other cities within the kingdom reflect a comparable trend in the proliferation of Hieronian bronze in circulation. These numbers can be compared with those from well-excavated sites on the western side of the island which were occupied at the same moment in time. Though Hieronian bronzes were undoubtedly circulating locally at sites such at Selinus and Iatas, they made up only

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300 275 Hieronian coins (out of a total 708 legible coins) were recovered during excavations in the agora at Kamarina between 1983 and 1995, LUCCHELLI and DI STEFANO (2004). Excavation coins from other sites within the kingdom are poorly published and do not provide much of a sample size. However, hoard evidence from the region confirms the numerical dominance of Hieron’s coinage. See, for instance, Pachino (1923; IGCH 2227), Megara Hyblaea (1967), Burgio (1902, IGCH 2216), and Barrafranca (1907/8; IGCH 2241).
a small percentage of the total coinage in circulation. The great disparity in the percentages of Hieronian bronze coinage found at Morgantina and Kamarina as opposed to ancient Selinus and Iatas is illustrated in Chart 4.

Chart 4. Indicating percentages of Hieronian and Punic coinage found at four sites in Sicily.

Just by the sheer scale of production did the Hieronian mint facilitate trade by creating a ubiquitous medium of exchange, reducing transaction costs related to conversion. Furthermore, the large–scale production of several denominations, including small fractional coinage, made it possible for bronze coinage to be used for a range of transactions.\(^{301}\)

\(^{301}\) The names of the denominations to which the types correspond are unknown, but they share a clear relationship together and with a third bronze coin, apparently struck in far smaller quantities, that was twice the weight (and presumably twice the value) of the Hieron/Horseman issues.
It seems reasonable to expect that in exercising his prerogative to authorize the minting of coinage, the issues and denominations struck the implicit endorsement of the crown. Royal endorsement was accentuated by the addition of the king’s portrait and name in the genitive case. But beyond this did Hieron’s coinage enjoy status as legal tender throughout the kingdom? While there is no surviving documentary evidence to confirm this supposition, it would not be without precedent for certain coinages to be granted status as legal tender elsewhere in the Hellenistic period. If this was the case, merchants operating within the kingdom may have been obligated by law to accept any coinage struck under Hieron’s authority as payment in exchange for goods or services. Punishments for refusing to accept a legally guaranteed coinage could be severe. Hoards containing only Hieronian coins would appear to reflect a conscious privileging of the regal coinage during his lifetime and may be taken as evidence in support of the notion that Hieronian coinage enjoyed the status of legal tender within the kingdom. Coupled with large–scale production, the obligation to accept royal coinage as legal tender would inevitably lead to wide–spread and regular use of Hieronian bronze within the limits of the kingdom.

Did Hieron take any steps to further enhance the value of his coinage? It is unclear whether Hieron actively sought to suppress minting by the cities within the kingdom. Was this a concession made by the cities subject to Hieron’s authority? While such authority may have fallen to Hieron, the evidence for a royal policy of interference with civic mints is indirect. On one hand, none of the cities believed to have belonged to

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302 For the Roman period, see LO CASCIO (2009 627); [Paul.] Sent. 5.25.1.
the kingdom minted coinage during his reign.\textsuperscript{303} Added to this is the fact that many of these same cities did strike coins in the period immediately following Hieron’s death and the dissolution of the kingdom.\textsuperscript{304} Is the absence of coinage from these cities evidence that Hieron limited the autonomy of subject cities in this respect?

There are several reasons to question the validity of this hypothesis, not the least being that in only one instance does a city, namely Tauromenium, cease to mint coinage around the time that it came under Hieron’s political authority. The others, as far as we know, had either never minted civic coinage (Akrai) or had not operated an active mint for over a century (e.g. Leontinoi, Morgantina). The sudden florescence in minting that occurs in the years following the dissolution of the kingdom, may have had less to do with the expression of civic autonomy and more to do with meeting local need for coinage due to a decrease in the amount of coinage in circulation, likely caused by an interruption in activity at the Syracusan mint during and after the siege of 214–212 BCE.

Compounding the problem is the fact that a similar phenomenon can be observed for many other cities in eastern Sicily that did not belong to the kingdom. Major cities such as Catana, which almost certainly located beyond the political borders of the Hieronian kingdom, did not resume minting until the late third or early second century.\textsuperscript{305} Thus the cessation of minting during much of the third century was not a phenomenon that we can strictly associate with limitations placed on civic autonomy by Hieron.

\textsuperscript{303} This includes Tauromenium, if Anna Carbè’s recent re-evaluation of the city’s coinage is correct. She proposes dividing several series traditionally dated ca. 270–210 BCE into two groups corresponding roughly to periods between 270–265 BCE and from 215 into the early second century; CARBÈ (1995).
\textsuperscript{304} CRAWFORD (1985, 155) reads an expression of “status” in the coinages struck by cities in Asia Minor ‘freed’ by Rome following their victory over Antiochus III; cf. ALLEN (1983, 109–11).
\textsuperscript{305} According to Eutropius (2.19.1), Catania was among the Sicilian cities to request an alliance with Rome in 264 BCE, during the Roman siege of Centuripe; see also, Pliny, \textit{NH} 7.214.
Lacking decisive evidence for a royal monetary policy suppressing the operation of civic mints, we may proceed with the supposition that local minting did not occur for other reasons. Thomas Martin arrived at a similar conclusion regarding the influence (or lack thereof) of Macedonian royal policy on local civic minting in Thessaly during the fourth century, concluding that “Macedonian royal policy had nothing directly to do with the fate of Thessalian coinage. A combination of practical factors made it easy for Macedonian royal coinage eventually to supplant local coinage to such an extent that further local production would have been superfluous even for purposes of convenience in exchange.” 306 Among the ‘practical factors’ considered by Martin was the likelihood that Macedonian coinage continued to circulate as a well–known and trusted medium of exchange. Absent the need to produce new coinage, Thessalian cities could simply continue to use Macedonian tetradrachms for payments.

Older coinage and issues struck by civic mints in Sicily may have been forced out of circulation simply by the prolific amount of regal coinage in circulation. Following on Martin’s observations, the cities in southeastern Sicily may have found the market sufficiently saturated with Hieronian bronze. A similar phenomenon can be observed in the wake of the incredible minting campaigns of Alexander III, whose precious metal coinage became so ubiquitous that local mints ceased to produce civic issues in silver and gold. 307

Whatever the cause, the situation on the ground was such that communities within Hieron’s kingdom did not rely on local, civic coinage for exchange. The choice was

306 MARTIN (1985, 163). Profit was another factor for which it would appear factored into the calculus of whether or not to operate a civic mint. On this point, see SEYRIG (1951). The well–known inscription from Sestus (OGIS 339; second century BCE) honoring a certain Menas for his role in overseeing the minting of a local bronze coinage is often cited in favor of evincing the profit motives behind the decision to issue coins. For this decree, see ROBERT (1973) and MARTIN (1985, 238–41).

between the royal coinage of Hieron and the denominations struck by foreign mints which continued to circulate in southeast Sicily. Hieron had a number of options when it came to dealing with foreign coinages. In theory, as sovereign he had the royal prerogative to determine which coins were to be accepted within his kingdom.\footnote{Such is often the interpretation of the passage, τὸ νόμισμα λέγω ποιὸν καὶ πότε [τίμιον ἡ εὔωνον] ποιητόν, in the pseudo–Aristotelian Oikonomika (2.1345B); See PANAGOPOULOU (2001, 348). This passage from the oikonomika has been used in the past, most notably by VAN GRONINGEN (1933, 25–41), to suggest that Hellenistic kings, at least at the time of composition in the last quarter of fourth century BCE, and the Achaemenid kings, who served as models for Hellenistic monarchy, exercised a royal monopoly over the minting of coinage. MARTIN (1985, 266–70) provides a concise and convincing refutation.} Judging by the way other Hellenistic monarchs dealt with this issue, it seems Hieron could have adopted an open policy, which allowed foreign coins circulate alongside his own issues, or a closed policy, which sought to diminish the value and use of foreign coins within his kingdom. The Antigonid and, at times, the Seleucid kingdoms have been credited with open monetary policies, while the Ptolemies and Attalids are routinely held as the models of closed systems.\footnote{Ptolemies: VON REDEN (2007, 43–8). Attalids: KINNS (1987, 105–7), MORKHOLM (1982), CRAWFORD (1985, 158). For an attempt by the Seleucid monarch Antiochus IV, see MØRKHOLM (1982, 301–5).}

In this light, we should note that shortly after becoming king, Hieron abandoned the Attic standard and adopted one based on the Sicilian litra. The silver litra had a theoretical weight of c. 0.85g or about one–fifth of an Attic drachm. Hieron’s silver was struck in multiples of four–litra, resulting in coins that were slightly smaller than the popular Attic tetradrachm. In many respects, this shift to striking a lighter coinage resembles the monetary policies adopted by the Ptolemies and Attalids, who struck a lighter silver coinage that was intended for internal circulation within their respective kingdoms. The purpose generally attributed to such “closed” monetary policies was to discourage the loss of silver through trade. Merchants arriving at a major commercial

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center in one of these kingdoms would have to exchange their foreign coinage for lighter coins of an “equivalent” value, which was greater than its intrinsic value. A well–known letter dating to the reign of Ptolemy II (258 BCE) attests to this practice. The letter written by one Demetrius, perhaps an official with the royal mint, to Apollonius the dioiketes, elucidates the process by which foreign and old coins, in this case gold coins, were brought to the mint and exchange for Ptolemaic denominations.\footnote{P.Cair.Zen. I 59021. For translation and interpretation, see BAGNALL and DEROW (2004, 163–4, no. 102); LE RIDER (1986, 49–51); RICHTER (1992, 177–86).} Though incomplete, the sense of the letter is clear when Demetrius writes,  

To Apollonios greeting from Demetrios. If you are in good health and your affairs are to your mind, it is well. As for me, I am attending to the work as you wrote to me to do, and I have received in gold 57,000 pieces, which I minted and returned. We might have received many times as much, but as I wrote to you once before, the foreigners who come here by sea and the merchants and middlemen and others bring both their local money of unalloyed metal and the gold pentadrachms, to be made into new money for them in accordance with the decree which orders us to receive and remint, but as Philaretos (?) does not allow me to accept, not knowing to whom we can appeal on this subject we are compelled not to accept —; and the men grumble because their gold is not accepted either by the banks or by us for. . . , nor are they able to send it into the country to buy goods, but their gold, they say, is lying idle and they are suffering no little loss, having sent for it from abroad and being unable to dispose of it easily to other persons even at a reduced price. (P.Cair.Zen. I 59021; trans. R. Bagnall and P. Derow)  

There was also little use for such coins outside of these areas, so they rarely left to circulate more widely around the Mediterranean. This is largely confirmed by the almost complete absence of lighter silver coins struck by the Ptolemies and Attalids outside the areas of their political influence.\footnote{The circulation of Ptolemaic coins outside of Egypt tends to have been restricted to overseas possessions, including Cyprus and Coele Syria, see BAGNALL (1976).}  

Judging from the archaeological evidence, non–Hieronian coinages never ceased to circulate or be used as instruments of exchange within the kingdom. While their
overall numbers are certainly miniscule compared to the amount of Hieronian coinage in circulation, there are still bronzes of South Italy, Punic Sicily, and perhaps Ptolemaic Egypt circulating in commercial contexts. In the end, we cannot be sure if this reflects a royal policy of openness towards these coins or if the penetration of foreign denominations was simple a reflection of the practical limitations to the efficacy of such policies, namely that royal oversight diminished the farther away one was from the capital or other centers of administration. Small denominations from foreign mints could help to alleviate shortages of Hieronian bronze in the interior. At Morgantina, the continued use of non–Hieronian coinage may be a factor of the city’s location at what is currently believed to by the far western edge of the kingdom. In relation to the amount of non–Athenian coinage recovered during the excavations of the Athenian agora, the Jack Kroll proposed the situation was akin to that of Canadian currency circulating in U.S. states along the border. In support of the notion that there was in fact a royal policy forbidding the use of certain coinage is the near complete absence of Mamertine coinage from pre–211 BCE contexts at Morgantina. Morgantina Studies II lists the 706 coins recovered from twenty-four sealed archaeological contexts, associated with the capture of Morgantina in 211 BCE. Of this number, only one Mamertine coin was recovered and it was of a series struck ca. 285–280 BCE. This is remarkable, given the amount of Mamertine coinage found at Morgantina (n. = 609). While Mamertine coins struck after 212 BCE accounts

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312 DE CALLATAY (2006, 187), notes that for any given site, foreign coins had higher discard rates than the local coinage, which was treated as legal tender.
313 KROLL (1993)
315 56–1667; Type: Head of Ares r.; behind, helmet / Eagle l. on thunderbolt; at left, Φ. MS II 219; SÅRSTRÖM II.Aa². Context: MS II “Catalogue,” 165, no. 30: “South Sanctuary. Destruction level below fallen tile roofs.”; see also, PR III, 171 and PR VII, 169–70.
for the largest part (n. = 345, 57%) of this number, there is nevertheless a significant amount of Mamertine bronze (n. = 247, 41%) struck between ca. 264 and 212 BCE that does not turn up in contemporary contexts at Morgantina. In fact, only one other Mamertine bronze is identified in *Morgantina Studies II* as coming from a pre–211 BCE context and this coin (inv. 56–62; *MS* II 222; ca. 280–278 BCE) was found in an early–third century context. 316 This stands in contrast to the number of Mamertine coins recovered from sealed post–211 contexts from the site. 317 Among this group are 19 Mamertine coins struck ca. 220–216 BCE and 21 struck ca. 216–212 BCE. While the numbers are not conclusive, they are suggestive that Mamertine coins did not circulate at Morgantina until after Hieron’s death and, even then, did not reach the city in great quantities until the last decade of the third century. One explanation for the absence of these coins in pre–211 archaeological layers may be that Hieronian policy forbade their use within the territories subject to his authority. Hieron had waged several campaigns against the Mamertines in the 270’s and early 260’s, before Rome’s intervention in 264 BCE. Deprived of a decisive military victory, Hieron may have sought to harm the Mamertines with something approximating an embargo. It is also possible that the decision to limit trade with the Mamertines was made on a local level by the communities of southeastern Sicily, many of which had suffered grievously at the hands of the Mamertines in the 280’s and 270’s. 318

316 *MS* II “Catalogue” no. 14. I do not count the Mamertine Zeus head / Warrior bronze found inside of a jug within the House of the Gold Hoard, *MS* II “Catalogue” no. 59 (inv. 66–207; *MS* II 235; ca. 212–200 BCE), given that its context is listed as being in the “stratum immediately above” the stratum associated with the destruction of the house and so most certainly post–dates 211 BCE.

317 *MS* II “Catalogue” lists 19 examples (ca. 220–216 BCE), 21 examples (ca. 216–212 BCE), and 50 examples (ca. 212–200 BCE).

318 Polyb. 1.7.3; Diod. 22.1.3–2.2; 23.1.4. On Mamertine violence in southeastern Sicily see, BELL (2011, 194–5); VALLONE (1955/56); ZAMBON (2000); .
Foreign coins need not have been targeted for exclusion if their value was somehow diminished in relation to Hieronian coinage (i.e. if they were not considered legal tender) or if no official conversion–rate was established. Though their utility as a medium of commercial exchange would be reduced, foreign and other non–regal coinages could have nevertheless remained in circulation and been valued for their weight rather than legal value. The numerous small bronze and lead weights discovered in commercial contexts at Morgantina may have been used for this purpose. Still, the general impression one gets when looking at the third–century data from Morgantina is a decline in the amount of non–Hieronian coinage reaching the city. Again, Jack Kroll’s observations regarding the use of bronze coinage in Athens during the late third century are instructive. He finds that

After the Athenian restriking of this Macedonian bronze in the 220s, therefore, the inflow of supplementary outside bronze currencies was sharply reduced; either because the supply of Athenian bronze had become more abundant or, more probably, because a new attitude or policy discouraged the use of non–Athenian bronze now that bronze coins were more commonly issued in larger denominations and were playing a larger role vis–à–vis silver in the monetary economy.  

IIC.1. Coins and Trade.

Judging from hoards and deposits, Hieron’s bronze coinage became a common medium of exchange in southeastern Sicily. While we may not be able to identify the operative motivation behind Hieron’s monetary policy, the archaeological and numismatic evidence clearly illustrates the predominance of his coinage within southeastern Sicily for the greater part of his reign. The sheer amount placed in circulation by the royal mint at Syracuse would have certainly facilitated trade and exchange, whether or not the use of his coins was officially mandated.

Compared with gold or silver, bronze coinage in the ancient Mediterranean tended to have a much more localized pattern of circulation, centered around the civic body which legislated its production and ensured its value. Such localization is often exhibited by the civic coinages of Sicily. The Hispanorum series, struck at Morgantina in the decades following the Second Punic War, is a perfect example. Of the several hundred specimens discovered in archaeological excavations only one has been found outside of Morgantina. In cases where bronze circulated more widely, it often tended to be within a zone comprised of politically affiliated cities. The bronze coinage struck by members of federal leagues, such as the Achaean and Aetolian Leagues, offers an example of such collective coordination and circulation.

The wide circulation enjoyed by Hieronian bronzes across the region of southeastern Sicily is a clear reflection of its widely recognized value during the third century BCE. Along with the unification of volumetric measures, the prevalent availability and use of Hieronian bronze, whether motivated by policy or preference, would have lead to greater economic integration of all communities within the kingdom. The value of a unified monetary zone in terms of trade and exchange on all levels has been recently summarized by Elio Lo Cascio, who writes of Roman monetary policy during the Principate,

The creation of a single monetary area may have contributed most to the reduction in transactions costs: a centrally produced coinage circulated almost

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320 For the Hispanorum series, see ERIM (1957) and MS II, 34–67. The single example recovered in an excavation outside of Morgantina was found at Kamarina; LUCCHELLI and DI STEFANO (2004, 74, no. 31), identified as a Minerva/Horseman of either Erim’s 9 or 12–series. For another example, chosen almost at random, see REINDERS and PRUMMEL (2003, 138–45), who observe a similarly restricted circulation of bronze coinage minted at New Halos in Thessaly in the third century.

321 On the koinon and federal coinage, see MACKIL and VAN ALFEN (2006) and more generally MACKIL (2012).

322 Those who were not regular participants in market exchange (i.e. small landowners) would be more likely to buy and/or sell goods and produce due to ease of using common units of measure and reckoning.
everywhere, and locally issued coins (chiefly small bronze denominations) were linked to the mainstream coinage by a common system of fixed rates of exchange. Moreover, it was a serious offense, indeed a crime, to refuse to accept current coins which carried the *vultus* of the emperor and were not counterfeit. Again, the enforcement of the legal value of the coins can be viewed as instrumental in reducing transaction costs. High levels of coin output and circulation from Augustus to the third century seem to have been instrumental in facilitating safe and smooth exchanges of goods at local, regional, and interregional level.\footnote{LO CASCIO (2009, 627).}

Though many details of Hieron’s monetary policy remain opaque, we can nevertheless see some clear reflection of the conditions described by Lo Cascio within the preceding portrait of coin circulation in the Hieronian kingdom.

**IID. Supply.**

**IID.1 Meeting Demand.**

Having established the likelihood that Hieron’s tithe administration lead to greater market integration and economic incentives for surplus production, can we establish conditions for supply? Even if there was nearly inexhaustible demand on the Mediterranean scale and even if during the Hieronian period barriers to selling surplus grain on the market were reduced, could communities even supply grain above what was taken as tithe? And even then, was there a willingness to participate in the market?

According to my model, demand was met when farmers sold surplus grain through trade networks created or simply strengthened by the tithe administration. While ten percent of this surplus was owed to Hieron, some portion of the remainder was likely available to be sold on the market. In the absence of accessible and reliable trade networks, the costs involved in bringing surplus grain to the market could be prohibitively expensive for the small–scale farmer. Establishment of an administrative infrastructure upon which smaller communities could rely resulted in an increased level
of market involvement. Under these conditions, small landowners and tenant farmers entering the market derived higher profits from decreased transportation and storage costs that came with the administration of the tithe.

I will not attempt to quantify the available surplus here, but simply to establish that the conditions and mechanisms for participation in market exchange existed. As with the preceding discussion, the following discussion will be necessarily impressionistic. The aim here being simply to arrive at a series of reasonable conclusions, which may be accepted or rejected in the future as more evidence and better models become available to us.

Returning to the first question, were communities in southeastern Sicily capable of producing a disposable surplus above what was owed as tithe. By “disposable surplus” I mean grain that was not earmarked for household consumption, use as seed, owed as rent, or that used to pay the tithe. Farmers had several choices when it came to disposable surplus. They could store it in case of an unforeseen food shortage.\(^\text{324}\) They could share it with relatives or community members with whom they had ties. This could serve as a form of communal storage strategy, in which food shortage was relieved by redistribution among communal or familial groups.\(^\text{325}\) Farmers could also sell their disposable surplus in exchange for cash or other goods or commodities. All three possibilities may be considered viable and rational options, even for the archetypal risk–averse peasant.

Allowing for a full spectrum of behavior does the most justice to the available historical and anthropological evidence on the matter.

\(^\text{324}\) For household storage, see GALLANT (1991, 94–8).
\(^\text{325}\) On the role of communal obligations and reciprocity in household decision–making, see GALLANT (1991, 143–69); SEAVOY (1986).
It seems reasonable to assume that on the community scale, production of disposable surplus was a regular possibility, but that there was greater variation on the level of the individual landowner. Wealthy individuals with large tracts of land were clearly more capable of producing disposable surplus than farmers who worked small plots. This was certainly a case where economies of scale could allow for specialization. A landowner with 50 hectares under wheat cultivation needed to devote a smaller percentage of the total harvest to consumption and seed–grain than a small farmer with only one hectare of land on which a range of crops were grown.

This is not to say that small–scale farmers could not produce surpluses as well. Ethnographic research conducted by Mahir Şaul in Burkina Faso has shown that wheat farmers with less than ten hectares of land under cultivation were capable of producing disposable surpluses of up to 50% of annual production. At the risk of comparing two incompatible scenarios, it may not be without merit to consider Şaul’s figures in relation to those advanced by Richard Duncan–Jones for ‘average’ land–holding in Sicily and in Egypt during the Late Republic and Empire. Drawing on literary and documentary evidence, Duncan–Jones calculates that in the first century BCE landholdings in the territory of Herbita (Sicily) were on average about 56 iugera (14 hectares) in area, which is not all that different than the average landholding, 69.6 iugera (17.5 hectares), he calculates for the Hermopolis nome in the fourth century CE. Allowing for all manner

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326 ŞAUL (1987, 91).
327 10 hectares translates to roughly 40 iugera. On the area of a iugerum, see Columella, Re Rust. 5.1.4–13; Pliny, NH 18.3.
328 DUNCAN–JONES (1990, 127–9). These figures are based on numbers given in Cicero’s Verrine Orations (2 Verr. 3.75–80) and a land register (P. Flor. 71) from the Hermopolis nome. See also, DUNCAN–JONES (1976) and GARNSEY and SALLER (1987, 67) who estimate the “model” of the arable farm envisioned by ancient agricultural writers was roughly 200 iugera or 50 hectares. A group of late–third or second–century cadastral inscriptions from Thessaly (SEG 26.672–6) list holdings between 20.9 and 0.87 hectares, with a mean size of 6.2 ha; see, SALVIAT and VATIN (1974, 247–62), HABICHT
of variation between the situation documented by Šaul in Burkina Faso and that of the 'average' landowner in the territory of Herbita, the correspondence in the size of landholding and the productive capabilities of Burkinabè farmers may give us some indication as to productive capability of their ancient Sicilian counterparts. In their analysis of a second–century inscription from Larissa that records a shipment of grain from the four nomoi of Thessaly to Rome, Peter Garnsey, Thomas Gallant, and Dominic Rathbone calculate that in order to meet the specified amounts and deadlines mentioned in the inscription, Thessalian communities would have to have had on average between 10% and 30% of the available surplus on hand in the last two months prior to the new harvest.329

The tithe (dekate) itself was not an oppressive form of taxation, so far as ancient taxes went.330 In years of poor harvest, collecting a percentage of total harvest was far less burdensome than taking a fixed amount (i.e. 500 medimnoi) irrespective of the total harvest. We know that much larger portions were collected elsewhere during the Hellenistic and Roman periods. For instance, tenants who farmed royal lands in third century Egypt paid one–sixth of total harvest for certain commodities.331 In Sicily, we

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330 For instance, grain taxes collected in Egypt during the New Kingdom and Late Pharaonic Period range from 20% and up; MUHS (2005, 2); HARING (1997, 283–315).
331 The 1/6 tax on vineyards and orchards (apomoira) was collected by temples from tenants of temple lands during the reign of Ptolemy I. In the 22nd year of the reign of Ptolemy II (264 BCE) the apomoira on vineyards and orchards was extended to private landowners, who could chose to pay in either cash or kind, as lease in the case of vineyards; for the apomoira tax, see CLARYSSE and VANDORPE (1998); VANDORPE (1995); MUHS (2005, 7–9). In the case of grain land, VANDORPE(2000) distinguishes two different practices. In Middle Egypt (including the Fayum) tenants of cleruchic and temple lands paid a land–tax (aptebeta) of 1/2, 1, or 2 artabas per aroura. This land tax was collected on the entire area of the property, not just on the cultivated land. In the Thebaid, where most of the arable land was owned by hereditary lease or temples, a harvest tax (epiprophos) was collected. Unlike the land–tax (aptebeta), the
know that the amount of grain annually requisitioned by the state during the Roman Republican period could exceed 10% of the harvest. On several occasions during the second and first centuries BCE close to 30% of the total harvest was collected by the Romans in the form of a second tithe, plus mandatory sales of grain amounting to nearly one million modii. Cicero (2 Verr. 3.163) provides the most detailed description of this practice with particular reference to the collection of additional grain by Verres, as authorized by the so-called Law of Terentius and Cassius of 73 BCE. Earlier instances where double tithes were collected from the Sicilian communities are mentioned by Livy, the earliest of which he cites (37.3) takes place in 190 BCE, during Rome’s war with Antiochus III (192–188 BCE). Requisitioning of grain above that paid as tithe may have been a far more regular event than the handful of instances mentioned by Livy and Cicero and may have even begun under Hieron during the third century. That such levies and purchases of additional occurred with the frequency they are recorded suggests that at least an additional 10–20% of the island’s total annual harvest could be categorized as disposable surplus.

From this same period, we also have a few accounts of large amounts of Sicilian grain leaving the island as “gifts” or being sold on the market. For instance, Livy (33.42) reports that the Sicilian communities sent one million modii of wheat to Rome in 196 BCE, apparently as a gift. A “gift” of one million modii was certainly no insignificant

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332 For further discussion, see PRITCHARD (1971, 226).

333 Livy (42.31) mentions a double tithe was collected in 171 BCE, in the lead–up to the Third Macedonian War (171–167 BCE).


335 According to Livy, this benefaction on the part of the Sicilians was made out of respect for Gaius Flaminius, one of the presiding curule aediles in 196 BCE, and for his father, who was killed at Trasimene
gesture, amounting to about one–third of the amount collected in tithe during the
governorship of Verres. Only two years prior, in 198 BCE, the Senate had granted
permission to the Rhodians, who had requested license to export 100,000 *medimnoi*
(roughly 600,000 *modii*) of grain from Sicily.\(^{336}\) This remarkable event reveals a great
deal about Roman perceptions of their prerogative over Sicilian grain, but it also suggests
that Sicilian communities possessed a great deal of surplus grain.

Now, what about the willingness of agricultural producers to sell their surplus?
Again, the most significant factor determining one’s inclination to sell or market produce
was likely to be the size of one’s landholding.\(^{337}\) Authors of ancient agronomic texts,
such as Columella, Cato, and Varro, at times reveal an awareness of the profit–driven
motivation for production above and beyond the level of subsistence.\(^{338}\) There is also an
awareness of the market forces that drove price fluctuations for agriculture produce. In
the *de agricultura*, Varro counsels his readers to refrain from selling grain immediately
after the harvest, noting that,

As to the crops intended for sale, care must be used as to the proper time for
taking out each. Thus you should take out and sell at once those which do not
stand storage before they spoil, while you should sell those which keep well
when the price is high. For often products which have been stored quite a long
time will not only pay interest on the storage, but even double the profit if they
are marketed at the right time. (*Agr.* 1.69.1)

\(^{336}\) Polybius, 28.2

\(^{337}\) This was certainly a factor observed by Saul among Burkinabè farmers.

\(^{338}\) Columella 10.311ff.
Varro’s advice was certainly directed towards large landowners, who would be more capable than small farmers of withholding grain until late in the year, when general stockpiles had diminished and grain fetched higher prices.\(^{339}\)

Although they stood less to gain, small landowners, tenant farmers, and even “peasants” engaged in market transaction. Paul Erdkamp has presented a wealth of literary and documentary evidence in support of the position that ancient farmers in the Mediterranean—even those of modest means—sold surplus grain on the market.\(^{340}\) While the notion of the “profit–maximizing” peasant has not gained much traction among scholars, opinions have nevertheless changed in recent decades as to the willingness and ability of small–scale farmers and small landholders to produce beyond subsistence needs and sell surplus for profit.\(^{341}\) The position of those who support a primarily subsistence–based model is succinctly captured by Thomas Gallant, who holds that “in general peasants in ancient Greece did not regularly mobilize their surplus production through the mechanism of the market”.\(^{342}\) According to this model compulsion was often a prerequisite for participation of peasants and tenant farmers in market exchange. The risk averse peasant preferred to stockpile surplus produce in the event of food shortage or participate in communal storage strategies, Gallant’s dictated by social conventions of reciprocity.

\(^{339}\) See also, Cato, \textit{Agr.} 3.2, for a similar opinion: “It is well for the master to have a well–built barn and storage room…so that he may hold his products for good prices.” Though in a wholly different genre, Cicero (\textit{2 Verr.} 3.214–15) confirms the relationship between market prices for grain and the distance from harvest: “One should always regard the whole question of grain values in relation to the seasons and the current market prices.” For evidence of the delayed sale of grain by wealthy landowners in Roman Egypt, see SHARP (1998, 95).

\(^{340}\) ERDKAMP 2005.

\(^{341}\) ELLIS (1988) 63ff.

An alternative, which refines but does not reject Gallant’s position, would be to frame discussion in terms of transaction costs and barriers to entry, which could include distance from urban markets, transportation costs, and reluctance to sell based on asymmetry of information. This approach interprets the relationship between agrarian producer and the market in terms of access rather than aversion. Limited access to markets may result in reliance on the subsistence strategies traditionally ascribed to peasant communities. But if conditions were such that participation in market exchange could serve as a viable risk–buffering strategy, the decision calculus may shift in favor of selling rather than stockpiling or sharing. It is unlikely, in any scenario, that agricultural surplus was completely given over to any one mode, since distributing resources helped to diminish risk. But, in order for this to work we need not presuppose a full–scale commitment to specialization akin to the “cash–crop” farmer. Perhaps a more realistic scenario is that similar to that which Columella presents of a variety of products brought to market for sale. Access to markets was a key component to making participation in market exchange a viable strategy for small farmers. As ethnographic work in West Africa has shown, when entry to markets was readily accessible, and even encouraged through policies such as monetization and farm–gate purchases, small–scale farmers were more likely to participate in market exchange.

Within this framework, we can posit several ways in which the tithe administration may have lead to reduced transaction costs, making it possible for greater a share of small farmers to sell surplus grain. The increased presence of standardized measures and a common coinage throughout the kingdom helped to level the playing

343 Col. 10.311. ERDKAMP (2005, 99).
344 Developing this idea around the notion that greater market integration helps to reduce the severity of localized food shortages, see ERDKAMP (2005, 103–4); MORLEY (1996, 75).
field between merchants and farmers. Moreover, the tithe system’s reliance on tax farmers lead to greater involvement by private individuals who worked to supply grain to the coast. In turn, these individuals, whether merchants or agents working on behalf of tax–farmers, may have found added incentive to purchase additional grain which could be conveyed to the coast by the same network as the tithe grain. The greater opportunity for interconnectivity could have had the effect of bringing those engaged in agricultural production, on both a large– and small–scale, into growing involvement in market exchange, whether out of necessity or choice.

Small farmers may have entered the market for several reasons. They may have been forced to sell surplus in order to obtain the coin necessary to pay taxes collected in cash. Taxes collected in cash may have only accounted for a fraction of annual expenditure for a small landowner or tenant farmer. Rents, as well, were more likely to be collected in kind, as a percentage of annual production. The need to purchase goods and materials which could not be manufactured within the household would have also lead some farmers to sell surplus grain.

In the end, we see that there were many reasons for even small landholders and tenant farmers to sell grain. Moreover, the policies adopted by the Hieronian administration may have helped to reduce sizable barriers to entry. The increase in the amount of bronze coinage in circulation over the amount from preceding generations undoubtedly reflects increased monetization in southeastern Sicily during the Hieronian

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345 This is the principal mechanism behind Hopkins’s “Tax and Trade” model; HOPKINS (1980). See also, GARNSEY and WHITTAKER (1998, 317–20). VON REDEN (2007) argues that monetization of the Egyptian countryside was accomplished in part by the collection of a cash tax, which required small farmers to sell surplus produce in exchange for bronze coinage.
347 For instance, Cato (de Agri Cult. 22.135) admits that even the most self–contained farm would necessarily turn to the market to purchase certain goods, which could not be manufactured on the premises.
period. The proliferation of legal tender would have served to make transactions more equitable between farmer and merchant, thereby reducing some of the cost involved in participating in the sale of grain and other commodities. Monetization may have also been adopted out of increasing necessity, especially if a growing number of transactions and payments during the Hieronian period were being made with coinage.

This of course did not mean that everyone necessarily profited. In almost every respect, the wealthy, large landowners were better served by the growing number of opportunities to provide grain for the large urban markets of Syracuse and abroad.\textsuperscript{348} The situation encouraged expansion of landholding and specialization of agricultural production. As more land came into the hands of fewer individuals, there was greater need for increased tenancy, which itself lead to increased amounts of produce collected in rents and made available for sale.\textsuperscript{349} Moreover, large landowners were certainly better equipped to specialize in production for the market and withhold produce until prices were favorable. The ability of larger and wealthier landowners to maintain through poor harvests would even offer an opportunity to profit. Bad harvests drove up prices, as Cicero notes in the \textit{Verrine Orations},

\begin{quote}
Year by year so much labor and so much money is definitely expended for an indefinite and variable result. Further the market price is never high unless the harvest is a failure; when an abundant crop has been gathered in, a low selling price is the consequence; so you find that in a good year you have to sell cheap, and if you sell for a good price, you have had a bad harvest. (2 Verr. 3.227)
\end{quote}

Wealthy landowners are often those who control the local or regional grain trade. They possessed the resources to transport crops to large urban markets where their produce would fetch higher prices. Thus wealthy individuals, heavily invested in agriculture,

\textsuperscript{348} ERDKAMP (2005, 323–6).
\textsuperscript{349} Ibid. 328–9.
could capitalize on their position by buying up grain locally from small landowners and supplying it either to merchants operating between the interior and the coast or to coastal markets directly.

Small farmers were less likely to withstand the pressure to sell early after the harvest, when grain was most abundant and prices were at their lowest. In addition, small-scale farmers were more likely to find themselves in a situation in which they were forced to sell or part with non-disposable surplus (on account of rents, repayment of loans, etc.), putting themselves in the position of having to buy back grain as the year progressed. Saul observed this practice among the grain producing districts of western Burkina Faso.

III. Testing the Model: Market Integration in Hieronian Sicily.

The preceding discussion sought to establish the basic parameters of a model which posits greater market integration in Southeastern Sicily resulted from the formation and consolidation of the Hieronian kingdom. The institution of Hieron’s monarchy helped to create conditions by which interior communities were brought into increased economic contact with Syracuse and, by extension, greater Mediterranean trade networks. Such market integration was accomplished by, among other things, the advent of long-term peace and stability within the kingdom, the unification of coinage and measures under a single, royal standard, and the collection of an annual agricultural tithe. For some portion of the population at this time, the mechanisms that lead to market integration also

350 Ibid. 152; DE LIGT (1993, 137f.).
351 BAGNALL (1972, 94); ERDKAMP (2005, 152, with bibliography).
352 See also MCARDLE (1978, 110ff.) for a similar phenomenon in medieval Tuscany, and ARDT ET AL. (2001) for Mozambique.
reduced transaction costs associated with market exchange. For some, perhaps the largest portion affected, this may have resulted in a greater willingness to sell surplus grain for cash. For a smaller group, the economic conditions created during Hieron’s reign may have spurred profit–driven intensification of agrarian activity and greater investment in agriculture.

Similar models have been used to interpret data related to production and exchange in various other micro–regions of the Mediterranean. The piggybacking of trade and intensification of production are often associated with the agricultural taxes collected from agrarian communities during the Roman Imperial period. Application of this model has been rather limited for Sicily and has tended to overlook the developments within the Hieronian kingdom, focusing rather on the situation under Roman rule. Phillip Perkins applied this model with convincing results to a small area in western Sicily around the ancient city of Iatas (modern Monte Iato). Based on the data collected by the Monreale Survey in the area between Monte Iato and Monte Maranfusa, Perkins has argued that Roman administration, and in particular the system of agricultural taxation, lead to greater market integration in the region. These developments affected both urban and rural settlements, manifesting in increased imports of, among other things,

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353 LLOYD (1991, 182–184) has connected prosperity in Samnite regions with the production of an agricultural surplus for the market, the presence of imported goods also shows that the region was becoming ever more connected with wider networks of trade and distribution. 354 KINGSLEY (1983, 56–7) supports a piggyback model for Palestinian wine brought to major urban centers by merchants carrying taxes in kind for the annona civica. He describes the situation as “a commercial superstructure overlying the foundation of a state fiscal framework.” DECKER (1983, 77–8) cites evidence for market integration among communities in Northern Syria, based on surplus production purchased by merchants operating in the hinterland. 355 PERKINS (2007). 356 A final report of the finding from the Monreale Survey is in preparation. The Swiss excavations at Monte Iato are reported annually in Sicilia Archaeologica (from 1971) and Antike Kunst (from 1972), plus the coinage recovered from excavations will be published by FREY–KUPPER (1992; forthcoming). For Monte Marafusa, see SPATAFORA (2003)
amphora containing Campanian wine as well as an influx of bronze coinage from the mint at Panormus, which served as the principal port for the region. According to Perkins,

The survey evidence indicates that as W Sicily developed as part of the province, subject to taxation in kind, it became involved in a complex of economic exchanges linking the province to Italy and Rome. This economic nexus drew together the Sicilian elites and the Roman authorities, officials and traders. It also became a driving force in the activities of Sicilian elites responsible for assessing the tax and for organising the territory to be sufficiently productive to meet the tax demands. Subaltern classes in Sicily also participated: they produced the corn for the tithe and consumed a portion of the annona–linked Campanian wine. Thus this part of the province was drawn into a Tyrrhenian world under Roman hegemony where political power manifested in taxation generated an economic bond that formed a structural part of local society.357

III. A Case Study: Morgantina.

In order to test this model for the area of southeastern Sicily subject to Hieron II, I will rely on material evidence from Morgantina. The data suggests that such inter–regional exchange on the scale of Perkins’s study had occurred already by the third century, spurred no doubt by the structural bonds established in service of the Hieronian tithe system. The data from Morgantina also reflects a restructuring of economic exchange once the city is incorporated within the network of Rome’s provincial administration.

The city has many characteristics that make it a valuable case study, including the agricultural basis of the local economy and its political affiliation with Hieron II. The community enjoyed peace and security, as an ally or semi–autonomous subject of Hieron, and in return paid their share of the annual tithe. In addition to the construction of the granaries, standardized measures and bronze coins struck by Hieron’s royal mint are found in great abundance at the site. In addition to the instruments of administration, the material record at Morgantina reflects increased economic ties with Syracuse during the

357 PERKINS (2007, 45).
course of the third century. It is also during this period that the urban center of Morgantina enjoyed its greatest florescence.

III.1. Morgantina: The Urban Settlement.

Civic wealth is perhaps nowhere better reflected than in the initiation of a monumental building program that radically transformed the city’s agora. Three stoas, each measuring roughly 300 feet in length, framed the north, east, and west sides of the upper agora.\(^{358}\) A stone theater, with seating for approximately 2,000 people, was built against the hillside at the southwest corner of the agora.\(^{359}\) A tripartite staircase, which may have also doubled as the city’s *ekklesiasterion*, or assembly place, united the upper and lower portions of the agora. The lower agora was dominated by the construction of the East and West Granaries, now both reliably dated to the middle decades of the third century.\(^{360}\) It was also around this period that the city’s fortification walls were reinforced and a defensive arrangement in the form of a *porta a tenaglia* was added at the agora’s postern gate.\(^{361}\) Several smaller buildings, including the Fountain House, Public Office, Northwest Stoa, and Bouleuterion, filled in the remaining spaces around the perimeter of the agora.\(^{362}\) Malcolm Bell has dated the construction of nearly all of these building to the

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\(^{358}\) On the Morgantina stoas, BELL (1993). *East Stoa*: *PR* VIII, 137–8. *North Stoa*: *PR* VIII, 138–40, where it is referred to as a “gymnasium” by Sjöqvist. *West Stoa*: *PR* V, 278; *PR* VI, 135–6; construction of the West Stoa was halted before the building was complete. It is nevertheless possible to gauge the full extent (300 feet; 0.333 m = 1 foot) and plan (two stories with seventeen two-room shops) of the stoa from the extant remains. Construction of the West Stoa was begun a short time after construction ceased on the slightly earlier Northwest Stoa. Only three rooms of the Northwest Stoa were completed before the construction halted and work began on the much grander West Stoa.\(^{359}\) *PR* VI, 137–8; *PR* VII, 163–4; *PR* IX, 245–6; STILLWELL (1964/65); DOBBINS (1985); BONANNO (2009).\(^{360}\) *East Granary*: *PR* IV, 130–31; *PR* V, 277–78. *West Granary*: *PR* XIII, 321–24.\(^{361}\) *PR* IV, 127; *PR* XIII, 316–18.\(^{362}\) *Fountain House*: *PR* XII, 331–37; BELL (1985). *Public Office*: The building was originally referred to as a “prytaneion”. For interpretation as an administrative office, see BELL (2004; 2007a; 2007b). *Bouleuterion*: *PR* VIII, 140–41. Construction of a bouleuterion and *ekklesiasterion* at this time would suggest that even under Hieron, the community exercised some degree of local autonomy; BELL (1993).
decades between 270 and 240 BCE. The flurry of activity reflects a major investment in the city’s civic infrastructure. At around this same moment in time, two monumental bathing complexes were built at the western edge of the city, not far from the city gate. The size and complexity of these monuments reveals an openness to experimentation. Based on an analysis of the geometry employed in the layout and design of the North Bath, Sandra Lucore has suggested that contemporary Syracusan principles influenced the form of the Morgantina baths. The construction of several religious complexes around various parts of the city may also be a symptom of civic prosperity. That these sanctuaries appear to be sites for the worship of Demeter and Persephone may only serve to reinforce the connection between agriculture and civic prosperity at Morgantina.

Amidst the wider backdrop of urban embellishment, there are also unmistakable signs of increased private wealth. Perhaps this is most clearly documented in the construction of large peristyle houses on the hills immediately flanking the agora. Embellished with decorative wall painting, mosaic floors, and rooms designed for entertaining, this new style of residence was undoubtedly designed to be an expression of wealth and status for its owner. That many of these peristyle houses came to occupy the space of two lots in the city’s grid is just one sign that increased prosperity lead to greater social stratification in the community. The growing class divide is evident when the large peristyle houses of the East and West Hills are compared with the more humble residences found as one moved farther away from the agora along the city’s main east–

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363 PR XII, 338–40; BELL (1993, 330–31), suggests construction of all major architectural elements in the agora began within the quarter century between 275–250 BCE.
364 LUCORE (2007; 2009)
365 BELL (2008);
366 For the Hellenistic Houses at Morgantina, see TSAKIRGIS (1984; 1995, 131–8)
west thoroughfares. The so–called House of Eupolemus is an example of a smaller residence, which did not undergo expansion in the third century. But even this house may only mark a midway point between elite and poor, who may have lived in close quarters in residential complexes similar to those excavated to the northeast of the agora in part of the Serra Orlando plateau referred to as Contrada Drago.

Private wealth was also manifest in the public sphere as well. For instance, a partially preserved inscription on one of the stone seats in the theater’s cavea appears to document a dedication from a certain Arkelas, son of Eukleidas to the god Dionysus. Even though the details of Arkelas’ patronage remain open to speculation, the prominent location and scale of the inscription was highly visible reminder of his status within the community. In the same vein, a limestone sculpture of a female figure discovered in 1956 in the agora may represent another member of the local elite. Malcolm Bell has suggested the statue originally stood on a base located at the midway point along the south wall of the East Stoa. Given its original location and under life–size scale (which may point to the non–divine statue of the female subject) it is tempting to identify the sculpture as an honorific statue and perhaps even the sponsor of the East Stoa. Bell posits that the sculpture may represent the Syracusan queen Philistis, wife of Hieron II,

367 The area today known as Papa Hill, located to the west of the agora, seems to have been the site of a non–elite neighborhood during the Hellenistic period at Morgantina. Smaller houses of third century date are also documented on the slopes of the Cittadella.
368 *PR* XI, 362–6.
369 *PR* VI, 138; *PR* IX, 245.
370 *Inv.* 56–1479; *PR* I, 159. The sculpture was likely toppled from its base and damaged during the siege of 211 BCE. BELL (1993, 332 and n. 30), dates the sculpture to the second half of the third century BCE, noting the stylistic affinities of the drapery with that of contemporary Syracusan sculpture and terracotta figurines; see also, *MS* I, 47.
371 BELL (1993, 332), notes that the limestone plinth to which the female figure is attached and the masonry base in the East Stoa are of equal width (0.44 m).
372 BELL (2011, 203, n. 72), mentions a second limestone statue recovered during excavations in the agora at Morgantina. This too was evidently a draped female, but was smashed into dozens of small pieces in antiquity. It was sculpted in the same pseudo–acrolithic technique as the better preserved *inv.* 56–1479.
but admits that a less-regal benefactor is a possibility. Less monumental signs of private wealth include the increased consumption of luxury items such as jewelry, drinking vessels, and other objects made from precious metals.

III.A.2 Morgantina: The Rural Landscape.

At roughly the same time as these developments were taking place in the urban center at Morgantina, changes in the patterns of rural activity were occurring in the surrounding hinterland. An intensive landscape survey conducted in the territory around Morgantina in the late 1990’s revealed a wealth of data related to rural occupation during the Hellenistic and Roman periods. While it is not possible to establish the exact nature of these changes in rural activity, they nevertheless lend themselves to an interpretation that agrees quite well with the evidence for increased wealth in the urban center.

The survey revealed Late Classical–Early Hellenistic (LC–EH) artifacts from a total of 56 locales within the roughly 150 km² range of the survey universe. While this

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373 BELL (1993, 332), in support of a royal patron of the East Stoa, cites the examples of Apollonis, wife of Attalos I, who donated stoas in the sanctuary of Demeter at Pergamon and Lamis, a mistress of Demetrios Poliorcetes, who sponsored the construction of a stoa at Sikyon. For examples of non–royal female patronage of civic buildings in the Hellenistic period, see VAN BREMEN (1996). An inscription from Priene, dating to the first century BCE, records that a certain Phile, daughter of Apollonios, sponsored the construction of a cistern and aqueduct for the community at her own personal expense (ἀν[έ[θηκε παρ’ ἐαυτῆς τῷ] ἐγγόνου τοῦ [ὑπ’ ἡστήρας] καὶ τῇ ἐν τῇ πόλει τῷ διοραγόμαι); HILLER VON GAERTRINGEN (1906, no. 208). See also, IG V² 461, an honorific inscription from Megalopolis praising a woman named Euxenia, who sponsored a building project associated with a temple of Aphrodite.

374 Jewelry: pair of gold earrings (inv. 70–592; PR XI, 366; third century; domestic context); silver diadem (inv. 57–1166; PR II, 160, pl. 30, fig. 24; fourth or third century; sanctuary); pair of gold earrings, one gold ring, one gold pendant, and four gem stones (PR I, 158, pl. 60, figs. 27–8; third century; domestic context). Certainly the largest group of vessels and objects made of precious metal to be recovered at Morgantina is the sixteen–piece silver hoard that was clandestinely excavated at the site in the 1980’s; GUZZO (2003); although cf. BELL (2011) 205, who suggests the silver may have been brought from Syracuse around the time of the Roman siege (214–212 BCE) and subsequently buried at Morgantina in 211 BCE. Several dozen bronze handles, once attached to drinking or serving vessels, have also been discovered at Morgantina, the majority of which were found in and around the large Hellenistic houses that occupied the East and West Hills.


376 Of the 56 locales, 47 were classified as sites and 9 as tracts. For definition of site and tract, see ibid. (1999). Given the broad chronological range of materials collected during the survey, artifacts were
represents only a slight increase in the total number of sites registered from the preceding Late Archaic–Early Classical (LA–EC) period, several “fundamental differences” in rural activity between the LC–EH and the LA–EC periods were noted by the survey’s director, Steve Thompson. On a regional level, there appears to have been a general movement away from the area north of the Gornalunga river and into the area southeast of the Serra Orlando ridge. This is reflected in the fact that less than half of the sites (n.= 23) occupied during the LC–EH period had evidence of prior occupation in the LA–EC period. Twenty four new sites came to be occupied only from the LC–EH period. Thompson observed that from the LC–EH period the majority of sites came to be concentrated in the area of the Belmontino and Aquabianca river valleys south of the Serra Orlando ridge.

There was a concomitant decrease in visible activity in the marginal areas to the north of the Gornalunga river and around Monte Dragofosso in the Baccarato Valley. The concentration of sites in the LC–EH period was accompanied by both an increase in the number of sites with high artifact/hectare densities and within those sites a greater on–site density of artifacts. Thompson suggests this data may reflect a qualitative shift in the nature of rural activity from that of the preceding period towards an intensification of rural production and greater degree of permanent residence in the countryside.\textsuperscript{377} Thompson dismisses the idea that the increased number of permanent rural sites was the consequence of population growth in the urban center due to the fact that occupation in the marginal areas of the region decreased when one would expect them to increase.

Rather, the concentration of sites in the river valleys southeast of the Serra Orlando ridge classified within the broader periods of Late Archaic–Early Classical, Late Classical–Early Hellenistic (c.400–200 BCE), Late Hellenistic (c.200 BCE – 50 CE).

\textsuperscript{377} THOMPSON (1999, 412–13), notes that the number of sites which could be reasonably classified as permanent residences rose from 8 in the LA–EC period to 18 in the LC–EH period, a 125% increase. Thompson suggests that densities of 70 artifacts/hectare or greater be considered the threshold for identifying locales as sites of permanent residence; See also CHERRY ET AL. (1991).
would appear to reflect conscious effort towards the intensification of production. This intensification, of course, occurs around the time when the Hieronian tax administration was in full swing, and it is tempting to see a causal link between the tithe and increase in rural activity.

A range of site types were identified in the survey. The majority of which have been identified as farms or sites of agricultural production, based on the size of the site (by area) and on-site artifact density. Thompson suggests that the numerous small sites, of less than 0.5 hectares in area, with ‘medium’ to ‘high’ artifact densities may be identified as family farms. These he compares with findings from the Metaponto survey, which found that family farmsteads typically covered an area of around 2000–2500 square meters. Medium–large sites (0.5 – 0.88 ha.) were probably larger farming establishments. The majority of which (n. = 19) were located within a 2 to 5 km band around the urban center at Serra Orlando. The five largest sites with a medium and high artifact/hectare densities were all located at distances greater than 4.5 kilometers from the urban center and tended to be located in close proximity to a river. Four of these sites revealed evidence for continued occupation well into the first century BCE. On account of their size, length of occupation, and density of artifacts, Thompson suggests these sites may have been locations where agriculture produce could be collected and processed prior to shipment via river down to the coast.

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379 THOMPSON (1999, 428–428) notes that the site distribution for the Late Classical and Early Hellenistic period shows that Large, High Density and Large, Medium Density sites are almost all 4.5 to 5.0 km away from the Serra Orlando settlement. Medium, High Density sites also show a pattern of largely being situated at a distance 4.0+ km from Serra Orlando.
380 THOMPSON (1999), sites R04/S4, R88/S1, MC17/S1, MC52/S1
381 THOMPSON (1999, 452–53). Evidence for continued occupation into the Late Hellenistic and Roman periods would suggest that they retained the function as transshipment points for agricultural products moving to the coast.
The survey data for the subsequent Late Hellenistic period (LH; c. 200 BCE – 50 CE) is somewhat difficult to interpret, in part given ambiguities in the available ceramic chronologies for the third and second century. Thompson admits that the conclusions drawn from analysis of Hellenistic fine wares are influenced by difficulties in distinguishing between black–gloss fine wares and unpainted coarse ware of the third and second centuries. The resulting conclusions as to patterns of rural activity between 200 BCE and 50 CE are based primarily on analysis of better known ceramics of the period, namely Campana C and Italian Sigillata. Given this proviso, Thompson finds that the total number of sites occupied in the LH period dropped anywhere from 40% to 72%, depending on which type of pottery (Campana C or Sigillata) was given preference. Of the remaining LH sites, almost all produced evidence for occupation in the LC–EH period. LH sites also tended to cluster around rivers to an even greater degree than sites from the preceding LC–EH period. Thompson interprets the data from this period to possibly reflect a sharp drop in the local population following the siege of 211 BCE. Nevertheless, he suggests that the nature of these rural sites continued to be defined by agricultural production in service of the tithe, citing the continued occupation of several large LC–EH sites into the LH period and the proximity of other LH sites to rivers.

Both the changing patterns in rural activity and increased wealth of the urban center can be plausibly associated with the growing influence of the Hieronian administration in the area, as posited by the model. During the middle decades of the third century there is no evidence which would suggest the population of Morgantina adopted alternatives to agricultural production which would account for increased wealth. For much of the agrarian–based community, collection of the tithe would have lead to an

382 THOMPSON (1999, 440).
overall increase in agricultural productivity, aimed at simply matching the amount lost in taxes. Aware of the potential to profit from marketing grain through the opportunities created by the tithe, wealthy members of the community may have responded by expanding and intensifying production. The shift in large-scale farms towards river valleys observed by the Morgantina Survey may reflect efforts to reduce transportation costs as well as to invest in the infrastructure necessary for processing and shipping grain to the coast. Local elites may have found further opportunities to profit by playing the role of merchant, purchasing surplus grain from small farmers or collecting it as rents from tenant farmers, which could be sold for higher prices on the coast or even locally, as supplies diminished throughout the year. Local elites may have even bid on the tax–farming contracts to collect the tithe grain owed by the community. Such new–found opportunities lead to increased wealth for a certain segment of the population, which in turn could be invested in both private and public displays of wealth in the urban center. In time, social stratification became more pronounced, manifest in the construction of large peristyle houses and sponsorship of public building projects. The strengthened economic and administrative connection with Syracuse and Hieron’s court was accompanied by an equally strong reception of cultural and artistic developments coming from Syracuse, evidenced by the art, architecture, and ceramics. In order to further test this model, we might consider the types and amounts of coinage in circulation at the site.

IIIB. A Case Study: Part II – Morgantina, Coinage and Trade.

We can only speculate as to the full complexity of monetary exchange in southeastern Sicily during the Hieronian period. We are left with little or no evidence to as regards many fundamental aspects including prices, contracts, and credit institutions.
One area for which we possess a relative wealth of evidence is coinage. Hoards and archaeological excavations have produced significant quantities of coins dating to the Hellenistic and Roman Republican periods. Study of coinage as a medium of exchange offers a promising avenue to pursue issues of circulation and exchange, particularly as it relates to interstate trade. In order to test this hypothesis, I have studied coins recovered from secure archaeological contexts that are associated with two commercial complexes at Morgantina. The coins recovered from these contexts may serve as a worthwhile case study of general circulation patterns for several reasons, including the city’s location in the grain–producing region in the interior as well as its political affiliation with Hieron II and within Rome’s administrative structure. Not least, the long history of scientific excavation allows for an unusual breadth and depth of analysis.

Throughout the following section, I will advance an argument that by treating bronze coinage as a material index of inter–regional trade in grain, we can trace the movement of an inherently perishable material. This hypothesis is predicated in large part on two principles. First, that coins recovered from sealed archaeological contexts offer a reasonable index of overall patterns of coin circulation at a given site. And, second, that coin circulation and monetary flow may serve as reasonable indicators of inter–regional trade and may be used to determine the direction and intensity of trade between two or more sites at any given time.

\__\textsuperscript{383} See LOVEJOY (1974, 564ff.) who uses the movement of coinage as an index for long–distance trade in the region of western Africa between Central Sudan and the Guinea Coast during the medieval period.\__
IIIIB.1. Coins in Hellenistic Morgantina: The Central and South Shops (c. 275–211 BCE).

The Central and South Shops are comprised of three independent suites of shops, each made up of five to six small rooms (Figure 56). Aside from their location in the city’s agora, the commercial nature of these spaces can be inferred from the materials found both within the rooms and in the associated midden. Excavation of the rooms revealed hundreds of coins in well–stratified archaeological deposits related to the construction, use, and destruction of the shops.  

The Central and South Shops represent a rare instance of stratified coin deposits recovered from a commercial context on the island. As such, they serve as an excellent index of circulation patterns in the area around Morgantina and offer a perspective into the nature and use of coinage in commercial settings that is neither well–documented nor emphasized in the numismatic scholarship for Hellenistic Sicily.  

The coins document sustained commercial activity over a period of roughly sixty years, a period corresponding almost precisely with the regnal years of Hieron II.  

The northernmost suite of rooms was built first around the year 275 BCE. The long rectangular building was divided into six smaller rooms. These opened onto the east, where a light, wooden portico was constructed to protect from rain. This suite of shop rooms was a predecessor of the monumental building program that came to define the form of the agora. The shops remained in use for no more than 25 years. The six rooms

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384 For previous discussion of coin finds from the Central and South Shops: MS II, 162–4, nos. 27–28 and 187, nos. 56–57; PR XII, 324–30; BELL (1995).

385 Current numismatic literature regarding the circulation of coinage in Hellenistic Sicily tends to privilege discussion of its presumed military function, essentially attributing circulation to the movement of troops; for instance, PUGLIESE (2004; 2005; 2009) and CALTABIANO ET AL. (2006). While not to deny that the payment of soldiers was among the principal motivations for striking coins in antiquity, the model, to my mind, does not serve to reasonably explain either the increased monetization nor the patterns of circulation in the largely demilitarized territory subject to Hieron II.

386 PR XII, 326–30.
were intentionally razed around the year 250 BCE to make way for the Great Steps, which were built immediately to the north. Their demolition was followed by the placement of a thick (0.35m) leveling fill, which raised the ground level of the lower agora in preparation for the construction of the Steps. The central suite of rooms was built around this time, likely as replacements for the northern rooms. The central suite lie to the north of Theater Street, between the north and south suites. The orientation of the central suite resembles that of the northern and southern rooms, but unlike the other shop suites, they were not independent. They formed the east side of the so-called Central Market complex. The southern suite was composed of six adjacent rooms set against a limestone outcropping, located to the south of Theater Street in the lower agora. The rooms are oriented along a roughly north–south axis and open onto the east, where they would have faced the principal thoroughfare entering and exiting the lower agora. Both central and southern suites remained in use for roughly 40 years and were abandoned and destroyed in or around the year 211 BCE, when the city was captured by the Roman praetor M. Cornelius Cethegus. Excavators found thick strata of ash and tiles in all of the rooms of the central suite, suggesting that they were destroyed in a conflagration.\textsuperscript{387} Several rooms of the southern suite showed signs of having been used as a dump prior to the collapse of the roof.\textsuperscript{388}

A total of 476 coins were recovered from contexts related to the use of these eighteen shop rooms. Of this number, 472 are bronze and 4 silver coins. The silver coins are of types struck by Roman and Punic mints during the Sicilian phase of the Second Punic War, and thus could only have arrived at Morgantina between the years 213 and

\textsuperscript{387} PR I, 155–6, where the complex is referred to as the “South Market.”
\textsuperscript{388} PR XII, 326.
Bronze coinage appears to have been the primary medium of commercial exchange for practically the entire lifetime of the Shops. The preponderance of bronze coinage in small denominations suggests that routine commercial transactions occurring within these spaces were highly monetized.

340 or 74% of the 462 legible coin finds from the Shops are Hieronian. This number is made up almost exclusively of the Hieron’s three principal bronze emissions, the Persephone/Bull IE (16%; 53/340), Hieron/Horseman (11%; 37/340) and Poseidon/Trident (70%; 239/340) issues. The next largest group of coins (10%; 46/462) from the Shops belong to the pre–Hieronian mint at Syracuse and is comprised largely of issues struck between the period of the Third Syracusan Democracy (330–317 BCE) and the reign the tyrant Hiketas (287–278 BCE). Almost completely absent from the Shop contexts are coins from nearby Sicilian mints. Those present—Tauromenium, Agrigento and Tyndaris—comprise only 2% of the total. The remaining 14% is made up of smaller numbers of South Italian, Punic, Ptolemaic, and Roman coins. The prevalence of Hieron’s coinage is even more apparent when only contemporary coinages are compared. The percentage jumps to 76% when we exclude coins struck after Hieron’s reign, such as the Roman bronzes struck between 214 and 212 BCE and coinage of the Fifth Syracusan Democracy (214–212 BCE).

With the exception of the large bronzes of Ptolemy II and a few Campanian and Siculo–Punic issues, Hieron’s Syracusan mint is the only active minting authority represented in the shop contexts for the greater part of the third century.

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390 CRAWFORD (1972, 42–3), emphasizes the importance of small denominational bronze coinage found in hoards or stratified contexts as evidence for the use of small change for routine commercial transactions.

391 To arrive at this number I have excluded all illegible coins (14 ex.) as well as coins struck at Roman, Punic, and Syracusan mints after 215 BCE, including: MS II 503 = RRC 42/4 (14 ex.); MS II 520, RRC 69/6 (1 ex.); MS II 373 (1 ex.); MS II 445 (2 ex.).
The percentages of Hieronian coins recovered from individual shop rooms are equally striking. For instance, in Room 3 of the northern suite, excavators exposed five successive beaten–earth floors spanning the lifetime of the room. Treating each floor as a discrete period in the use of the room, we find that Hieronian bronze represents the lion’s share of coinage in circulation throughout the lifetime of the shop (Chart 5).

Chart 5. Distribution of Coin Finds from Floor and Fill–layers in Room 3 of the Northern Wing of the Central Shops.

Hoard evidence, as well, reflects a preference for Hieronian bronze during this period. Of the four bronze hoards discovered in the Central Shops, all were comprised entirely of Hieronian coinage (Figure 57). As I suggested in section IC, the selectivity might indicate that they were valued differently from the other bronze coins circulating alongside them.
The impression of commercial dominance enjoyed by Hieronian coinage one gets from the Central and South Shops is, moreover, reflected in the total number of coins recovered at Morgantina (see Chart 3, above). The overall numbers themselves reflect a dramatic increase in the amounts of bronze coinage that reached the city from previous generations. A quick survey of total coin finds from Morgantina reveals that Hieronian coinage outnumbers not only all other Syracusan coinage by a ratio of nearly 2:1, but also represents a nearly 400% increase over the amount of Syracusan coinage which had reached the city in the previous 40–year period spanning the reigns of Agathokles, Hiketas, and Pyrrhus (Chart 6). There is a similarly drastic decrease in the amount of Syracusan coinage reaching Morgantina in the late third and second century, following Hieron’s death. This will be important when we consider the coin finds from our second commercial complex at Morgantina.

Comparable percentages of Hieronian coinage are reported from the agora at Kamarina, a city which I have argued was, like Morgantina, subject to Hieron’s authority.
for much of the third century.\textsuperscript{392} Of the 708 legible coins recovered during excavations in the city’s agora between 1983 and 1995, 275 or roughly 40% were identified as Hieronian.\textsuperscript{393} This number increases dramatically, jumping up to 76% (275/360), when we look only at the coins in circulation down to 215 BCE. Though the sample size is only one–tenth of that from Morgantina, the general circulation pattern for the fifth through third centuries at Kamarina is remarkably similar in that the agora sample shows the same dramatic increase in the amount of bronze coinage in circulation during the Hieronian period. Lucchelli and Di Stefano recognized that the large numbers of Hieronian bronzes recovered from the agora represent more than sporadic specimens reaching the site and suggested they reflect close trade relations with Syracuse.\textsuperscript{394} If I am correct in arguing for Kamarina’s inclusion within Hieron’s kingdom, the high degree of economic intercourse between the city and Syracuse may have been as much politically determined as geographic. While Lucchelli and Di Stefano do not go so far as to attribute any political affiliation between Kamarina and Morgantina post 258 BCE, they, nevertheless, note that the circulation patterns, “suggerisca un certo parallelismo tra l'afflusso di moneta a Camarina e a Morgantina piuttosto che una situazione camarinese radicalmente differente”.\textsuperscript{395} To grasp the significance of these numbers, we might compare them to those recorded from well–excavated cities in the western half of the island. The number of Hieronian coins recovered at Selinunte and Monte Iato, for instance, are much smaller,

\textsuperscript{392} WALTHALL (2011b).
\textsuperscript{393} LUCCHELLI and DI STEFANO (2004) publish 923 coins from the agora excavations. Of this total, 918 were bronze and 5 were silver. For a summary of the numismatic evidence from the excavations see, LUCCHELLI (2004).
\textsuperscript{394} LUCCHELLI and DI STEFANO (2004, 57).
\textsuperscript{395} LUCCHELLI and DI STEFANO (2004, 56).
representing only 2% and 11% of the total coins recovered in excavations respectively (see Chart 4, above).\textsuperscript{396}

To summarize, the numismatic evidence from the Central and South Shops appears to reflect a period when Hieronian coinage was commercially dominant, circulating in such numbers at Morgantina to the near exclusion of other mints. When looking at the larger, site–wide picture, we see that Hieronian coinage arrives in great numbers into Morgantina during this period, contemporary with the use of the Central and South Shops. A similar pattern is observed at Kamarina. Judging from the total number of coins recovered at both sites, the Hieronian period was one of intense monetization for communities in southeastern Sicily.

\textit{IIIB.2 Coins in Roman Morgantina: The Macellum (c. 130’s – 30’s BCE).}

The second commercial complex was built in the open area of the upper agora during the second century BCE and remained in use for nearly a century, until its abandonment and destruction in the third quarter of the first century BCE (Figure 56). The complex, on account of its plan and date, is commonly referred to as the Macellum.\textsuperscript{397} The two rows of shop rooms along the north and south sides of the complex

\textsuperscript{396} Selinunte: 20 of the 1,054 coins published by TUSA–CUTRONI (1957, 1958/59, 1968) are Hieronian; Iato: 86 of the 669 coins published by FREY–KUPPER (forthcoming: 77 of 557 coins) and REUSSER ET AL. (2011: 5 of 47 coins), (2011: 4 of 65 coins) Hieronian coins. From these same sources Punic coins account for 93% (984/1054) of the total coin finds from Selinunte and 73% (488/669 ) from Iato.

\textsuperscript{397} For discussion of the excavation and identification of the Macellum at Morgantina see, PR I 154–5; NABERS (1967) 126–142; also, DE RUYT (1983) 109–114. The building’s construction is presently dated on the basis of several coins recovered from within contexts identified by the original excavators as builder’s trenches. The single most important coin to be recovered from one of these builder’s trenches (said to be recovered from the risega wall) is a denarius of Sextus Pompeius Fostlus (55–2097; MS II 592; RRC 235/1a) struck in 137 BCE. On the basis of this coin, some have suggested that the construction of the Macellum was a reflection of Rome’s administrative efforts to stabilize the island following the slave revolt of 135–132 BCE. STONE (1983, 17) argues the building was destroyed in the 30’s BCE, during Octavian’s reprisal against supporters of Sextus Pompey. The Macellum at Morgantina is the subject of a forthcoming study currently in preparation by H. Sharp and J. Spurza.
appear to have been loci for commercial activity, judging from the concentration of coins and other artifacts related to exchange recovered therein.

The total number of coins (t. = 432) recovered from the seven shop rooms along the north side of the courtyard, as well as from the courtyard and peristyle, approaches the number recovered from the Central and South Shops (t. = 476). As such, the Macellum should offer an equally representative estimate of coin circulation at Morgantina in the second and first centuries BCE.398

Chart 7 shows the mint distribution of the coins from the Macellum. We can immediately observe several differences between the character of the coins found in the Macellum and those from the Central and South Shops. Bronze is still the prevalent medium of exchange, with silver coins (5 Roman denarii) comprising only a tiny fraction of the total coin finds. When the coins are arranged by mint, one is immediately struck by the amount of non–Syracusan coinage in circulation. Most notably, a much larger number of Sicilian mints, including Aetna, Catania, Centuripe, Messana, and even Morgantina itself, are represented by substantial numbers of coins. Judging from the coin finds from the Macellum, Syracusan bronze no longer represents the dominant medium of exchange at Morgantina, as it did in the Central and South Shops during the Hieronian period.

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398 Many thanks to Hal Sharp for providing me with a detailed inventory of coin finds from the Macellum. Twenty five of the 432 coins were illegible and are thus do not factor into the following calculations.
The most prevalent coinage recovered from the shops in the Macellum are small bronze denominations struck at Catania in the late third and early second centuries. An overwhelming number of these are of the type *Obv.* Head of Apollo l. / *Rev.* Isis standing r. (Chart 8). Mina Casabona has recently studied these small bronze denominations from Catania and has concluded that the earliest series, including the prolific Apollo/Isis issue shown here, were minted between 216/5 and 205 BCE. More than 1,400 examples of these late-third and early-second century coins have been recovered in

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**Chart 7: Distribution of Coin Finds from Macellum, Shops 1–7**

<table>
<thead>
<tr>
<th>Location</th>
<th>Coinage</th>
<th>Number</th>
<th>Mint Mark</th>
<th>Location</th>
<th>Coinage</th>
<th>Number</th>
</tr>
</thead>
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<td>101</td>
<td></td>
<td>Mamertine</td>
<td>35</td>
<td>1</td>
</tr>
<tr>
<td>Rome</td>
<td>Syracuse (pre-215 BCE)</td>
<td>55</td>
<td></td>
<td>Aligento</td>
<td>1</td>
<td>Alium</td>
</tr>
<tr>
<td>Syracuse (post-215 BCE)</td>
<td>Aetna</td>
<td>53</td>
<td></td>
<td>Aigenna</td>
<td>13</td>
<td>Calicata</td>
</tr>
<tr>
<td>Morgantina</td>
<td>Centuripe</td>
<td>47</td>
<td></td>
<td>Tauromenium</td>
<td>8</td>
<td>Panormus</td>
</tr>
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<td></td>
<td></td>
<td><strong>Total</strong></td>
<td><strong>194</strong></td>
<td></td>
</tr>
</tbody>
</table>

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399 *MS II* 140, 141, and 142.
400 CASABONA (1999). In a review of Casabona’s work, Harold Mattingly suggests the introduction of this series should be pushed down into the first three decades of the second century; MATTINGLY (2000) 47. Mattingly does note the two Apollo/Isis coins listed in *MS II* “Catalogue” no. 60, which is identified by the editors as a sealed context from the 211 BCE capture of the city, but he points out that BUTTREY (1965, 265–6; reprinted in *MS II*, 218) states that none of the nearly nine hundred specimens of the Apollo/Isis coins came from secure third century contexts at Morgantina. The so–called House of the Official does seem to have suffered damage in 211 BCE, but it was soon reoccupied and remained so down into the late first century BCE; TSAKIRGIS (1984, 211–25) and STONE (1983, 18).
excavations at the site so far. Their total number being second only to the total number of Syracusan coins to recovered from the site (Chart 8).

Chart 8: Coin Finds from Macellum, indicating numbers of coins by mint and type.

The archaeological evidence from Morgantina suggests that these Catanese bronzes had indeed arrived in great numbers certainly by the first quarter of the second century, if not by the last decade of the third (Chart 9). We can be fairly certain that these Catanese bronzes were not in circulation at Morgantina before the city was recaptured in 211, since none have been recovered from secure 211–BCE contexts at the site.402

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401 For brief discussion of die counts associated with the Apollo/Isis coins see, MS II, 140–141. The editors suggest that production of the series (nos. 140–142) must have been “enormous,” based on both the number of surviving coins as well as the number of distinguishable dies. For Cat. 140 the editors note six die pairs from thirty coins. Fifteen obverse dies and twenty–seven reverse dies were identified among sixty two well–preserved specimens of Cat. 141.

402 However, the contents of a hoard from the East Granary (MS II “Catalogue” no. 39) suggest that these coins did arrive very shortly after 211 BCE. The entry for the hoard in MS II, “Group of twenty–seven AE found loose in fill” (p. 170), is imprecise and suggests the coins may not have actually belonged together as a hoard. However, autopsy of the supervisor’s notebook for 30 April, 1960 confirms that the coins were in fact found together as a single group along with a small terracotta vase, which may have originally held the coins. The latest coin in the hoard is a Apollo/Isis (MS II Cat. 142c). A date not long after 211/210 BCE is
If we again compare these numbers to those recorded at Kamarina, the data for the circulation of coinage struck after 215 BCE shows an interesting deviation from Morgantina. While the coins recovered from the Macellum reflect an increase presence of coinage from coastal cities in the northeast part of the island, Catania and Messana in particular, only a handful of coins from these cities turn up at Kamarina. Syracusan bronze continues to make up the largest percentage of late–third and second century coins at Kamarina. This divergence in numismatic data reflects, I believe, a divergence in the direction of trade for these two cities after the dissolution of Hieron’s kingdom.

suggested by the inclusion of bronze coins struck by the Fifth Syracusan Democracy (214–212 BCE; MS II Cat. 375) and Hieronymus (215–214 BCE; MS II Cat. 371).
III.B.3. Interpreting the Data.

Now my model would explain the influx of bronze coinage at sites like Morgantina during the Hieronian period by associating bronze coinage with payments made for surplus grain that was purchased by agents operating out of Syracuse. While it may be impossible to determine whether the bronze coins document purchases made by merchants and private individuals or by royal officials, the overall numbers from Morgantina speak to an intensification of trade with Syracuse. Judging from the concentrations recovered in the Central and South Shops, it is clear that the Hieronian bronzes quickly found their way into local, commercial circulation. It was during this same period that major transformations took place in both the urban center at Morgantina and the surrounding hinterland, which are themselves interpreted as resulting from the increased market integration enjoyed by Morgantina and other cities subject to Hieronian administration.

Working with this model, one must confront several obstacles. First, how can it be established that bronze coinage flowed into the interior of the island due to trade in grain rather than on account of a more traditional explanation for circulation, such as the movement of troops? Second, to what degree does coinage reliably tell us about trade networks, particularly if Hieron encouraged a uniformity of coinage within his kingdom? Both issues are difficult to resolve, looking only at the data from the Hieronian period. But clarity is gained on both fronts when the numismatic data from the Roman period is brought into the discussion.

In the years following the death of Hieron in 215 BCE, communities across southeastern Sicily, including many former ‘allies’ of the Syracusan monarch, began
minting coins.\textsuperscript{403} For the most part, communities minted small denomination bronzes, limited in output and largely restricted in circulation to the immediate territory of the \textit{polis}. The situation was different for Catania, which in the late third century began what has all the signs of a prodigious campaign of minting bronze coins.

According to my model, the dramatic increase in Catanese bronze reaching Morgantina should reflect a shift in the direction of the grain trade—away from Syracuse towards Catania. This very scenario play out in our historical sources. Once Syracuse had fallen to Marcellus and the Carthaginians had been expelled from the island, it was Rome’s top priority to redirect grain exports to Rome.\textsuperscript{404} Peninsular Italy had suffered terribly during the Hannibalic campaigns and Sicily offered an immediate source of grain necessary to keep Rome’s urban population content and its armies marching.

As was discussed in the previous chapter, Livy reports that in the months immediately following the end of hostilities, the consul M. Valerius Laevinus encouraged Sicilian farmers to return to cultivating their fields in an effort to restore cereal productivity to pre–war levels. In 211 BCE, Laevinus reportedly send word to Rome that he and his troops had compelled the Sicilians to lay down their arms at last and turn their attention to tilling the soil, so that the island might not only produce food enough for the inhabitants, but might relieve the grain market of the city of Rome and of Italy, as it had done on many occasions… (Livy, 26.40.13–16)

By the following year, the newly harvested grain was being sent to Rome and Roman troops stationed at Tarentum. Livy (27.8.18) specifically names Catania as the port used by Laevinus to send the grain north.

\textsuperscript{403} Some cities, including Morgantina and Leontinoi, resumed minting activity after a hiatus of more than a century. Others, such as Akrai, appear to have initiated minting for the first time, having now gained some degree of independence from Syracuse.

\textsuperscript{404} Livy (29.1) reports that in 205 BCE, Scipio found that Syracuse still had not fully recovered from the violence and turmoil of Marcellus’s siege.
With Catania now operating as the island’s major commercial port, large profits stood to be made through the grain trade. The civic mint may have capitalized on the city’s new position, striking large quantities of small bronze coinage to serve as instruments of exchange. The movement of merchants within the network would also explain the penetration of the Catanese coinage into the island’s interior and the rather wide circulation pattern enjoyed by its bronze coinage, compared with that of contemporary coinages minted by other poleis on the island. Thus, Catanese bronzes most likely reached Morgantina as part of the same network of exchange that previously brought great quantities of Syracusan bronzes into the interior. As such, the coins may be taken as evidence that the grain trade between the interior and coast did not cease with the death of Hieron II. Bronze coinage continued to flow into the interior of the island, only now bearing the legend of the Catanese.

The influx of Catanese bronze into Morgantina in the late third and early second century, in fact, confirms the hypothesis

405 PUGLISI 2009, 274 no. 142. The identification of “Circulation patterns” among ancient coins is, of course, determined by many external factors, including most significantly the varying levels of archaeological fieldwork (excavation, survey) in a given region or location, as well as the quality of reporting.

406 The bronze coinage of third- and second-century Catania has been the subject of study by CASABONA (1999), who arranges the known issues according to stylistic analysis, metrology, and archaeological finds. Casabona’s first period dates 215–206/5 BCE. The earliest issues of this period (1–6) turn up at Morgantina, but in small numbers. Issues 7 and 8, including the Apollo/Isis series, have been recovered in exceptional numbers at the site. The dating of the Apollo/Isis series remains to be sorted out. The authors of Morgantina Studies II: The Coins recognized that Apollo/Isis coins did not show up in deposits associated with the 211 BCE siege and capture of the city. They assigned the issue to a rather vague “3rd to 2nd century BCE” period. Casabona narrows the emissions to a ten–year period between 215–206/5 BCE. MATTINGLY (2000), citing the absence of these coins from 211 BCE destruction deposits at Morgantina, suggests the Apollo/Isis coins date after 200 BCE, but offers no more specific dates. Important for the dating of the Apollo/Isis issue is a dispersed hoard recovered from the East Granary in the agora at Morgantina (MSII, Deposit #39). The hoard, composed of 27 bronze coins, contained 24 coins dating to the reign of Hieron II (240–215 BCE), one from the reign of Hieronymus (215–214 BCE), one of the 5th Syracusan Democracy (214–212 BCE), and one Apollo/Isis bronze of Catania. The contents of the hoard leads me to believe that the minting of bronze at Catania followed shortly upon the fall of Syracuse in 212 BCE. A date around 210/205 BCE for the earliest emissions of the Apollo/Isis type would not be out of sync with the available historical and archaeological evidence. The archaeological evidence from Morgantina, while strongly suggesting that these coins were not in circulation prior to 211 BCE, nevertheless points to a date in the last decade of the third century for their introduction.
that the circulation of Syracusan coinage in the interior of the island was due in large part to the movement of grain from the interior to the coast. Phillip Perkins makes a similar observation regarding the distribution of mints represented by the coin finds at Monte Iato, ranging from the third to first century BCE.\textsuperscript{407} He suggests that the predominance of bronze coinage from Panormus (44%), which would have served as the region’s largest port, and Rome (16%) found at Monte Iato may be related to the purchase of grain.\textsuperscript{408} In the case of Monte Iato, Perkins posits that it was the purchase of the second tithe that lead to the arrival of bronze from Rome and Panormus at the inland city. As a principal administrative center and commercial port on the north coast of the island during the Republican period, Panormus would have played a similar role with respect to Monte Iato as Catania would have for Morgantina. The notion that bronze coinage reflects the sale of tithe grain is an attractive theory that could be easily applied to Morgantina, both under Hieron and the Romans.

Catania remained a principal port through which Sicilian grain reached Roman markets throughout much of the second and first century, judging from surviving archaeological and epigraphic evidence.\textsuperscript{409} In addition to the bronze coinage, Shelley Stone has found that during the second century both the imported and locally–produced varieties of Campana C found at Morgantina exhibit a much stronger connection to the

\textsuperscript{407} PERKINS (2007, 44).
\textsuperscript{408} For the coin finds from Monte Iato see, FREY–KUPPER (1992).
\textsuperscript{409} For instance, \textit{CIL XIV} 364, an inscription discovered at Ostia that identifies a certain C. Granius Maturus as \textit{patronus} of a shipping guild, which had operations based in both Ostia and Catania; as reconstructed by MANGANARO (1988, 9). For a recent review of evidence related to the city’s harbor from the ancient to modern period, with particular emphasis on geological and topographic analysis, see BERLINGHIERI and MONACO (2010).
area around Catania than Syracuse. The number of Syracusan imports to the city drops markedly from the third century.

IV. Conclusion.

This chapter addressed the question of whether the administrative policies adopted by Hieron, which were intended to extract agricultural resources from his kingdom, had attendant economic impacts for the communities that paid the tithe. And, while the primary focus of inquiry was eastern Sicily, discussion turned towards revealing the broader implications of the analysis, namely to bring into greater detail the relationship between political institutions and economic behavior. As in previous chapters, my method was to approach the larger issue through detailed analysis of relevant archaeological material. In this case, attention was directed to numismatic material recovered from the excavations of two commercial complexes at Morgantina. This brief survey of the coin finds from the Central Shops and Macellum has enriched our narrative of grain trade in eastern Sicily during the Hellenistic and Roman periods. In addition to revealing the existence of trade networks otherwise unattested in our historical sources, the coin finds from the Macellum serve to highlight the fact that Morgantina did not suffer the severe economic isolation we generally attribute to communities on the interior of the island during the Roman period. In fact, as the numismatic evidence suggests, Morgantina experienced continued economic vitality into the second and first centuries, as trade networks with urban markets on the coast did not cease to exist, but were simply redefined, shifting from Syracuse to Catania, Messina, and other cities on

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410 MS VI. This includes the importation of clay and volcanic sand from the region around Etna, which was used in the local manufacture of Campana C at Morgantina.
the northern coast. The results of this brief investigation are encouraging and suggest that future work in this vein may prove fruitful.
CHAPTER V: CONCLUSION

The archaeology of agricultural administration stands as a rich field of investigation, one that promises to reward continued research both in Sicily and in the broader Mediterranean world. Throughout this dissertation, I have approached a well-known historical narrative through the material record. In the process, I attempted to enrich the discourse about Hellenistic and Roman Republican Sicily. In some respects, I have tried to accomplish this by simply introducing new data into the discussion, such as the stamped measures from Morgantina and Kamarina or the recent numismatic discoveries from excavations in the East and West Granaries. In other respects, this was accomplished by advancing new interpretations that challenge or elaborate on the standard historical narrative, such as by proposing an enlarged territorial extent of the Hieronian kingdom over previous estimates or by offering a model by which we might measure the impact of agricultural taxation on economic performance at both local and regional levels. In doing so, I have hopefully demonstrated the value of such an approach and encouraged others to adopt, revise, and improve upon my methods.

Chapter Two demonstrated that grain measures need not be relegated to antiquarian or metrological inquiry, but should rather be treated as vital documents of the political, commercial, and administrative systems to which they belonged. A singular measure may express little, but in great numbers they reveal abstract systems of ordering made tangible only in the vessels themselves. Having embarked on a path of reviving these long overlooked objects, I can only hope that others will continue to add to this corpus of material further expanding our understanding of ancient standards, trade, and administration.
Chapter Three established that granaries, when placed in the proper context, are more than simply warehouses but are, in fact, reliable indices of political control over agricultural resources and of a community’s participation in a political and economic network that extended far beyond its borders. Excavations conducted in 2011 and 2013 inside the East and West Granaries at Morgantina produced new data that allowed me to securely date the construction of both buildings to the Hieronian period. This revised chronology sheds light on Morgantina’s status within the Hieronian kingdom and offers an uncommon glimpse at how ancient agricultural policy was made manifest in the built environment. The eventual abandonment of the granaries at Morgantina within the first decade of Roman rule on the island speaks to a rapid shift away from the organization and administration of agricultural taxes during the Hieronian period.

Chapter Four took a syncretic approach to bronze coinage, blending numismatics and archaeology to argue that coins can be profitably analyzed as material vestiges of inherently ephemeral networks of trade and exchange. Here, detailed examination of coins recovered from two commercial complexes at Morgantina revealed previously unrecognized patterns in the direction and intensity of trade between Morgantina and cities on the east coast of Sicily during the final three centuries of the first millennium BCE. The discussion of Chapter Four also helped to establish that more attention must be paid to the archaeological contexts from which coins are recovered (particularly those from commercial contexts) as this offers a potentially fruitful means of refining our views on the use of coinage in commercial transactions. Going forward, I expect this will be the case as many more archaeologists and numismatists begin to recognize the value of such syncretic methods.
Taken together, these three case studies both reveal the complexity of agricultural administration in Sicily during the Hellenistic and Republican periods as well as offer valuable testimony to the ways in which archaeology can enrich the study of Ancient History.


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APPENDIX I: CATALOG OF SICILIAN GRAIN MEASURES

The 107 measures included in this catalog are listed according to the seven archaeological sites from which they were recovered. A brief tally reveals the breakdown per site:

<table>
<thead>
<tr>
<th>Site</th>
<th>Number of Measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Morgantina</td>
<td>75</td>
</tr>
<tr>
<td>Kamarina</td>
<td>22</td>
</tr>
<tr>
<td>Akrai</td>
<td>4</td>
</tr>
<tr>
<td>Leontinoi</td>
<td>2</td>
</tr>
<tr>
<td>Naxos</td>
<td>1</td>
</tr>
<tr>
<td>Apollonia</td>
<td>1</td>
</tr>
<tr>
<td>Megara Hyblaia</td>
<td>2</td>
</tr>
<tr>
<td>Total:</td>
<td>107</td>
</tr>
</tbody>
</table>

The preponderance of measures from Morgantina and Kamarina is due, in part, to the level of access that I was granted to study materials held in the storerooms of the Museo Archeologico Regionale di Aidone and the Museo Archeologico Regionale di Camarina. These sites have also benefited from systematic and long–term excavations, which have produced vast amounts of ceramic material. I expect the number of measures and sites to increase markedly, should standardized grain measures be recognized as the vital historical documents that they are considered to be in this dissertation. When possible, I have identified the vessels according to the four types outlined in Chapter 2. Of the 107 measures, only ten have been previously published. I am grateful to all of the individuals who have allowed me to study, photograph, and include the remaining 97 unpublished measures in this catalog.
Measurements are given in centimeters, unless otherwise indicated. MPD: maximum dimension; PH: preserved height; Diam.(int.): vessel’s interior diameter; Diam.(ext.): vessel’s exterior diameter. Color references are to Munsell Soil Color Charts, 1975 edition.

MORGANTINA:

Measures from the Morgantina excavations are currently housed in the storerooms of the Museo Archeologico Regionale di Aidone. Inventory numbers are those given to finds by the American Excavations at Morgantina.

M–1:  Inv. 62–1448.
Nearly complete Type–4 measure. Flat bottom with three feet at edge, straight sides; eleven horizontal incised grooves around upper body extending down from rim; one incised groove around middle body 17.5 cm below rim; small round hole in side.
Light–yellow wash over pinkish–buff clay; 5YR 7/4; terracotta inclusions of 1.0–3.0mm throughout.
H. 31.0, Diam. 38.0, volume ca. 31.75L.

M–2:  Inv. 62–1447.
Nearly complete Type–2 measure. Ring–base, straight inward–sloping sides, upper and lower root of one vertical handle.
H. 16.3, Diam. (rim) 14.8, Diam. (base) 21.3, volume ca. 2.75L.
Light–yellow wash (5Y 8/2) over pinkish buff clay; 5YR 7/4.

Nearly complete Type–4 measure. Flat bottom with three feet at edge, straight sides, rim missing; horizontal incised grooves near base and on upper body.
Light–yellow wash over light red clay; 2.5YR 6/6.
PH. 25.0, Diam. 37.5, volume ca.
Hellenistic House on West Hill; I.78.Section 3–East Part.Stratum 3. Before 211 BCE

M–4:  Inv. 58–916.
Fragment of a Type–3 or Type–4 measure. Foot and base of vessel similar to 62–1448; Foot stamped, ΑΚΡΙΒΑΖΟΝΤΟΣ ΑΡΤΕΜΙΔΟΡΟΥ.
Light–yellow wash over yellow–red clay with many dark, micaeous inclusions measuring 0.5–3.0mm; 5YR 5/6.
MPD. 10.8, PH. 4.8; Stamp: H. 1.6, L. 8.7
House of the Official; Before 211 BCE
Bibliography: WALTHALL (2011a).
M–5: Inv. 59–1767.
Fragment of Type–1 measure. Portion of rim and body preserved; five incised grooves on exterior of upper body; partial inscription [–]D.
Unpainted, light red clay; 2.5YR 6/6.
MPD. 8.5, PH. 7.2, Th.(rim) 0.7, Diam.(int.) ca. 10.0–11.0.
South Necropolis; II.4–B.Ext.Stratum 4
ca. 275–250 BCE

M–6: Inv. 84–193.
Fragment of Type–1 measure. Full profile preserved; walls slightly inclined toward center. Thirteen horizontal grooves on exterior wall.
H. 11.0, diam. ca. 10.6, volume ca. 0.97 l.
Unpainted, pale yellow–buff clay.
Agora, North Wing of Central Shops; I.122.
ca. 275–250 BCE

M–7: '85–uncat.
Fragment of Type–1 measure. Three joining fragments, full profile preserved. Eight horizontal grooves on exterior wall.
H. 8.1, diam. ca. 17.0, volume ca. 1.84 l.
Unglazed, pale reddish yellow clay; 5YR 7/6
Agora, North Wing of Central Shops, final floor surface of room 1; I.122G–4G.
ca. 275–250 BCE

M–8: '92–uncat.
Fragment of Type–1 measure. Rim preserved. Seven horizontal grooves on exterior wall. Thickness diminishes moving towards base.
MPD. 11.3, PH. 6.6, Diam ca. 16.0.
Light–yellow wash over light red clay; 2.5YR 6/6.
Agora, North Wing of Central Shops, leveling–fill over pottery dump; I.122J.11

Fragment of Type–1 or Type–3 measure. Rim preserved. Three horizontal grooves on exterior wall.
Thickness diminishes moving towards base.
MPD. 6.7, PH. 3.8, Th.(rim) 1.1, Diam. ca. 16.0.
Light–yellow wash over light red clay; 2.5YR 6/6.
Agora, North Wing of Central Shops, leveling–fill over pottery dump; I.122J.11

Fragment of Type–1 measure. Rim preserved. Four horizontal grooves on exterior wall
MPD. 7.0, PH. 4.1, Diam. ca. 36.0
Light–yellow wash; light red clay; 2.5 YR 6/6
Agora, North Wing of Central Shops, leveling–fill over pottery dump; I.122J.11

Eight fragments of Type–4 measure. Rim and two of three tripod feet preserved. Six horizontal grooves on exterior wall. Rectangular impression on interior wall, possibly a stamp.
MPD. 20.6, PH. (composite) 22.5, Diam.(int.) ca. 30.5; est. vol. 16.41L
Light—yellow wash; reddish yellow clay; 5YR 7/6. Matrix of foot and base has terracotta inclusions of 1–2mm.
Hellenistic Building, Contrada Drago; V.27.Zone 5.Room 3.Stratum 3
Before 211 BCE

M–12: '57–uncat.
Four fragments of Type–2 measure. Ring–base, straight inward–sloping sides, lower root of one vertical handle. One horizontal groove on exterior wall, just above base.
PH. 16.4, Diam (base ext.) 20.8, Diam (base int.) 18.5, vol. ca. 2.70 l.
Light–yellow wash over pinkish buff clay; 7.5YR 7/4.
North Demeter Sanctuary; IV.2F.Stratum 3, below roof tiles pre–211 BCE
Comparanda: M–2

Seven fragments of Fragment of a Type–3 or Type–4 measure. Full profile preserved, upper root and lower portion of vertical handle preserved. Thirteen horizontal grooves on exterior wall near rim.
H. 31.5, Diam. ca. 36.0, volume ca. 32.06 l.
Light–yellow wash; reddish yellow clay; 5YR 7/6; Matrix of clay at base has terracotta inclusions of 1–2mm.
House of the Double Cistern; II.69B.Saggio E.Room A.Cistern.Stratum 16
3rd century BCE

Two fragments of a Type–3 or Type–4 measure. Rim preserved; one vertical handle.
Seven horizontal grooves on exterior wall, extending down from rim.
MPD. 23.9, PH. (composite) 21.6, Diam. ca. 30–32.0
Pale yellow wash over light red clay; 2.5YR 6/6
North Demeter Sanctuary Annex; IV.12.Zone 1.Stratum 3
Before 211 BCE
Comparanda: M–11

Fifteen fragments of a Type–3 or Type–4 measure. Rim preserved; upper and lower root of one vertical handle. Eleven horizontal grooves on exterior wall, extending down from rim. One incised horizontal line at level of top of lower handle root.
MPD. 20.8, PH. (composite) 24.3, Diam. ca. 26–27.0;
Light–yellow wash over light red clay; 2.5YR 6/6.
West Stoa; I.44F.Room 5.Stratum 2.Within Tile–fall
Before 211 BCE

M–16: '56–uncat.
Fragment of Type–1 measure. Rim preserved; nine horizontal grooves on exterior wall, extending down from rim.
MPD. 12.3, PH. 6.8, Th.(rim) 0.9, Diam.(int.) ca. 15.0
Light–yellow wash over reddish clay; 2.5 YR 5/8. [Syracusan clay?]
Just south of Great Steps; I.39.Stratum 3

Fragment of Type–1 measure. Body sherd; four horizontal grooves on exterior wall.
MPD. 8.1, PH. 3.8, Th.(body) 0.6, Diam. ca. 15.0
Light–yellow wash over light red clay; 2.5YR 6/8. [Syracusan clay?]
Just south of Great Steps; I.39.Stratum 3

Two fragments of Type–1 measure. Rim preserved; seven horizontal grooves on exterior
wall, extending down from rim. Thickness diminishes moving towards base.
MPD. 7.1, PH. 5.2, Th.(rim) 0.9, Diam ca. 10.0–11.0
Unglazed, reddish yellow clay; 5YR 6/6.
Fill by West Granary; I.9A.Stratum 4
Third century BCE

Fragment of Type–1 measure. Rim preserved; five horizontal grooves on exterior
wall, extending down from rim.
MPD. 6.7, PH. 3.7, Th.(rim) 0.7,Diam. ca. 11.0, volume ca. 1L.
Light–yellow wash over very pale brown clay; 10YR 7/4.
Necropolis 3; II.4B–Ext.Stratum 4
Mid–third century BCE

Fragment of Type–1 measure. Body sherd; seven horizontal grooves on exterior wall.
MPD. 6.8, PH. 5.1, Th.(body) 0.7, Diam.(int.) ca. 10.0–11.0
Light–yellow wash over reddish yellow clay; 5YR 6/6
Complex east of House of Tuscan Capitals; II.10W.IB.Saggio between wall of Room B’
and steps

M–21. '56–uncat.
Fragment of Type–1 measure. Rim preserved; seven horizontal grooves on exterior wall,
extending down from rim.
MPD. 7.4, PH. 5.3, Th.(rim) 1.0, Diam.(int.) ca. 11.0; est. vol. 1L
Light–yellow wash over reddish yellow clay; 5YR 6/6
West Granary; I.41A.Stratum 1
Third century BCE
Comparanda: M–6

Two fragments of Type–1 measure. Rim preserved; eight horizontal grooves on exterior
wall, extending down from rim.
MPD. 7.2, PH. 6.2, Diam.(int.) ca. 11.0.
Light–yellow wash over light red clay; 2.5YR 6/6
North Baths; VI.6.8

Fragment of Type–3 or Type–4 measure. Body sherd; three horizontal grooves on
exterior wall.
MPD. 5.1, PH. 4.3, Th.(body) 0.8
Light–yellow wash over reddish yellow clay; 5YR 6/6.
North Baths; VI.27.Room 8.13

M–24: 05–207
Fragment of Type-1 measure. Rim preserved. Five horizontal grooves on exterior wall, extending down from rim.
MPD. 5.7, PH. 4.1, Diam.(int.) ca. 11.0.
Light–yellow wash over pink clay; 7.5YR 7/4.
North Baths; VI.31.41

M–25: 05–226
Fragment of Type-1 measure. Body sherd; six horizontal grooves on exterior wall. Body pierced by a small circular hole of diam. 2mm.
MPD. 5.8, PH. 4.7.
Pale yellow wash over very pale brown clay; 10YR 8/3
North Baths; VI.31.12

M–26: 67–126
Complete vessel. Walls slightly concave towards center, flaring towards rim and base.
H. (ext.) 9.1 cm, H. (int.) 8.5, Diam. (rim) 11.9, Diam. (base) 10.4; est. vol. 0.89L
Light–yellow wash over pinkish buff clay; 7.5YR 7/4.
I.70–1967.Stratum 2 (W.S. I find 10)

Fragment of Type-1 measure. Body sherd; three horizontal grooves on exterior wall.
MPD. 4.5, PH. 3.2., Th.(body) 0.9
Light–yellow wash over pale yellow clay; 2.5Y 7/4.
Agora, Central Shops, from pottery dump or fill over pottery dump; I.122J.49.

Fragment of Type-1 measure. Rim preserved; one horizontal groove on exterior wall.
MPD. 3.3, PH. 1.8.
Unglazed, reddish–yellow clay; 5YR 7/6.
Agora, Central Shops, from fill over pottery dump; I.122J.7.

Fragment of Type-3 or Type-4 measure. Rim preserved. Three horizontal grooves on exterior wall.
MPD. 4.7, PH. 3.0; Th.(rim) 1.1, Diam. ca. 36.0
Light–yellow wash over pink buff clay; 7.5YR 7/4.
Agora, Central Shops, from fill over pottery dump; I.122J.7.
comparranda: dimensions of rim similar to M–13.

Fragment of Type-1 measure. Rim preserved. Two horizontal grooves on exterior wall, extending down from rim.
MPD. 3.9, PH. 2.0, Th.(rim) 0.9, Diam. ca. 11.0
Light–yellow wash over pinkish grey clay; 7.5YR 7/2.
Agora, Central Shops, from fill over pottery dump; I.122J.65.

Three fragments of Type-1 measure. Rim preserved; five horizontal grooves on exterior wall, extending down from rim.
MPD. 4.4, PH. 3.6, Th.(rim) 0.9, Diam.(int.) ca. 10.0–11.0.
Pale yellow slip over light gray clay; 10YR 7/2.
Agora, Central Shops, from fill over pottery dump; I.122J.65.
[*may be from same vessel as M–32]

Two fragments of Type–1 measure. Rim preserved; five horizontal grooves on exterior wall, extending down from rim.
MPD. 5.1, PH. 3.1, Th.(rim) 0.9, Diam.(int.) ca. 10.0–11.0.
Pale yellow slip over light brown clay; 7.5YR 6/4.
Agora, Central Shops, from fill over pottery dump; I.122J.65.
[*may be from same vessel as M–31]

M–33: '92–uncat.
Two fragments of Type–1 measure. Rim preserved; four horizontal grooves on exterior wall, extending down from rim.
MPD. 4.7, PH. 3.1, Th.(rim) 0.7, Diam.(int.) ca. 10.0–11.0
Pale yellow slip over pink clay; 7.5YR 7/4.
Agora, Central Shops, from fill over pottery dump; I.122J.65.

Fragment of Type–3 or Type–4 measure. Rim preserved; four horizontal grooves on exterior wall, extending down from rim.
MPD. 6.0, PH. 3.1, Th.(rim) 1.1, Diam.(int.) ca. 36.0.
Pale yellow slip over light red clay; 2.5YR 6/6.
Agora, Central Shops, from fill over pottery dump; I.122J.65.

Two fragments of Type–1 or Type–3 measure. Rim preserved; three horizontal grooves on exterior wall, extending down from rim.
MPD. 4.7, PH. 3.3, Th.(rim) 1.1, Diam.(int.) ca. 16.0
Light–yellow slip over pink clay; 7.5 YR; 7/4
Agora, Central Shops, from fill over pottery dump; I.122J.65.

Two fragments of Type–1 measure. Rim preserved; two horizontal grooves on exterior wall, extending down from rim.
MPD. 2.7, PH. 2.2, Diam.(int.) ca. 10.0–11.0
Pale yellow slip over light brown clay; 7.5YR 6/4.
Agora, Central Shops, from fill over pottery dump; I.122J.65.

Fragments of Type–1 measure. Rim preserved; four horizontal grooves on exterior wall, extending down from rim.
MPD. 5.1, PH. 3.8, Diam.(int.) ca. 16.0
Unglazed reddish yellow; 5YR 7/6.
House of Eupolemos; VII.1.1.
Before 211 BCE

M–38: '57–uncat.
Fragment of Type–3 or Type–4 measure. Rim preserved; nine horizontal grooves on exterior wall, extending down from rim.
MPD. 12.2, PH. 7.9, Th.(rim) 1.0, Diam.(int.) ca. 36.0.
Light–yellow wash over reddish yellow clay; 5YR 6/6.
(KP p.234, 7 May; w/Campana C and Roman ceramics in sherd box; 32L)
House of the Doric Capital; I.34H.Zone 2.Stratum 2

Fragment of Type–1 measure. Rim preserved; six horizontal grooves on exterior wall, extending down from rim.
MPD. 9.3, PH. 5.4, Th.(rim) 1.1, Diam.(int.) ca. 12.0–14.0; est. vol. 1–2L
Pale yellow wash over reddish yellow clay; 7.5YR 8/6.
Contrada San Francesco Naïskos; V.4.Saggio A.Stratum 2.Below Tiles. (EO I, 24 May)
Before 211 BCE

Fragment of Type–1 measure. Rim preserved; fourteen horizontal grooves on exterior wall, extending down from rim.
MPD. 8.1, PH. 7.0, Th.(rim) 0.7, Diam.(int.) ca. 11.0; est. vol. 1L.
Unglazed red clay; 2.5YR 5/8. [Syracusan?]
w/ Roman ceramics in sherd box;
West Hill; II.70.Room 45.Stratum 1.

Fragment of Type–1 measure. Rim preserved; five horizontal grooves on exterior wall, extending down from rim.
MPD. 5.5, PH. 3.0, Th.(rim) 0.7, Diam.(int.) ca. 11.0.
Light–yellow wash over reddish yellow clay; 5YR 7/6
Before 211 BCE; cf. Stone 2013, Deposit

Fragment of Type–3 or Type–4 measure. Body sherd; three horizontal grooves on exterior wall. Body pierced by three small, circular holes of diam. 5mm.
MPD. 7.0, PH. 6.3, Th.(body) 1.1.
Light–yellow wash (5Y 8/2) over reddish brown clay; 2.5YR 5/8; [Syracusan?]
East Granary; I.61.East of Room B.Stratum 3

Fragment of Type–2 measure. Ring–base, straight inward–sloping sides, lower root of one vertical handle, two incised grooves on exterior of wall just above base.
Light–yellow wash over reddish yellow clay; 5YR 7/6.
PH. 11.6, Diam. (base, ext.) 19.6
(MDC;
comparanda: M–2, though slightly smaller diam. at base.
House of Ganymede; I.35C.found at base of SE col. of peristyle.

Fragment of Type–2 measure. Body sherd.
MPD. 18.4, PH. 11.8, Diam. (lower, int.) ca. 25.0
Light–yellow wash over reddish brown clay; 2.5YR 5/6.
comparanda: M–2, M–43
East Granary; I.61.Room A.Stratum 3
M–45: ’57–uncat.
Fragmentary measure. Ring base, straight vertical sides. Groove around wall just above base.
PH. 9.9, Diam. (base, ext.) 13.0, Diam. (base, int.) 11.8, Th.(wall) 0.6
Light–yellow wash over reddish yellow clay; 7.5YR 6/6.

Two fragments of Type–1 measure. Rim preserved; eleven horizontal grooves on exterior wall, extending down from rim.
MPD. 12.4, PH. 6.0, Th.(body) 0.7, Diam.(int. rim) ca. 10.5, Diam.(int. lower) ca. 12.5
Light–yellow wash over Macellum; I.17K.Stratum 3. (R. Grimm, 5 Nov 1955)

Fragment of Type–3 or Type–4 measure. Rim preserved; five horizontal grooves on exterior wall, extending down from rim.
MPD. 7.3, PH. 4.3, Diam.(int.) ca. 28.0.
Pale–yellow wash (2Y 8/2 over reddish yellow clay; 5YR 7/6
Macellum; I.17N.Stratum 2. (Del Chiaro, 5 April 1956)

Fragment of Type–3 or Type–4 measure. Body sherd; four horizontal grooves on exterior wall.
MPD. 5.5, PH 4.1.
Unpainted, reddish yellow clay; 5YR 7/6
Macellum; I.17F.Stratum 3. (R.Grimm, 8 Oct 1955)

Fragment of Type–3 measure. Body sherd; six horizontal grooves on exterior wall.
MPD. 5.8, PH. 4.0, Th.(rim) 0.9, Diam.(int.) ca. 12.0 to 15.0 cm
Light–yellow wash over light red clay; 2.5YR 6/6
Macellum; I.17L.Stratum 2, outside of wall.

M–50: ’70–uncat.
Fragment of Type–1 measure. Rim preserved; five horizontal grooves on exterior wall, extending down from rim.
PH. 8.2, Th.(body) 0.85, Diam.(int.) 11.0
Light–yellow wash over reddish yellow clay
Hellenistic Building, Contrada Drago; Area V, tr. 35, room 3, stratum 3
Before 211 BCE

Four fragments of a Type–3 or Type–4 measure. Rim preserved; seven horizontal grooves on exterior wall, extending down from rim.
PH. 6.1, MPD 6.9, Th.(body) 0.9, Diam.(int.) ca. 36.0.
Light–yellow wash over reddish yellow clay
House of the Antefixes; Area I, tr. 70 xyz, Dike–Cistern (4.3 to 4.8 m)
M–52: '70–uncat.
Two fragments of a Type–3 or Type–4 measure. Rim preserved; seven horizontal grooves on exterior wall, extending down from rim.
Light–yellow wash over reddish yellow clay

Fragment of Type–4 measure. Rim preserved; two horizontal grooves on exterior wall, extending down from rim.
MPD. 7.4, PH. 3.0, Diam.(int.) ca. 34.0 cm.
Light–yellow wash (5Y 8/2) over reddish yellow clay; 5YR 6/6
Agora, North Wing of Central Shops, leveling–fill over pottery dump; I.122J.9.

Fragment of Type–1 measure. Rim preserved; three horizontal grooves on exterior wall, extending down from rim.
MPD. 4.9, PH. 2.7, Diam.(int.) ca. 10.0–11.0.
Light–yellow wash (5Y 8/2) over reddish yellow clay; 5YR 6/6
Agora, North Wing of Central Shops, leveling–fill over pottery dump; I.122J.9.

Fragment of Type–1 measure. Rim preserved; five horizontal grooves on exterior wall, extending down from rim.
MPD. 5.0, PH. 4.1, Diam.(int.) ca. 10.0–11.0.
Light–yellow wash (5Y 8/2) over reddish yellow clay; 5YR 6/6
Agora, North Wing of Central Shops, leveling–fill over pottery dump; I.122J.9.

Fragment of Type–4 measure. Body sherd; three horizontal grooves on exterior wall.
MPD. 7.0, PH. 4.5, Th.(body) 1.2, Diam.(int.) 36.0–38.0.
Buff greenish–yellow surface; 2.5Y 7/4; fabric
North Baths; VII.6.5.33 (SEC 29, F48, 1/7/04).

Fragment of Type–4 measure. Rim preserved; four horizontal grooves on exterior wall, extending down from rim.
Pale yellow wash over very pale brown clay; 10YR 8/3
MPD. 5.9, PH. 4.7, Th.(rim) 1.2, Diam.(int.) ca. 36.0–38.0.
North Baths; VII.6.4 (6.7.8); SBF 19/7/04

M–58: 04–320.
Fragment of a Type–3 measure. Rim preserved; four horizontal grooves on exterior wall, extending down from rim.
MPD. 4.6, PH. 3.6, Th.(rim) 0.9 Diam.(int.) ca. 34.0–36.0.
Pale yellow wash over reddish yellow clay; 5YR 7/6
North Baths; VII.6.5

Fragment of Type–3 or Type–4 measure. Body sherd; three horizontal grooves on exterior wall.
MPD. 4.6, PH. 3.3, Th.(body) 1.3.
Pale yellow wash over reddish yellow clay; 5YR 7/6.
North Baths; VII.6.8 (22&25); SBF; 23/07/04.

Three fragments of Type–1 measure. Body sherds; five horizontal grooves on exterior wall.
MPD. 4.9, PH. 4.2, Th.(body) 0.7, Diam.(int.) ca. 10.0–11.0.
Pale yellow wash over pinkish clay; 7.5YR 8/4.
West Sanctuary; VI.13.4.13; Topsoil, SE room. HS 133, F217.

Fragment of Type–1 measure. Rim preserved; three horizontal grooves on exterior wall, extending down from rim.
MPD. 3.3, PH. 2.9, Th.(rim) 0.8, Diam.(int.) ca. 10.0–11.0.
Light brown clay; 7.5YR 6/4.
Agora, North Wing of Central Shops, leveling–fill over pottery dump; I.122J.65.

Two fragments of Type–1 or Type–3 measure. Rim preserved; six horizontal grooves on exterior wall, extending down from rim.
MPD. 7.0, PH. 5.2, Th.(body) 0.9, Diam.(int.) ca. 16.0.
Pale yellow wash (2.5Y 8/2) over pink buff clay; 7.5YR 7/4.
Agora, North Wing of Central Shops, leveling–fill over pottery dump; I.122J.65.

Fragment of Type–1 or Type 3 measure. Body sherd; nine horizontal grooves on exterior wall. Scoring on bottom, where base was joined to the walls (?).
MPD. 7.4, PH. 5.5, Th.(body) 0.9, Diam.(int.) ca. 15.0–16.0.
Light–yellow wash over reddish yellow clay; 5YR 6/6.
West Stoa; I.44F.Room 9. Stratum 2. Level of tiles and rubble.

M–64: ’60/61–uncat.
Fragment of Type–1 measure. Body sherd; ten horizontal grooves on exterior wall.
MPD. 8.1, PH. 5.7, Th.(body) 0.6, Diam.(int.) ca. 10.0–11.0.
Light–yellow wash over very pale brown clay; 10YR 7/4.
West Stoa; I.44F.Room 9. Stratum 2. Level of tiles and rubble.

Fragment of Type–1 measure. Rim preserved; nine horizontal grooves on exterior wall, extending down from rim.
MPD. 8.9, PH. 6.6, Th.(rim) 0.9, Diam.(int.) ca. 11.0.
Pale yellow wash over reddish–yellow clay; 5YR 7/6.
West Stoa; I.44A.North of Wall.Stratum 2.

Fragment of Type–1 or Type 3 measure. Body sherd; nine horizontal grooves on exterior wall.
MPD. 7.4, PH. 6.7, Th.(body) 0.7, Diam.(int.) ca. 16.0.
Pale yellow wash over reddish yellow clay; 5YR 7/8.
West Stoa; I.44E.Stratum 2.Extension. Above Wall.
Fragment of Type–1 measure. Rim preserved; thirteen horizontal grooves on exterior wall, extending down from rim. Thickness diminishes moving towards base. [full elevation ? est. vol. ca. ___]
MPD. 9.1, PH. 7.7, Th.(rim) 1.0, Diam.(int.) ca. 10.0–11.0
Unpainted, reddish yellow clay; 5YR 6/8
Theater; I.60Ext.Zone C. Stratum 3. Just above burnt layer (RHII, 31 May)
Comparanda: M–64, M–6

Fragment of Type–1 measure. Rim preserved; four horizontal grooves on exterior wall, extending down from rim.
MPD. 6.5, PH. 3.8, Th.(rim) 0.9, Diam.(int.) ca. 10.0–11.0.
Pale yellow wash over reddish yellow clay; 5YR 7/6.

Fragment of Type–1 measure. Body sherd; three horizontal grooves on exterior wall.
PH. 2.4, Th.(body) 0.8.
Pale yellow wash over reddish yellow clay; 5YR 7/6.
Central Market, Room 5; I.3P/92.46

Fragment of Type–3 or Type–4 measure. Rim preserved; two horizontal grooves on exterior wall, extending down from rim.
MPD. 4.0, PH. 2.1, Th.(rim) 1.1, Diam.(int.) ca. 28.0
Pale yellow wash over pinkish buff clay; 7.5YR 7/4.
Central Market, Room 5; I.3P/92.53

Fragment of Type–3 or Type–4 measure. Rim preserved; nine horizontal grooves on exterior wall, extending down from rim; below grooves, smooth surface. Notch cut in rim with width of 5mm. This cutting may have allowed for a leveling bar to be inserted at the level of the rim. Small hole of diam. 3mm pierces the body in the first groove below the rim.
MPD. 11.1, PH. 9.5, Th.(rim) 1.1, Diam.(int.) ca. 36.0
Pale yellow wash over light red clay; 2.5YR 6/6.
I.66.Room 2.Stratum 2or3.On bed rock. (Sitterding)

Fragment of Type–3 or Type–4 measure. Rim preserved; six horizontal grooves on exterior wall, extending down from rim.
MPD. 6.0, PH. 5.0, Th(rim) 0.8, Diam.(int.) ca. 36.0
Pale yellow wash (5Y 8/2) over light red clay; 2.5YR 6/8
I.66.Room 2.Stratum 2or3.On bed rock. (Sitterding)

Fragment of Type–2 measure. Shallow ring base.
MPD. 14.4, PH.(ext.) 8.7, PH.(int.) 7.6, Th.(body) 0.8, Diam.(ext.) ca. 16.0, Diam.(int.) ca. 14.0.
Pale yellow wash over pinkish–buff clay; 5YR 7/4
House of the Doric Capital; I.34J.Cistern.Stratum 2; (KP 297, 17 May).

Fragment of Type–2 measure. Shallow ring–base, straight inward–sloping sides, lower root of one vertical handle. Two shallow incised grooves around base.
MPD. 13.3, PH.(ext.) 7.5, PH.(int.) 6.2, Th.(body) 1.1, Diam.(ext.) 18.0, Diam.(int.) 16.0.
Light red clay; 2.5YR 6/6.
Lower Agora; I.62.Stratum 2.4–16; (CO I p.57, 14 April).

M–75: '59–uncat.
Fragment of Type–2 measure. Portion of base and wall preserved. Two deep grooves around base.
MPD. 12.7, PH.(ext.) 3.0, PH.(int.) 1.9, Th.(body) 0.9, Diam.(ext.) ca. 36.0, Diam.(int.) ca. 34.0
Reddish yellow clay; 7.5YR 8/6.
West Stoa; I.44A.Stratum 1; (Del Chiaro)

KAMARINA:

Measures recovered during excavations in the agora at Kamarina (K–2 through K–22), are currently held in the storerooms of the Museo Archeologico Regionale di Camarina.
Measure K–1 is presently on display in the Museo Archeologico Ibleo, Ragusa.

K–1: Inv. 2854.
Complete cylindrical vessel with a pair of horizontal grooves around the middle of the body; prominent lip and base.
H 8.2, Diam. 9.3; vol. ca. 0.410L
Local production.
mid–4th BCE
Bibl.: PISANI 2008, 126, no. 299, fig. 24.
‘West extension of the southern end of trench enlargement’

K–2: Inv. CAM 9.4.85
Fragmentary, portion of wall, one foot and part of base; lower root of vertical strap–handle; foot stamped, AKPIBAIONTOC APTEMIDOPOY.
PH 12, Diam. ca. 38–40 cm, est. vol. 32L
Agora: Stoa Ovest – Stoa Nord; T2.; 9.4.85.
3rd BCE
Bibl.: WALTHALL 2011

K–3: Fragment of Type–1 measure. Rim preserved. 11 horizontal grooves on exterior wall,
extending down from rim.
PH. 6.5, Th. 0.8, Diam.(int.) ca. 11.0, Diam.(ext.) ca. 13.0; est. vol. 1L
Agora: Stoà Ovest – facciata Est; T2. (–0.20 to –0.30); 17.2.84

K–4: Fragment of Type–1 measure. Rim preserved. 7 horizontal grooves on exterior wall, extending down from rim. Thickness diminishes moving towards base.
PH 4.2, Th.(rim) 1.1, Diam.(int.) 10.0; est. vol. 1L
Agora: Stoà Ovest – facciata Est; T2. (–0.20 to –0.40); 23.2.84

K–5: Fragment of Type–1 measure. Rim preserved. 10 horizontal grooves on exterior wall, extending down from rim.
PH 5.6 cm, Th.(rim) 0.9, Diam.(int.) ca. 10.5, Diam.(ext.) ca. 12.5; est. vol. 1L
Agora: Stoà Ovest – Saggio 5; T1. (–0.00 to –0.10); 27.3.84

K–6: Fragment of a Type–3 or Type–4 measure. Rim preserved. 6 horizontal grooves on exterior wall, extending down from rim.
PH. 5.1, Th.(body) 1.0 cm;
Agora: Stoà Ovest – Saggio 5; T1. (–0.00 to –0.10); 27.3.84

K–7: Fragment of Type–1 measure. Rim preserved. 6 horizontal grooves on exterior wall, extending down from rim.
PH 3.8, Th.(body) 0.5, Diam.(int.) 11.5; est. vol. 1L
Agora: Stoà Ovest – Saggio 5; T1. (–0.00 to –0.20); 3.4.84

K–8: Fragment of Type–1 measure. Rim preserved. 3 horizontal grooves on exterior wall, extending down from rim.
PH 2.0, Th.(rim) 0.9, Diam.(int.) 10.5; est. vol. 1L
Agora: Stoà Ovest – Saggio 5 – cella vinaria; T2. (–0.20 to –0.30); 12.3.84

K–9: Fragment of Type–1 measure. 6 horizontal grooves on exterior wall.
PH 4.6, Th.(body) 0.9 cm.
Agora: Stoà Ovest – Saggio 5 – cella vinaria; T2. (–0.20 to –0.30); 12.3.84

K–10: Fragment of Type–1 measure. Rim preserved. 6 horizontal grooves on exterior wall, extending down from rim. Thickness diminishes moving towards base.
PH 4.0, MPD 6.5, Th.(rim) 1.0, Diam.(int.) 10.5; est. vol. 1L
Agora: Stoà Ovest – Saggio 5 – cella vinaria; T3. (–0.40 to –0.50); 11.4.84

K–11: Fragment of Type–1 measure. Rim preserved. 5 horizontal grooves on exterior wall, extending down from rim. Thickness diminishes moving towards base.
PH 3.8, MPD 5.0, Th.(rim) 1.0, Diam.(int.) 10.5 cm; est. vol. 1L
Agora: Stoà Ovest – Saggio 5 – cella vinaria; T3. (–0.40 to –0.50); 11.4.84

K–12: Fragment of Type–1 measure. 11 horizontal grooves on exterior wall.
PH 5.0, Th.(body) 0.6, Diam.(int.) 10.5; est. diam. 1L
Agora: Stoà Ovest – Saggio 5 –cella vinaria; T4. (–0.50 to –0.60); 12.4.84
comparanda: M–6.

K–13: Fragment of Type–3 or Type–4 measure. Rim preserved. 4 horizontal grooves on exterior wall, extending down from rim.
PH 5.0, Th.(rim) 1.5, Diam.(int.) 40–41 cm.
Agora: Stoà Ovest – Saggio 5 – cella vinaria; T5. (−0.60 to −0.70); 14.4.84

K–14: Fragment of Type–1 measure. Rim preserved. 13 horizontal grooves on exterior wall, extending down from rim.
PH 7.0, Th.(body) 0.6, Diam.(int.) 10.5; est. vol. 1L
Agora: Stoà Ovest – Saggio 5 – cella vinaria (in profondità); T3. (−0.60 to −0.80); 16.4.84

K–15: 13 fragments of a Type–3 or Type–4 measure. Rim preserved. 13 horizontal grooves on exterior wall, extending down from rim. At at least five points, the body is pierced by a small, circular hole of ca. diam. 5mm. Two fragments have rectangular notches cut out from the rim. These rectangular cuttings may have allowed for a leveling bar to be inserted.
PH. 6.4, Th.(body) 0.7, Diam.(int.) 36.0.
Agora: Stoà Ovest – su caduta dentro il recinto; T2. (−0.20 to −0.30); 23.4.85 & 2.5.85

K–16: Fragment of Type–1 measure. Rim preserved. 7 horizontal grooves on exterior wall, extending down from rim.
PH 4.3, Th.(rim) 1.0, Diam.(int.) 10.5; est. vol. 1L
Agora: Stoà Ovest – su caduta dentro il recinto; T2. (−0.20 to −0.30); 18.4.85

K–17: Fragment of Type–1 measure. Rim preserved. 6 horizontal grooves on exterior wall, extending down from rim; the body is pierced by a small, circular hole of ca. diam. 5mm. PH 3.2, Th.(rim) 0.7, Diam.(int.) 9.0 cm; est. vol. 1L.
Area a Nord della Stoà Nord: Saggio 2; T2. (−0.20 to −0.30); 6.12.84

K–18: Fragment of Type–3 or Type–4 measure. Rim preserved. 4 horizontal grooves on exterior wall, extending down from rim.
PH 2.7, Th.(rim) 0.9.
Agora: Stoa Ovest – Allargamento Nord–Ovest; T1. (−0.00 to −0.20); 9.5.85

K–19: Fragment of Type–1 measure. Rim preserved. 5 horizontal grooves on exterior wall, extending down from rim.
PH 5.9, Th.(body) 0.6.
Agora: Stoa Ovest – Allargamento Nord–Ovest; T1. (−0.00 to −0.20); 9.5.85

K–20: 2 joining fragment of Type–3 or Type–4 measure. Rim preserved. 7 horizontal grooves on exterior wall, extending down from rim; below grooves, blank body; the body is pierced by a small, circular hole of ca. diam. 5mm between fourth and fifth groove.
Agora: Stoa Ovest – Allargamento Nord–Ovest; T1. (−0.00 to −0.20); 5.6.85

K–21: Fragment of Type–3 or Type–4 measure. Rim preserved. 9 horizontal grooves on exterior wall, extending down from rim; below grooves, blank body; rectangular notches cut out from the rim. These rectangular cuttings may have allowed for a leveling bar to be inserted.
Agora: Stoa Ovest – Allargamento Nord–Ovest; T1. (−0.00 to −0.20); 5.6.85

K–22: Approximately 15 fragments of Type 4 vessel; Ten horizontal grooves around upper body, extending down from rim; Several small, circular holes pierce the walls at various points. Three feet and portion of base preserved. One foot inscribed with partial dipinto, ZOD[ ].
Light–yellow wash over light red clay.
Agora: Stoa Ovest – Allargamento Nord-Ovest; T1. (−0.00 to −0.20); 20.5.85

* Fragments of several other measures from same trench; several fragments with small, circular holes; one frag w/ iron clamp.

**AKRAI (CONTRADA AGUGLIA):**

Measures from Contrada Aguglia are currently stored in the Museo Archeologico “Paolo Orsi,” Syracuse.

AK–1: Inv. 55757a  
Fragmentary, portion of rim and body preserved; seven incised grooves on exterior wall, extending down from rim; two grooves just above the middle of the body.  
H. 32.0 cm, Diam. ca. 30.4 cm, est. vol. 32L  
Comparanda: M–1  
Bibl.: PELAGATTI 1970, 493, nos. 85, 89.

AK–2: Inv. 5575b  
Fragmentary, portion of rim and body preserved; eight incised grooves on exterior wall, extending down from rim; two grooves just above the middle of the body.  
Diam. ca. 38 cm  
Comparanda: M–1  
Bibl.: PELAGATTI 1970, 493, no. 86.

AK–3: Inv. 55757c  
Fragmentary, foot and base of Type 4 vessel; Foot stamped, AKPIBATONTO[C].  
Bibl.: PELAGATTI 1970, 493, no. 87.

AK–4: Inv. 55757d  
Fragmentary, portion of wall, foot and base of Type 4 vessel; Foot stamped, [AKPIBA]I ONTOC [APT]EMIΔOPOY.  
Diam. ca. 32 cm  
Comparanda: M–4, identical die  

**LEONTINOI:**

L–1: Inv. 647.  
Cylindrical body with horizontal striations from top to bottom; missing bottom.  
Found in well–deposit. 4th BCE (A. Musumeci)  
h. 7.5 cm; d. 10.5 cm; vol. 650 ccm

L–2: Inv. 648.  
Fragment of cylindrical vessel, smooth exterior except for two vertical striations below lip  
Found in well–deposit. 4th BCE (A. Musumeci)  
Preserved h. 6 cm; d. 10.5 cm.
NAXOS:

N–1:  Inv. 2572
Fragmentary; black–gloss fine ware vessel with banding around majority of body below a defined collar.
Preserved height 13.5 cm, diameter (base) 16.5 cm

APOLLONIA (MONTE DI SAN FRANTELLO):

AP–1:  Cylindrical with ancient repairs; single vertical handle; banding around lip and middle.
h. 30 cm;  d. 34 cm;  vol. c. 27,224.00 ccm
From Saggio E – Ambiente Θ (theta), US 64–65; M5YR7/6
Possibly 5th BCE
Bibliography: BONANNO and PERROTTA 2008, 44, no. 3.2, pl. 6c.
Figure 1. Map of Sicily, showing locations of cities mentioned in text.
Figure 2. Plan of Morgantina, showing locations inside city mentioned in text.

Drawing by E. Thorkildsen; J.F. Huemoeller.
Figure 3. Map of the agora at Morgantina, showing locations of buildings mentioned in text.

Drawing by E. Thorkildsen; J.F. Huemoeller.
Figure 4. (above) Dry Measure. Athens.
“North Slope Measure”
terracotta;
inscribed ‘ΔΕΜΟΣΙΟΝ’
5th Century BCE.

Figure 5. (right) Dry Measure; Athens.
DM45; Lang & Crosby.
terracotta;
inscribed ‘ΔΕΜΟΣΙΟΝ’;
4th Century BCE.

Figure 6. Dry Measure; Corinth; 1972-335;
terracotta; inscribed ‘ΔΑΜΑΣΙΟΝ’;
4th Century BCE.

Figure 7. Dry Measure; Thorikos;
terracotta; 4th Century BCE.
Figure 8. Type-1 Measure; Morgantina; 84-193; Cat. no. M-6; Terracotta; 3rd BCE.

Figure 9. Inscribed Dry Measure; “Borchardt Measure”; Unprovenanced; Bronze; 6th Century CE.
Figure 10. Type-2 Measure; Morgantina; 62-1447; Cat. no. M-2; Terracotta; 3rd BCE.

Figure 11. Type-3 Measure; Morgantina; Cat. No. M-13; Terracotta; 3rd Century BCE.

Figure 12. Type-4 Measure; Morgantina; 62-1448; Cat. No. M-1; Terracotta; 3rd BCE.
Figure 13. Fragments of measures recovered from the Northern Wing of the Central Shops at Morgantina.

Figure 14. Photograph of two Type-1 measures recovered from Central Shops at Morgantina.
Cat. nos. M-1 and M-7.
Figure 15. Photograph of a Type-4 measures recovered from a Hellenistic house at Morgantina. inv. 62-1268; Cat. nos. M-3.

Photograph by C. Williams.

Figure 16. Detail of the foot, Type-3 measure from Morgantina with stamped inscription ακριβαζοντος Αρτεμιδωρου; inv. 58-916; Cat. no. M-4.

Photograph by C. Williams.
Figure 17. Photograph of measure (Type-3) recovered from residential complex at Contrada Drago; Cat. no. M-11.  Photograph by C. Williams.

Figure 18. Photograph of measure (Type-3) recovered from within a well at a Hellenistic house; Cat. no. M-13.  Photograph by C. Williams.
Figure 19. Photograph of measure fragments (type-1) from lower agora at Morgantina; 3rd Century BCE; Cat. no. M-18.

Photograph by C. Williams.

Figure 20. Plan of Kamarina and detail plan of agora.

Figure 21. Fragment of Type-3 measure from Kamarina with stamped inscription; ακριβαζοντος Αρτεμιδωρου; Cat. no. K-2.

*Photograph courtesy of Dott.ssa P. Pelagatti and Dott. G. Di Stefano.*
Figure 22. Fragment of a Type-1 measure from Kamarina; Cat. no. K-3.

Figure 23. Fragment of a Type-3 measure from Kamarina; Detail of dipinto, ZOD[--]; Cat. no. K-22.
Figure 24. Photograph of stamped measure from Contrada Aguglia, Akrai; Cat. no. AK-4; Museo "Paolo Orsi" Inv. 55757E. Photograph courtesy of the Museo Archeologico Regionale "Paolo Orsi"

Figure 25. Photograph of stamped measure from Contrada Aguglia, Akrai; Cat. no. AK-5; Museo "Paolo Orsi" Inv. 55757C. Photograph courtesy of the Museo Archeologico Regionale "Paolo Orsi"
Figure 26. Photographs of measure fragments from Contrada Aguglia; Akrai; Cat. nos. AK-1 and 2; Museo "Paolo Orsi" Inv. 55757A-B. 

Figure 27. Drawing of measure (Type-3) from Monte di San Fratello; Cat. no. AP-1. 
After Bonanno and Perrotta (2008).
Figure 28. Diagram illustrating fractional categories of third-century Sicilian dry measures.
Figure 29. Detail of stamped measures from Kamarina and Morgantina, indicating the smudging of the letters \textit{tau} and \textit{epsilon} in \textit{Αρτέμιδωρου}.

Figure 30. Detail of reddish, micaceous clay of the stamped \textit{ακριβοζοντος} measure from Morgantina; inv. 58-916; Cat. no. M-4.
Figure 31. Map showing sites where standardized measures have been identified and proposed extent of kingdom of Hieron II.
Figure 32. Map indicating proposed territorial extent of Hieron II's kingdom.
*Adapted from the Barrington Atlas.*
Figure 34. Plan of agora at Morgantina with monumental granaries highlighted in orange.

Drawing by E. Thorkildsen; J.F. Huemoeller, 2011.
Figure 35a. Plan of East Granary, Morgantina.  
*Drawing by E. Thorkildsen; J.F. Huemoeller, 2011.*

Figure 35b. Plan of West Granary, Morgantina.  
*Drawing by E. Thorkildsen; J.F. Huemoeller, 2011.*
Figure 36. Plan of Roman military granaries at Renieblas and Castillejo, Spain.
After Schulten (1927 and 1929).

Figure 37. Plan of the acropolis and agora at Pergamon, indicating location of the so-called Arsenals.
Figure 38. State plan of East Granary, Morgantina.

*Drawing by Bylund, 1980.*
Figure 39. Photograph and section showing detail of buttress construction, East Granary, Morgantina.

Figure 40. Two section drawings, showing proposed reconstructions for East Granary.

RIM FRAGMENT OF A RIBBED BLACK-GLOSS BOWL
FROM BUILDER’S TRENCH IN EAST GRANARY | ROOM A
MID-THIRD CENTURY BCE

Figure 41. Photograph of rim fragment of a black-gloss bowl recovered from East Granary, Room A Saggio (2013:1). Inv. 13-1.
Photographs by H.K. Sharp and C. Williams

Figure 42. Photograph of bronze coin from within packing fill below original floor surface or the East Granary. Inv. 59-1832.
Figure 43.
Plan and photograph of Room F of East Granary, indicating location of second-century kilns.

Figure 44. Plan of northern rooms of East Granary, indicating location of first-century BCE coin hoard.


Figure 45. Photographs of coins from the so-called East Granary Hoard.

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Figure 46. State plan of the West Granary.
Figure 47. Photograph showing hydraulic plaster applied to the exterior of the West Granary.

Photograph courtesy of Morgantina Archives, Princeton University.
Figure 48. Plan of West Granary, indicating location of trenches excavated in 2011 and detail of Trench 147.

Figure 49. Photographs of Trench 147, West Granary, 2011.
Figure 50. Plan of Trench 147, West Granary, 2011. Early (pre-granary, light blue) and late (post-granary, dark blue) walls indicated in blue.  
*Drawing by J.F. Huemoeller, 2011.*

Figure 51. Section drawing of Trench 147, West Granary, 2011.  
*Drawing by J.F. Huemoeller, 2011.*
Figure 52. Photograph and section drawing of Trench 147, West Granary, 2011. Drawing by J.F. Huemoeller, 2011.

Figure 53. Photograph of a bronze coin recovered within packing fill (light yellow soil with plaster inclusions) below floor surface in West Granary; inv. 11-35.
Figure 54. Hypothetical reconstruction of lower agora at Morgantina. Drawing by J.F. Huemoeller, 2013.
Figure 55. Photographs of bronze coin types struck during the reign of Hieron II.


Figure 56. Plan of the agora at Morgantina, indicating location of two commercial complexes. **Drawing by E. Thorkildsen; J.F. Huemoeller.**
Figure 57. Illustration showing location and number of coin hoards recovered from Central Shops, Morgantina.